DRAFT

ENVIRONMENTAL STATEMENT

GRANITE REEF AQUEDUCT TRANSMISSION SYSTEM

INT DES 74-105

A FEATURE OF THE
CENTRAL ARIZONA PROJECT

Prepared by

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Lower Colorado Region

Flood Control District
of
Maricopa County
3325 WEST DURANGO STREET
PHOENIX, ARIZONA 85009

December 6, 1974

Mr. E. A. Lundberg, Regional Director
United States Department of the Interior
Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

RE: Review of Draft Environmental Statement; Granite Reef Aqueduct Transmission System

Dear Mr. Lundberg:

Our office has the following comments on the referenced report:

> Item-II,G - "... Because of infrequent flow and small quantities of runoff, stream gaging stations have not been installed generally, and hydrologic records are incomplete or nonexistent for attempting to quantify the runoff." (p. 73)

This statement seems to imply that there is not a basis for hydrologic analysis of drainage. We request a rewording to better reflect the intent of this statement.

> Item-III,B,2,b(1) - "... Tower sites will be located far enough away to avoid flood hazard and not cause damage to wash bottom vegetation." (p. 108)

Here again we request amplification in the final statement whether hydrologic analyses will be made to determine "far enough away," and if so, what the design flood frequency will be.

> Item-IV,B,2 - "... Proper drainage control will be provided for any roads that are required and areas that are damaged will be restored." (p. 139)

We request assurance that drainage control will not divert flows from one watershed to another. However, if this is unavoidable, we wish to be kept up-to-date on specific locations for drainage which originates within or crosses portions of Maricopa County.

If you have any questions on our suggested revisions, please call me on (602)-262-3630.

Sincerely,

HERBERT P. DONALD, P.E.
Chief Engineer and General Manager

Bill Jolly, P.E.
Engineer

HPD/BJ/ly

United States Department of the Interior
BUREAU OF RECLAMATION
LOWER COLORADO REGIONAL OFFICE
P.O. BOX 427
BOULDER CITY, NEVADA 89005

IN REPLY REFER TO: LC-150
120.1

November 15, 1974

NOTICE

Enclosed for your information is a copy of the Draft Environmental Statement on the Granite Reef Aqueduct Transmission System, a feature of the Central Arizona Project. The statement has been prepared by the Bureau of Reclamation in compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190. The statement was assigned Control Number INT DES 74-105 and filed with the Council on Environmental Quality on November 14, 1974.

There is a 45-day review and comment period on this draft in which written comments may be submitted to this office for consideration and incorporation into the final statement.

E. A. Lundberg
Regional Director

DEPARTMENT OF THE INTERIOR

DRAFT
ENVIRONMENTAL STATEMENT

INT DES 74-105

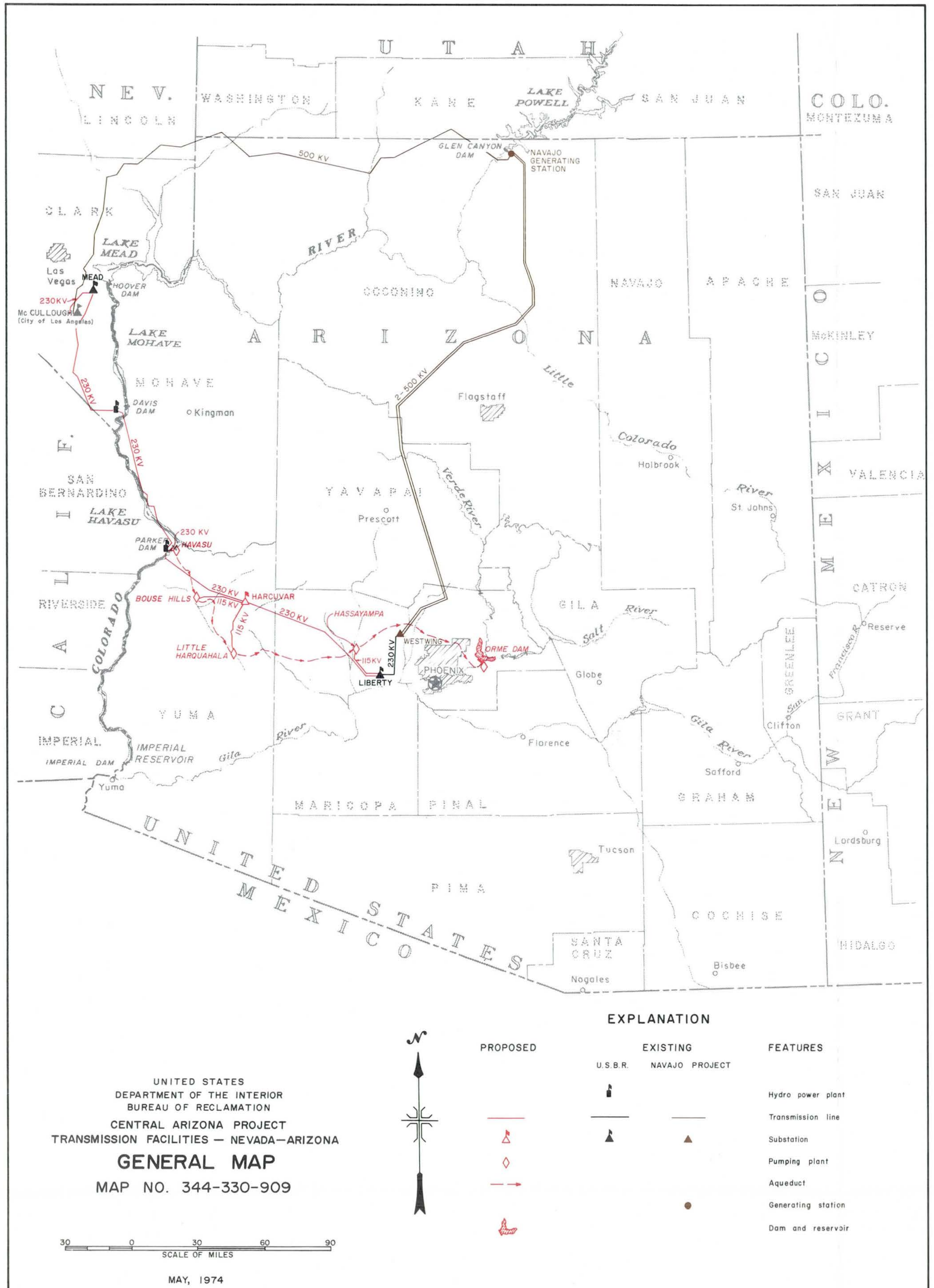
AUTHORIZED
GRANITE REEF AQUEDUCT
TRANSMISSION SYSTEM
CENTRAL ARIZONA PROJECT
ARIZONA-NEW MEXICO

Prepared by
Bureau of Reclamation
Department of the Interior

NOV 14 1974

E. A. Lundberg
Regional Director

Interior - Reclamation, B.C., Nev. 10-74



Interior - Reclamation, B.C., Nev. 7-74

Figure 1

(x) Draft ( ) Final Environmental Statement

Department of the Interior, Bureau of Reclamation, Lower Colorado Region

1. Type of action:

(X) Administrative ( ) Legislative

2. Brief description of action:

This statement describes the environmental impact associated with constructing an electric power transmission system to supply power to pumping plants and check structures along the Granite Reef Aqueduct. The main backbone transmission line will connect McCullough switchyard in Clark County, Nevada with Liberty Substation in Maricopa County, Arizona. The line will also interconnect Mead Substation, Davis Switchyard, and Parker Switchyard. In addition, a new substation, called Harcuvar, will be constructed in Yuma County, Arizona. Approximately 275 miles of backbone 230-kV transmission line will be constructed. Also, 77 miles of radial transmission line, at 230-kV and 115-kV, of which 19 miles are double circuited to the backbone Parker-Liberty line, will be constructed to service Havasu, Bouse Hills, Little Harquahala and Hassayampa Pumping Plants along the Granite Reef Aqueduct. Construction activities will be staged and occur over a 10-year duration.

3. Summary of environmental impacts and adverse environmental effects:

The principal impact of construction of the transmission line will be esthetic in nature. About 333 miles of new transmission line will be constructed most of which will parallel existing lines.

A long-term average of 1,675 GWH/yr. will be required for the pumping load of the Granite Reef Aqueduct.

Construction activities will have a temporary effect on the biota of the area. Certain temporary localized effects of increased noise and blowing dust as normally encountered with construction will be experienced.

Acquisition of approximately 4,200 acres of land will be required for the transmission system right-of-way which will restrict development and future land use by man. Of this amount, 14 acres will be permanently occupied by structures which will preclude wildlife use.

4. Alternatives considered:

a. Transmission systems alternatives
b. Routing and location alternatives
c. Alternatives in design
d. No action

5. List of entities from which comments have been requested:

See attached list.

6. Date draft statement made available to CEQ and the public: NOV 14 1974

GRANITE REEF AQUEDUCT TRANSMISSION SYSTEM

LISTING OF FEDERAL, STATE, AND LOCAL AGENCIES AND PRIVATE ENTITIES FROM WHICH COMMENTS HAVE BEEN REQUESTED:

Federal Agencies (submitted by the Commissioner, Bureau of Reclamation)

Department of the Interior, Washington, D. C.
- Commissioner, Bureau of Indian Affairs
- Director, Bureau of Land Management
- Director, Bureau of Mines
- Director, Bureau of Outdoor Recreation
- Director, Fish and Wildlife Service
- Director, Geological Survey
- Director, National Park Service

Advisory Council on Historic Preservation, Washington, D. C.
Department of Agriculture, Washington, D. C.
Department of Health, Education, and Welfare, Washington, D. C.
Department of Housing and Urban Development, Washington, D. C.
Environmental Protection Agency, Washington, D. C.
Federal Power Commission, Washington, D. C.
Department of Defense, Corps of Engineers, Washington, D. C.
Department of Transportation, Washington, D.C.

Individuals and State and Local Agencies (distributed by the Regional Director or Projects Manager, Lower Colorado Region, Bureau of Reclamation)

Governors of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming

Clearinghouses of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming

Arizona Military Department, Phoenix, Arizona
Advisory Commission on Arizona Environment, Phoenix, Arizona
Arizona Game and Fish Department, Phoenix, Arizona
Arizona State Land Department, Phoenix, Arizona
Arizona State Parks Board, Phoenix, Arizona
Arizona State Reclamation Association, Phoenix, Arizona
Arizona Water Commission, Phoenix, Arizona
Arizona Outdoor Recreation Coordinating Commission, Phoenix, Arizona
Arizona Environmental Planning Commission, Phoenix, Arizona
Office of Economic Planning and Development, Phoenix, Arizona
Arizona Highway Department, Phoenix, Arizona
Arizona Atomic Energy Commission, Phoenix, Arizona
Arizona Game and Fish Department, Yuma, Arizona
Arizona State University Library, Tempe, Arizona
Department of Parks and Recreation, Sacramento, California

California Department of Water Resources, Sacramento, California
California Department of Fish and Game, Sacramento, California
Colorado River Board of California, Los Angeles, California
The Resources Agency of California, Sacramento, California
Division of Colorado River Resources (formerly Colorado River Commission of Nevada)
Eldorado Valley Advisory Group, Las Vegas, Nevada
Nevada Department of Fish and Game, Las Vegas, Nevada
Nevada Department of Fish and Game, Reno, Nevada
Clark County, Nevada
Clark County Regional Planning Council, Las Vegas, Nevada
City of Boulder City, Nevada
City of Searchlight, Nevada
New Mexico Interstate Stream Commission, Santa Fe, New Mexico
New Mexico Game and Fish Department, Santa Fe, New Mexico
Arizona Cooperative Fishery Unit, Tucson, Arizona
Arizona Farm Bureau Federation, Phoenix, Arizona
Arizona Conservation Council, Phoenix, Arizona
Museum of Northern Arizona, CPEAC, Flagstaff, Arizona
Mohave County Board of Supervisors, Kingman, Arizona
Arizona Water Sports Council, Phoenix, Arizona
Maricopa County Board of Supervisors, Phoenix, Arizona
Yuma County Board of Supervisors, Yuma, Arizona
Maricopa County Flood Control District, Phoenix, Arizona
Maricopa Association of Governments, Phoenix, Arizona
Yavapai County Board of Supervisors, Prescott, Arizona
Yuma County Parks and Recreation Department, Yuma, Arizona
Yuma County Chamber of Commerce, Yuma, Arizona
Yuma County Natural Resources Committee, Yuma, Arizona
Dr. M. A. Cazier, Professor of Entomology, ASU, Tempe, Arizona
College of Earth Sciences, University of Arizona, Tucson, Arizona
Flagstaff Branch Library, Flagstaff, Arizona
Northern Arizona University Library, Flagstaff, Arizona
University of Arizona Library, Tucson, Arizona
Cooperative Extension Service, University of Arizona, Yuma, Arizona
Dr. W. L. Minckley, Department of Zoology, ASU, Tempe, Arizona
Dr. Duncan T. Patten, Center for Environmental Studies, ASU, Tempe, Arizona
Dr. Robert D. Ohmart, Department of Zoology, ASU, Tempe, Arizona
University of Southern California, Law Center Library, Los Angeles, California
Clark County Comprehensive Health Planning Council, Las Vegas, Nevada
Four Corners Regional Commission, Farmington, New Mexico
Dr. Bruce Hayward, Department of Biological Sciences, Western New Mexico University, Silver City, New Mexico
Museum of New Mexico, State Archeologist, Santa Fe, New Mexico
Colorado River Tribal Council, Parker, Arizona
Salt River Pima-Maricopa Community Council, Scottsdale, Arizona
Fort McDowell Community Council, Scottsdale, Arizona
Fort Mohave Tribal Council, Needles, California
Gila River Community Council, Sacaton, Arizona
Ak-Chin (Maricopa) Community Council, Maricopa, Arizona

Papago Community Council, Sells, Arizona
Paradise Valley Planning Commission, Phoenix, Arizona
City of Phoenix, Arizona
City of Bullhead City, Arizona
Túcson Gas and Electric Company, Tucson, Arizona
Federal Aid Coordination, City of Phoenix, Phoenix, Arizona
Phoenix Public Library, Phoenix, Arizona
City of Parker, Parker, Arizona
Los Angeles Department of Water and Power, Los Angeles, California
Arizona Electric Power Cooperative, Benson, Arizona
Arizona Public Service Company, Phoenix, Arizona
Central Arizona Water Conservation District, Mesa, Arizona
Salt River Project, Phoenix, Arizona
Mohave County Planning Commission, Kingman, Arizona
Citizens Utilities Company, Kingman, Arizona
Metropolitan Water District of Southern California, Los Angeles, California
Frank Lloyd Wright Foundation, Scottsdale, Arizona
Sun City Home Owners, Sun City, Arizona
Maricopa Audubon Society, Phoenix, Arizona
American Society of Civil Engineers, Tucson, Arizona
W. S. Gookin and Associates, Scottsdale, Arizona
Arizona Wildlife Federation, Phoenix, Arizona
DNA, Attorneys at Law, Chinle, Arizona
Sierra Club, Southwest Regional Conservation Committee, Santa Fe, New Mexico
State Chairman of Environmental Quality Programs for the
League of Women Voters, Sedona, Arizona
Tucson Urban Area Regional Reviewing Committee, Tucson, Arizona
Arizona Environmental Health Association, Scottsdale, Arizona
Arizona Republic, Phoenix, Arizona
Yuma Valley Rod and Gun Club, Yuma, Arizona
Arizona Consulting Engineers Association, Phoenix, Arizona
Arizona Society of Architects, Tucson, Arizona
Bivens and Associates, Inc., Phoenix, Arizona
Sierra Club, Grand Canyon Chapter, Tucson, Arizona
American Water Resources Association, Tucson, Arizona
William R. McGill & Associates, Phoenix, Arizona
City of Scottsdale, Public Works Department, Scottsdale, Arizona
Southwest Gas Corporation, Las Vegas, Nevada
El Paso Natural Gas Company, El Paso, Texas
California Wildlife Federation, Sacramento, California
Operating Engineers Research, Western Conference, San Mateo, California
Sierra Club, Southern California Representative, Los Angeles, California
Native American Rights Fund, Boulder, Colorado
Albuquerque Environmental Center, Albuquerque, New Mexico
Environmental Improvement Center, Albuquerque, New Mexico
Ms. Lee Oler, Tucson, Arizona
Frank Welsh, Phoenix, Arizona
Thomas L. Sarbeck, Phoenix, Arizona
John R. Nicholson, Hemet, California
Charles D. Raydl, President, Lake Havasu Irrigation and Drainage District,
Lake Havasu City, Arizona

Federal Agencies (field offices, submitted by the Regional Director)*

District Manager, Bureau of Land Management, Yuma, Arizona
Regional Director, National Park Service, San Francisco, California
Department of Housing and Urban Development, Los Angeles, California
Department of Transportation, San Francisco, California
State Director, Bureau of Land Management, Phoenix, Arizona
Arizona Archeological Center, National Park Service, Tucson, Arizona
Division of River Basin Studies, Fish and Wildlife Service, Phoenix, Arizona
Area Director, Bureau of Indian Affairs, Phoenix, Arizona
Environmental Protection Agency, San Francisco, California
Los Angeles District, Corps of Engineers, Los Angeles, California
District Manager, Phoenix District Office, Bureau of Land Management, Phoenix, Arizona
District Manager, Las Vegas District Office, Bureau of Land Management, Las Vegas, Nevada
Area Manager, Havasu Planning Unit, Bureau of Land Management, Lake Havasu City, Arizona
Superintendent, Lake Mead National Recreation Area, National Park Service, Boulder City, Nevada

* These were intended as information copies only with official responses anticipated from their Washington offices.

LISTING OF LIBRARIES

Repositories of Environmental Statements for Public Access

Arizona Collection
University Library
Arizona State University
Tempe, Arizona 85281

University Library
Documents Section
The University of Arizona
Tucson, Arizona 85721

Reference Librarian
University Library
Northern Arizona University
Flagstaff, Arizona 86001

Librarian
Prescott College
Prescott, Arizona 86301

Arizona Department of Library
and Archives
3rd Floor, State Capitol
Phoenix, Arizona 85007

Library
Navajo Community College
Many Farms, Arizona 86503

Library
Arizona Western College
Yuma, Arizona 85364

Library
Central Arizona College
Signal Peak Campus
Overfield At Woodruff Road
Coolidge, Arizona 85228

Library
Cochise College
Douglas, Arizona 85607

Library
Maricopa County
Community College District
P. O. Box 13349
Phoenix, Arizona 85002

Law Center Library
University of Southern California
University Park
Los Angeles, California 90007

Library
New Mexico State University
Las Cruces, New Mexico 88001

New Mexico State Library
State Capitol
Santa Fe, New Mexico 87501

Zimmerman Library
University of New Mexico
University Hill N.E.
Albuquerque, New Mexico 87106

Silver City Library
Silver City, New Mexico 88061

Library
Western New Mexico University
Silver City, New Mexico 88061

Library
Pima College
2202 West Anklam Road
Tucson, Arizona 85709

Library
Yavapai College
P. O. Box 553
Prescott, Arizona 86301

Mrs. Leah Cook, Librarian
Casa Grande Public Library
Casa Grande, Arizona 85222

Mrs. Della Stevens, Librarian
Clifton Public Library
Clifton, Arizona 85533

Mrs. Esther Baker, Librarian
Coolidge Public Library
Coolidge, Arizona 85228

Mrs. Frances E. Thomas, Librarian
Yuma City County Library
Regional Headquarters
350 South 3rd Street
Yuma, Arizona 85364

Mrs. Elaine Burke, Librarian
Lake Havasu City Public Library
Mohave County Stytem
Lake Havasu City, Arizona 86403

Librarian
Clark County Library
1401 E. Flamingo Road
Las Vegas, Nevada 89109

Director
University of Nevada Library
45055 Maryland Parkway
Las Vegas, Nevada 89154

Librarian
Searchlight Library
Searchlight, Nevada 89046

Librarian
Henderson Library
55 Water Street
Henderson, Nevada 89015

Librarian
Boulder City Public Library
539 California Street
Boulder City, Nevada 89005

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APPENDED MATERIAL

APPENDIX A

Appendix A contains copies of comments received by the Bureau of Reclamation from Federal and State agencies that have reviewed the proposal.

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APPENDED MATERIAL (Continued)

APPENDIX B

APPENDIX C

APPENDIX D

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(Continued)

APPENDED MATERIAL (Continued)

APPENDIX E

CHAPTER I

DESCRIPTION OF THE PROPOSAL

I. DESCRIPTION OF THE PROPOSAL

A. Introduction [1, 2, 3, 29]

This environmental statement describes the facilities, environment along and adjacent to the facilities, the impacts and effects upon the environment, mitigation considerations and alternatives considered in developing a system to provide for the power requirements of the Granite Reef Aqueduct. The construction of the transmission system would integrate with the existing Federal facilities between McCullough Switching Station near Boulder City, Nevada, and the Liberty Substation near Phoenix, Arizona. Figures 1 and 2 show the relationship of the proposed transmission system to the area, the other planned facilities of the Central Arizona Project and to the existing Federal transmission lines in the area.

This environmental statement on the transmission system serving the Granite Reef Aqueduct (Granite Reef Division) of the Central Arizona Project (CAP) is submitted in compliance with the National Environmental Policy Act of 1969 (83 Stat. 852, 42 U.S.C. 4321, et seq.), the Council on Environmental Quality Guidelines (38 F.R. 20550, August 1, 1973), Department of the Interior regulations (36 F.R. 19343, October 2, 1971), and Bureau of Reclamation directives (37 F.R. 24910, November 23, 1972). It is also submitted in accordance with policy set forth in the overall environmental statement on the CAP (FES 72-35) which provided for preparation of individual environmental statements for major features of the CAP prior to initiation of construction on the separate components. Future

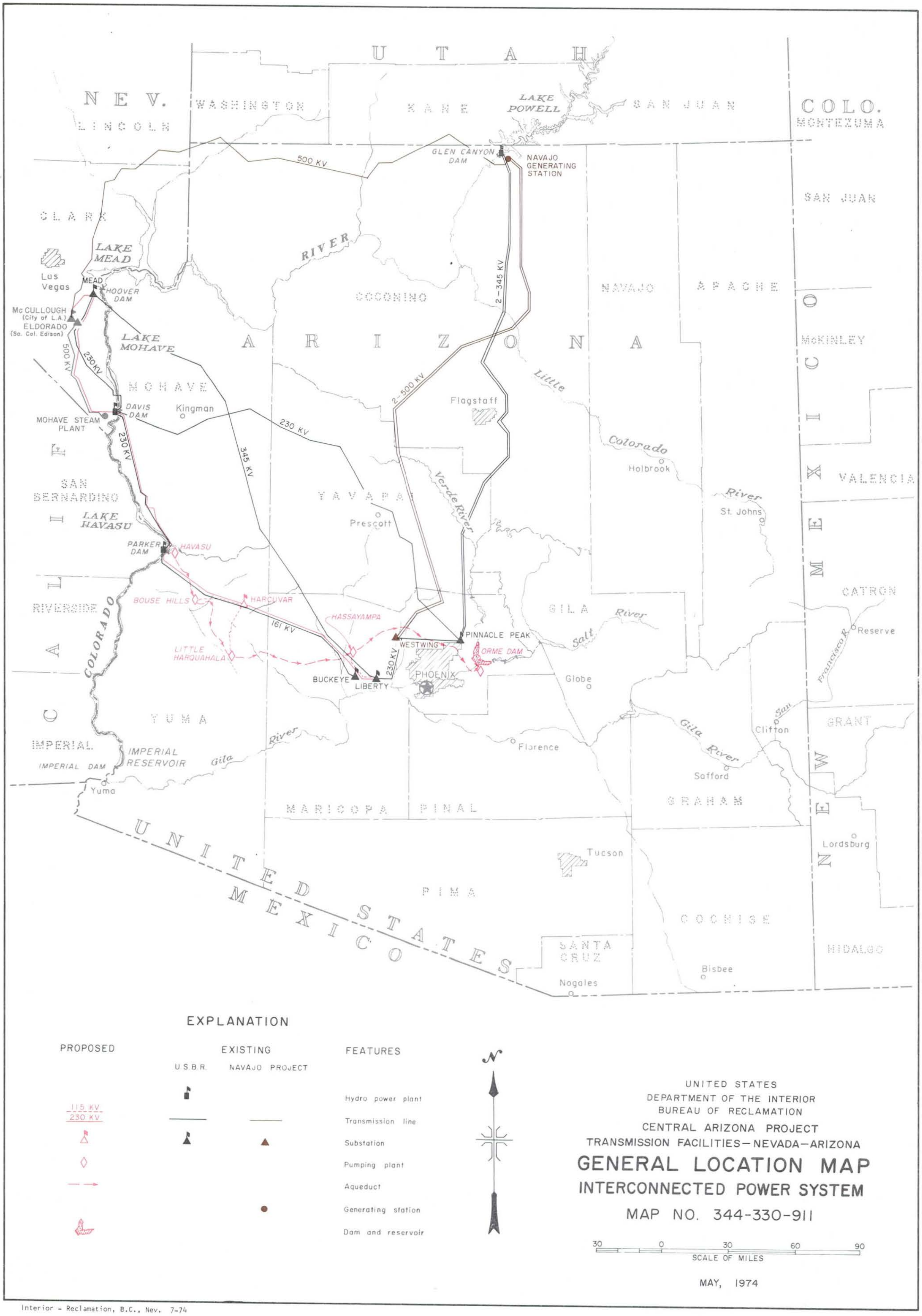

UTAH
NEV.
LINCOLN
WASHINGTON
KANE
LAKE POWELL
SAN JUAN
COLO.
MONTEZUMA
GLEN CANYON DAM
NAVAJO GENERATING STATION
500 KV
CLARK
LAKE MEAD
Las Vegas
MEAD
HOOVER DAM
Mc CULLOUGH (City of L.A.)
ELDORADO (So. Cal. Edison)
RIVER
COCONINO
2-345 KV
NAVAJO
APACHE
ARIZONA
LAKE MOHAVE
500 KV
230 KV
MOHAVE
DAVIS DAM
Kingman
MOHAVE STEAM PLANT
2-500 KV
Flagstaff
Little Colorado
230 KV
345 KV
Holbrook
SAN BERNARDINO
YAVAPAI
Verde River
River
St. Johns
LAKE HAVASU
Prescott
PARKER DAM
HAVASU
BOUSE HILLS
HARCUVAR
RIVERSIDE
COLORADO
HASSAYAMPA
161 KV
LITTLE HARQUAHALA
WESTWING
PINNACLE PEAK
GILA
River
Salt
ORME DAM
BUCKEYE
LIBERTY
230 KV
PHOENIX
Globe
YUMA
IMPERIAL
IMPERIAL DAM
IMPERIAL RESERVOIR
Gila River
Florence
Gila River
Safford
Clifton
San
MARICOPA
PINAL
GRAHAM
Yuma
UNITED STATES
MEXICO
Tucson
PIMA
COCHISE
SANTA CRUZ
Nogales
Bisbee
CALIF.
SAN JUAN
McKINLEY
VALENCIA
CATRON
Reserve
Francisco R.
GRANT
NEW MEXICO
Lordsburg
HIDALGO
EXPLANATION
PROPOSED
EXISTING
U.S.B.R.
NAVAJO PROJECT
FEATURES
115 KV
230 KV
Hydro power plant
Transmission line
Substation
Pumping plant
Aqueduct
Generating station
Dam and reservoir
N
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES—NEVADA—ARIZONA
GENERAL LOCATION MAP
INTERCONNECTED POWER SYSTEM
MAP NO. 344-330-911
30 0 30 60 90
SCALE OF MILES
MAY, 1974
Interior - Reclamation, B.C., Nev. 7-74

Figure 2

additional environmental statements on other features of the CAP will include the transmission facilities applicable to those features.

This statement supplements the general information for the power and transmission requirements of the Granite Reef Aqueduct system as covered in the above-referenced final overall environmental statement for the CAP (FES 72-35), filed with the Council on Environmental Quality (CEQ) on September 26, 1972. A final environmental statement for the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel (FES 73-2) was filed with CEQ on January 15, 1973, and the final environmental statement for the Granite Reef Aqueduct (FES 74-5) was filed with CEQ on January 22, 1974.

The source of power for the electrical facilities of the Granite Reef Aqueduct will be from the Navajo Generating Station located near Page, Arizona. The Navajo Generating Station and attendant transmission system are described in the final environmental statement for the Navajo Project (FES 72-1), dated February 4, 1972. Power will be delivered over the Navajo Project's Southern Transmission System from the generating station south to the Navajo Project Westwing Substation located northwest of Phoenix, Arizona. From the Westwing Substation, power will be delivered to the Pacific Northwest-Pacific Southwest (PNW-PSW) Intertie Project's Liberty Substation located west of Phoenix, Arizona, over the Intertie's existing Pinnacle Peak-Liberty 230-kV transmission line and a short (230-kV) interconnection line (approximately 2 miles in length) that connects the Westwing Substation to the Pinnacle Peak-Liberty 230-kV transmission line. The short interconnection line will be completed in 1974 as a part of the Intertie Project system for the purpose of delivering power to the Liberty Substation. Power will also be delivered over the Navajo Project's Western Transmission System, from the Navajo Generating Station west to the McCullough Switching Station located west of Boulder City, Nevada. The CAP transmission system will connect the Liberty Substation and McCullough Switching Station points of delivery to the Granite Reef Aqueduct pumping plants and interconnect with the existing Parker-Davis and PNW-PSW Intertie systems. The integration of these systems will provide a backbone system for the delivery of power to meet the demands of the Granite Reef Aqueduct and will also improve the reliability of the Federal power system.

In addition to the main 230-kV, or backbone of the transmission system, this statement includes a description of the 230-kV and 115-kV radial transmission system to the pumping plants and distribution system to the check structure along the Granite Reef Aqueduct. The transmission system is a major component of the CAP, for which this separate environmental statement is prepared.

The estimated cost of the integrated transmission system to serve the Granite Reef Aqueduct loads, based on the 1974 cost index, is $45,975,000. Proper allocation of costs to the various projects, i.e., Parker-Davis Project, CAP, served by the integrated system will be necessary. Salvage values of replaced facilities, remaining costs to be amortized, system capacity usage, and many other factors will be considered to determine the proper allocation of costs among the projects affected. About 70 percent of the CAP share of construction cost will be repaid to the Federal Treasury by the water and power users who benefit directly from the CAP. By provisions of Public Law 89-72, dated July 9, 1965, the joint project costs and one-half of the separable construction cost for fish and wildlife and recreation purposes are nonreimbursable. Costs allocated to flood control in the National interest are also nonreimbursable.

Initial construction of this portion of the Granite Reef Aqueduct transmission system is expected to start in mid-1975 and will take approximately 10 years to complete.

In order to assist the reviewing public in interpreting several of the technical terms included in this environmental statement, an engineering glossary and environmental glossary have been put in Appendix D.

B. Legislative History, Authorization, and Requirements [14, 15, 16, 17, 18]

1. Legislative History [4-7, 9, 10, 20-25, 35-37]

At the request of the Colorado River Basin States (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming), Congress passed an act on August 19, 1921, giving consent to the States to negotiate and enter into a compact for the equitable apportionment of the water supply of the Colorado River. This agreement, known as the Colorado River Compact, was signed in Santa Fe, New Mexico, on November 24, 1922. The Compact divides the entire Colorado River Basin into two parts, the Upper Basin and the Lower Basin, separated at a point on the river in northern Arizona known as Lee Ferry. Article III(a) of the Compact apportions to the Upper Basin and to the Lower Basin in perpetuity the exclusive beneficial consumptive use of 7,500,000 acre-feet each of water per year from the Colorado River system. Article III(b) apportions an additional 1,000,000 acre-feet annually to the Lower Basin for beneficial use.

In 1928, Congress passed the Boulder Canyon Project Act authorizing construction of the Boulder Canyon Project. The Act and its subsequent amendment by the Boulder Canyon Project Adjustment Act directed the Secretary of the Interior to make investigations and publish reports of the feasibility of projects for irrigation, generation of electric power, and other purposes in the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

In 1944, the Bureau of Reclamation and the State of Arizona entered into a contract for the expenditure of $400,000 for a cooperative investigation of the utilization of Colorado River water in Arizona. That investigation resulted in the Central Arizona Project Report which was submitted to the Secretary of the Interior on December 19, 1947. The Secretary's findings relative to CAP were submitted to Congress in September 1948. Preliminary hearings on the CAP were actually started in 1947 in the Senate and House of Representatives in advance of submittal of the report. A favorable vote on the CAP (52-28) was obtained in the Senate, but in 1951 the House Committee on Interior and Insular Affairs postponed action until such time as Arizona's right to the use of Colorado River water was adjudicated or settled by other means.

In the summer of 1952, the State of Arizona initiated an interstate suit in the Supreme Court of the United States against California and others to confirm its entitlement to Colorado River water. On June 3, 1963, the Supreme Court rendered an opinion on Arizona's entitlement, and subsequently, on March 9, 1964, the Supreme Court decree in Arizona v. California confirmed Arizona's entitlement to 2,800,000 acre-feet annually of the first 7,500,000 acre-feet of Colorado River mainstream flow available to the three Lower Basin states plus 46 percent of flows in excess of 7,500,000 acre-feet.

On June 4, 1963, the day following the Supreme Court opinion, bills to authorize the CAP were introduced in both Houses of Congress. From 1963 through 1968, many additional bills and amendments were introduced proposing different versions of the CAP, and hearings were held yearly.

The most significant bills considered were:

a. S. 1658, introduced June 4, 1963

b. H.R. 4671, introduced February 9, 1965

c. H.R. 3300, introduced January 23, 1967

d. S. 1004, introduced February 16, 1967

Different versions of the CAP were passed by the United States Senate (S. 1004, August 7, 1967) and the House of Representatives (H.R. 3300, May 16, 1968). S. 1004 cleared a conference committee on August 1, 1968, and was approved by both House and Senate. The compromise version became Public Law 90-537 with the approval of President Johnson on September 30, 1968.

During the long legislative history of the CAP, many environmental issues were examined by various Congressional committees. Persons and groups demanding that environmental consequences of the CAP be considered presented their views to a responsive Congress. Hualapai (Bridge Canyon) and Marble Canyon Dams on the Colorado River were dropped from the CAP as a result of opposition from environmental groups. A decision was made by the Congress and the Department of the Interior that a thermal electric generating station was a feasible alternative to provide pumping energy and financial assistance to the CAP.

In consideration of environmental concerns over effects of the dams on the Grand Canyon area, the Secretary of the Interior directed the Bureau of Reclamation to reevaluate and study all possible power alternatives for the CAP. Studies led to a recommendation that the Federal Government participate with public and private power utilities in the development of a large coal-fired thermal power unit which later became known as the Navajo Generating Station. It was this revised power development program and recognition of the Mexican Treaty obligation as a National responsibility which provided the final catalyst for quick Congressional approval and authorization of the CAP.

The CAP was authorized under Public Law 90-537 on September 30, 1968, as part of the Colorado River Basin Project Act. The first construction contract for the excavation of the Havasu Pumping Plant site and construction of the Havasu Intake Channel embankment has been completed and a contract for Reach 11 flood detention dikes for the Granite Reef Aqueduct was awarded on April 30, 1974. Additional contracts will be awarded for the construction of transmission lines, substation and switchyard additions, and a new substation.

2. Legislative Requirements [1-3, 11, 12]

Public Law 90-537, the Colorado River Basin Project Act, authorizes construction of the CAP subject to a number of specific requirements and restrictions. Generally, these conditions are imposed in order to assure that existing rights are protected and that operation of the CAP is consistent with National policies and preferred water management practices. The requirements relevant to this statement are listed below.

The restrictions applicable to the water conveyance system features have been delineated in the environmental statements on the overall project (FES 72-35), the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin

Mountains Tunnel (FES 73-2), and the Granite Reef Aqueduct (FES 74-5). The legislative requirements relating to power sources preclude hydroelectric production from Colorado River flows between Glen Canyon Dam and Hoover Dam by restricting the Secretary of the Interior from studying or constructing any dams on the mainstream of the Colorado River between these two dams. The law further requires that the accounting for water service to a thermal generating plant in Arizona above Lee Ferry be charged against Arizona's Upper Colorado River Basin Compact entitlement of 50,000 acre-feet annually. The law authorizes the marketing of power and energy intermittently not required for CAP pumping.

C. Purpose

The proposed transmission system will connect the power delivery points of the Navajo Project transmission system to the pumping plants and other associated power demands of the Granite Reef Aqueduct system. Interconnecting with the existing Parker-Davis and PNW-PSW Intertie Federal power systems will prevent unnecessary duplication of facilities inherent with an independent system, afford reliability for both the existing and proposed Federal transmission systems, and provide advantages for delivering or marketing any CAP energy which is not needed for project facilities during offpeak periods.

D. Description of Transmission System [1-3, 8, 25, 29]

1. General

Power for the Granite Reef Aqueduct pumping plants will be supplied by the Navajo Generating Station at Page, Arizona, and will be delivered to the McCullough Switching Station southwest of Boulder City, Nevada, and the Liberty Substation through the Westwing Substation, both near Phoenix, Arizona. The capacity of the existing Parker-Davis Project transmission system in the CAP area is not adequate to serve both the existing loads and the CAP electrical loads, therefore, additional transmission facilities will be required. System planning studies were considered to devise a transmission plan which would best serve the joint requirements of the CAP, Parker-Davis Project and the Pacific Northwest-Pacific Southwest Intertie.

Through a process of analysis of alternative routes, a transmission system was selected that will use and interconnect to existing facilities. By interconnecting with and uprating some existing facilities, it will be possible to use some existing rights-of-way and substation sites and thereby minimize the amount of additional lands and facilities required.

The proposed 230-kV transmission system additions to serve the Granite Reef Aqueduct will be as shown in Figure 2 and consist of individual segments as shown in Table 1. The radial transmission system to serve the pumping plants will consist of individual lines as shown in Table 2.

Table 1
Transmission System Additions
Serving the Granite Reef Aqueduct

Transmission Lines (230-kV)	Length (Miles)
McCullough Switching Station to Mead Substation	15.3
Mead Substation to Davis Dam Switchyard	68.3
Davis Dam to Parker Switchyard	71.0
Parker Switchyard to Liberty Substation	120.9 1/
Total Length	275.5

Table 2
Radial Transmission System Serving the Pumping Plants

Voltage	Radial Transmission Line	Length (Miles)
230-kV	Parker Switchyard to Havasu Pumping Plant	2.2
115-kV	Harcuvar Substation to Bouse Hills Pumping Plant	22.6
115-kV	Harcuvar Substation to Little Harquahala Pumping Plant	26.8
115-kV	Liberty Substation to Hassayampa Pumping Plant	6.5 1/
	Total Length	58.1

1/ Does not include 19 miles of this transmission line double circuited with the Parker-Liberty 230-kV transmission line.

The transmission system will have a total length of 333.6 miles, of which 19 miles will be on double circuited 230/115-kV structures making the system 352.6 circuit miles long. Of the total length, 256.5 miles of single circuit and 19.0 miles of double circuit comprise the 230-kV interconnection backbone delivery portion. The radial transmission lines consist of 58.1 miles of single circuit line and the same 19 miles of double circuit line. Of the net length (333.6 miles), 264.3 miles will parallel or replace existing lines, and approximately 69.3 miles, most of which is for radial transmission lines to the pumping plants, will require new routing.

Additions will be constructed at existing substations and switchyards to accommodate the new system and facilitate the interconnections. A new substation called Harcuvar will be constructed for the distribution of power to the Bouse Hills and Little Harquahala Pumping Plants.

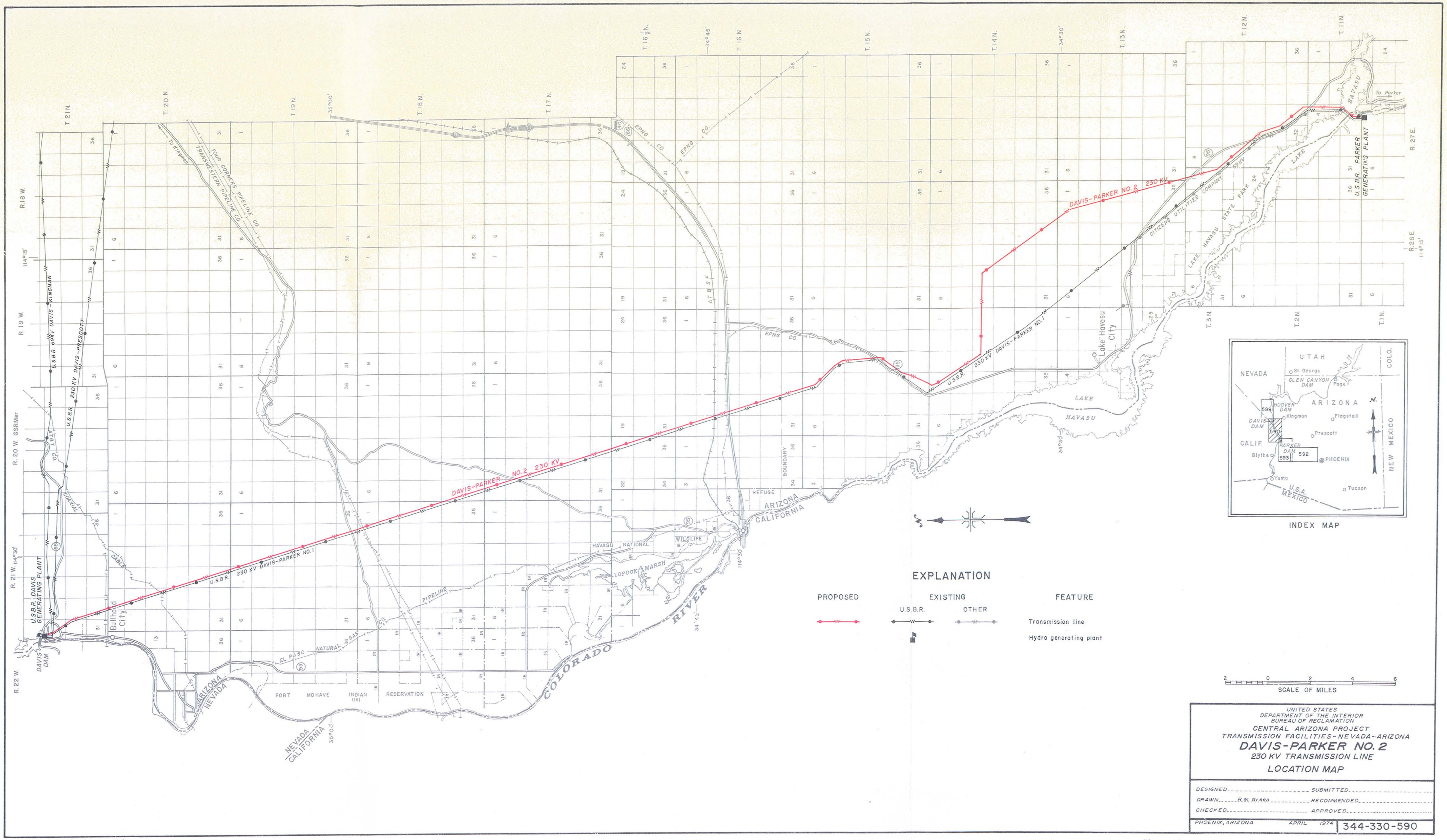
Electric power to operate the automatic gates at each of the check structures along the aqueduct will be supplied by a buried cable placed within the aqueduct right-of-way.

2. Location

The route of the 230-kV interconnecting lines, as shown on Figures 3 through 7, begins at the McCullough Switching Station southwest of Boulder City, Clark County, Nevada, moves northeast to the Mead Substation

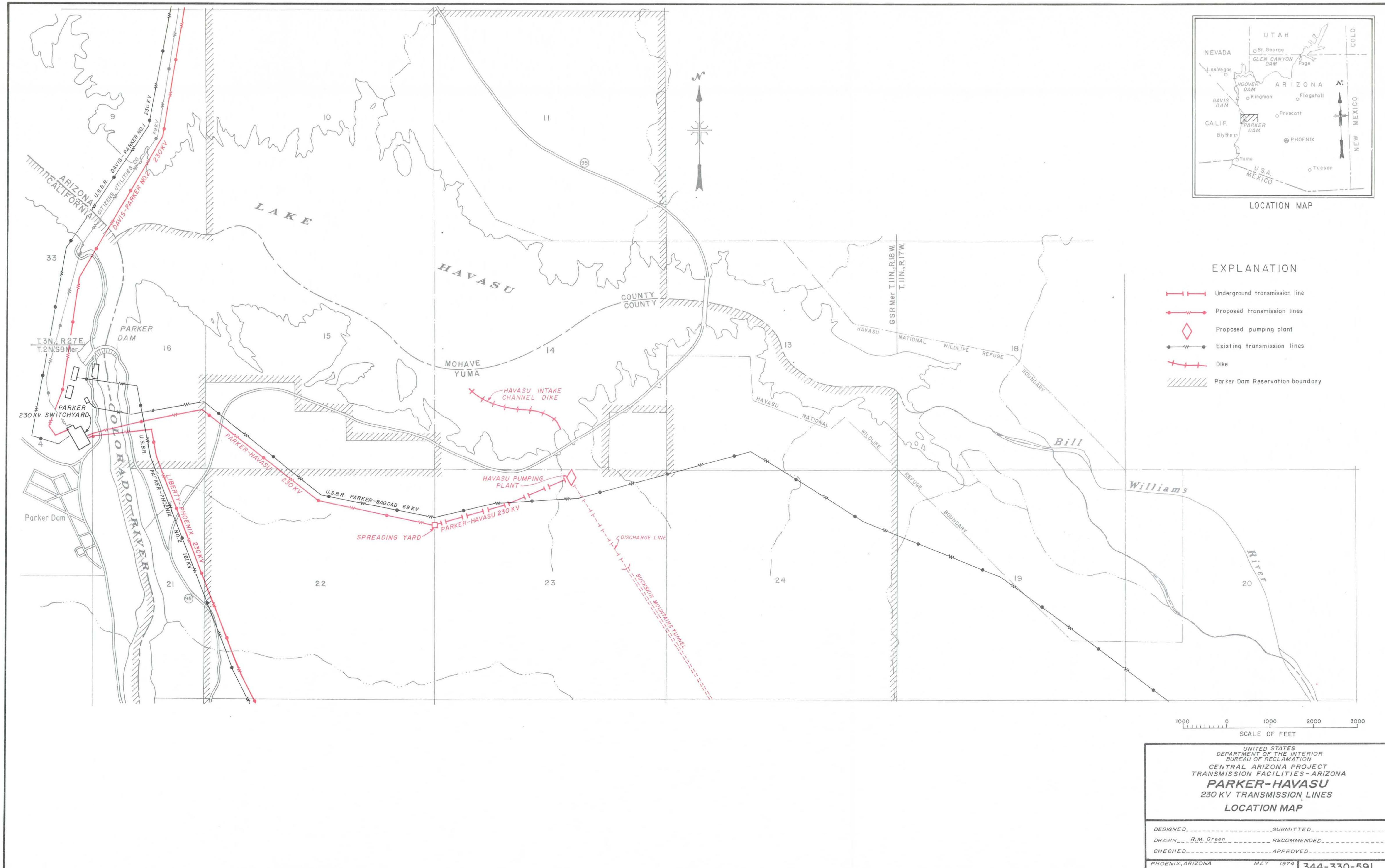
Interior - Reclamation, B.C., Nev. 7-74

Figure 3



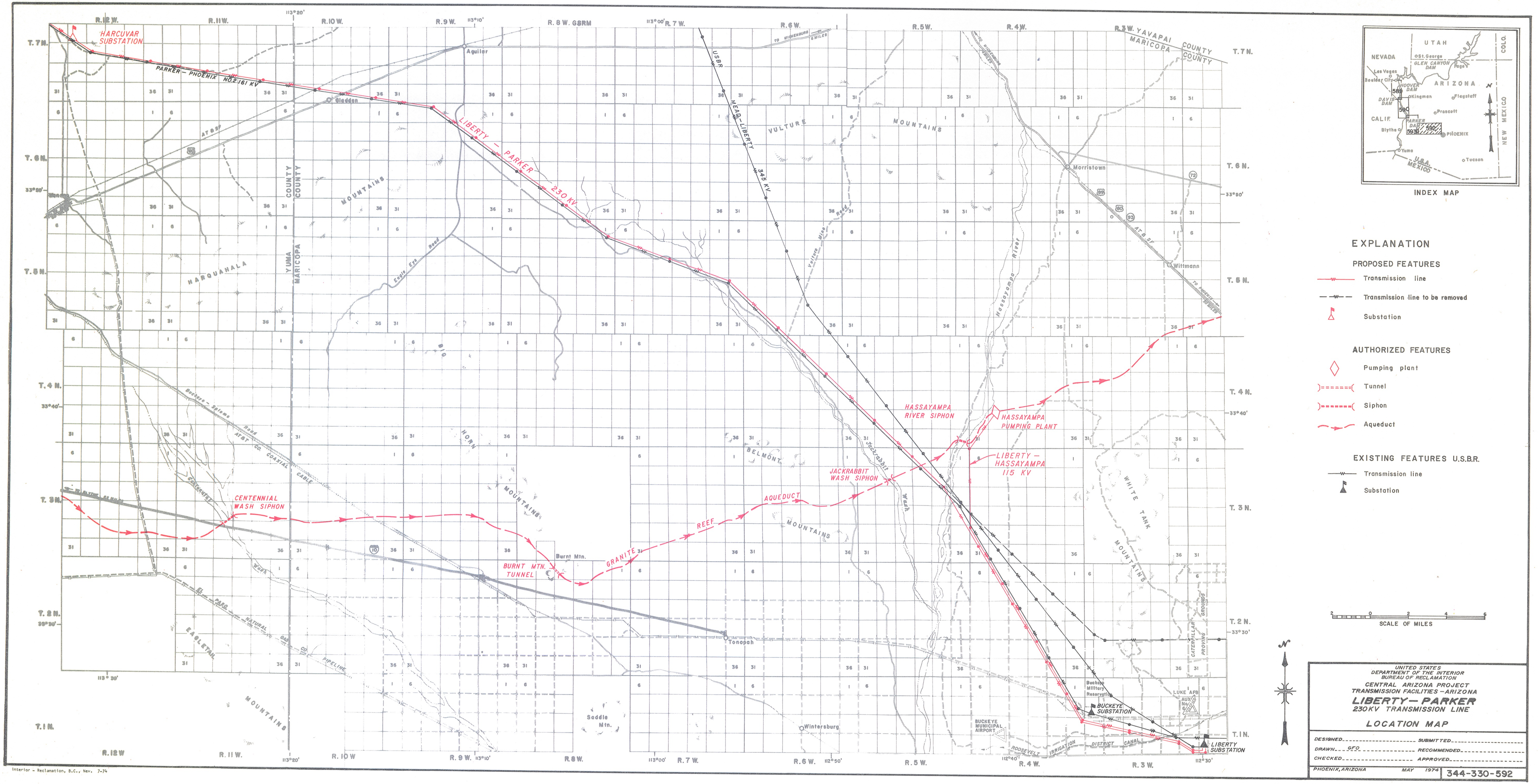
Interior - Reclamation, B.C., Nev. 7-74

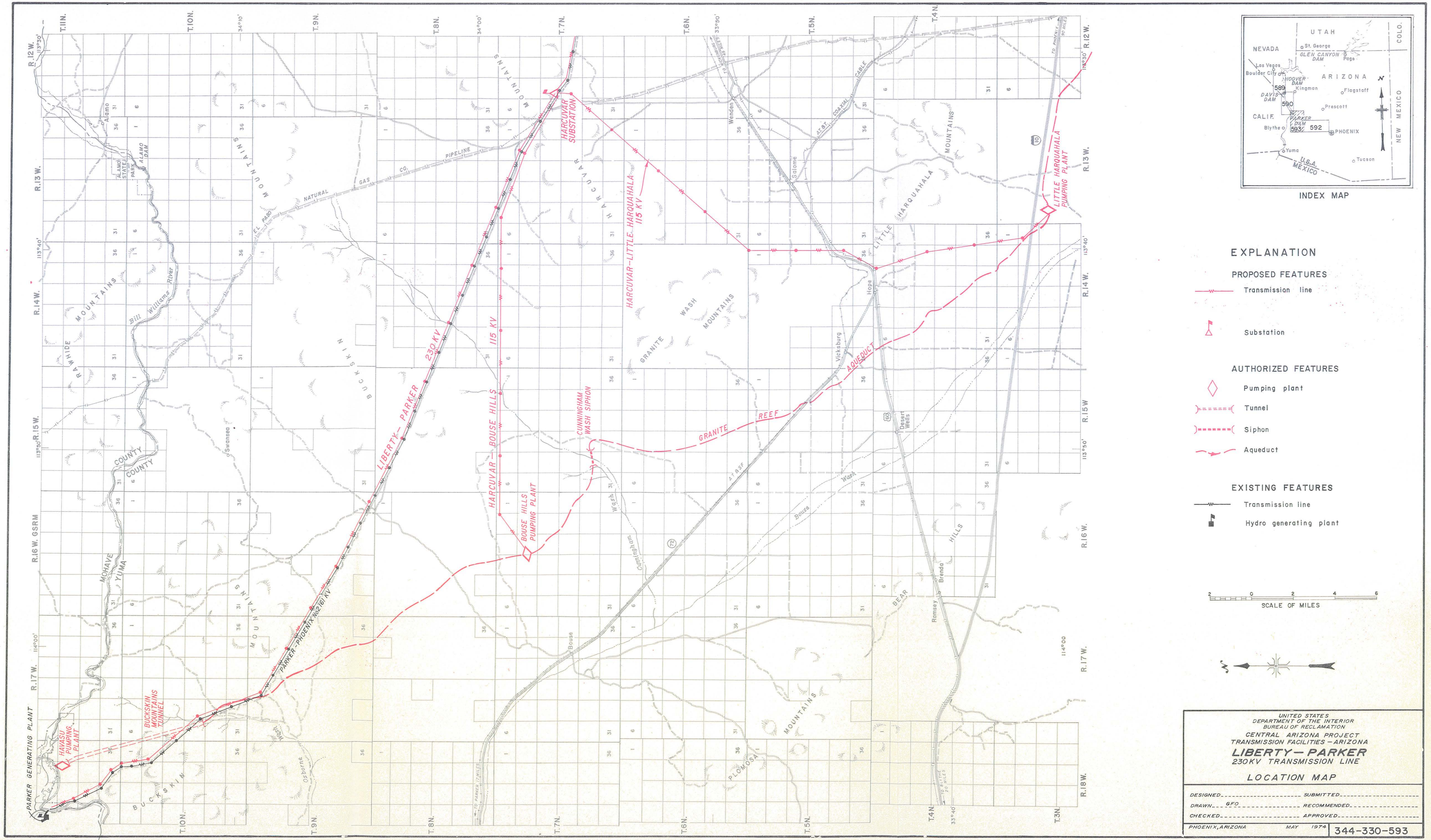
Figure 4



Interior - Reclamation, B.C., Nev. 7-74

Figure 5


HARCUVAR SUBSTATION
PARKER – PHOENIX NO.2 161 KV
LIBERTY – PARKER 230 KV
USBR MEAD – LIBERTY 345 KV
Aguila
Gladden
Wenden
Morristown
Wittmann
Tonopah
Wintersburg
Burnt Mtn.
Saddle Mtn.
YAVAPAI COUNTY
MARICOPA COUNTY
YUMA COUNTY
MARICOPA COUNTY
HARQUAHALA MOUNTAINS
VULTURE MOUNTAINS
BIG HORN MOUNTAINS
BELMONT MOUNTAINS
WHITE TANK MOUNTAINS
EAGLETAIL MOUNTAINS
Hassayampa River
Jackrabbit Wash
Centennial Wash
CENTENNIAL WASH SIPHON
BURNT MTN. TUNNEL
GRANITE REEF AQUEDUCT
JACKRABBIT WASH SIPHON
HASSAYAMPA RIVER SIPHON
HASSAYAMPA PUMPING PLANT
LIBERTY – HASSAYAMPA 115 KV
BUCKEYE SUBSTATION
LIBERTY SUBSTATION
Buckeye Military Reservation
BUCKEYE MUNICIPAL AIRPORT
LUKE AFB
ROOSEVELT IRRIGATION DISTRICT CANAL
CATERPILLAR PROVING GROUNDS
T. 7 N.
T. 6 N.
T. 5 N.
T. 4 N.
T. 3 N.
T. 2 N.
T. 1 N.
R. 12 W.
R. 11 W.
R. 10 W.
R. 9 W.
R. 8 W. GSRM
R. 7 W.
R. 6 W.
R. 5 W.
R. 4 W.
R. 3 W.
INDEX MAP
UTAH
NEVADA
ARIZONA
CALIF.
NEW MEXICO
COLO.
U.S.A.
MEXICO
St. George
GLEN CANYON DAM
Page
Las Vegas
Boulder City
HOOVER DAM
DAVIS DAM
Kingman
Flagstaff
Prescott
PARKER DAM
Blythe
PHOENIX
Yuma
Tucson
EXPLANATION
PROPOSED FEATURES
Transmission line
Transmission line to be removed
Substation
AUTHORIZED FEATURES
Pumping plant
Tunnel
Siphon
Aqueduct
EXISTING FEATURES U.S.B.R.
Transmission line
Substation
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES – ARIZONA
LIBERTY – PARKER
230KV TRANSMISSION LINE
LOCATION MAP
DESIGNED
SUBMITTED
DRAWN GFO
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA
MAY 1974
344-330-592
Interior – Reclamation, B.C., Nev. 7-74



Interior - Reclamation, B.C., Nev. 7-74

Figure 7

then south in Nevada through the Mohave Desert to the southern tip of the Lake Mead National Recreation Area. At this point, the route turns east to cross the Colorado River to the Davis Dam Switchyard in Mohave County, Arizona, and from there runs south in the Mohave Desert to Parker Dam in Yuma County, Arizona. It crosses Lake Havasu upstream from the dam into San Bernardino County, California, and continues to the Parker Dam Switchyard. As the map on Figures 5 and 7 indicates, the line crosses the Colorado River back into Arizona. It then runs in a southeasterly direction through the Harcuvar Substation terminating at the Liberty Substation located southwest of Phoenix, Maricopa County, Arizona (see Figures 6 and 7).

The mid-aqueduct pumping plant 115-kV radial transmission lines shown on Figures 6 and 7 originate at Harcuvar and Liberty Substations. The 230-kV Havasu Pumping Plant radial transmission line, shown on Figure 5, originates at the Parker Dam Switchyard.

Details of routing and location are presented in the following discussion of system design. Alternatives considered in developing the primary plans are presented in Chapter VIII.

3. <u>System Design</u> [1-3, 26-29, 116, 120-123]

System studies were run to determine an integrated Federal transmission system which would serve all project loads in the area in the most economical and reliable manner. The system that connects a power source to loads should be designed to provide the greatest benefits with the least possible environmental impact. With these objectives defined, special considerations as well as established guidelines were used for the planning and designing of the system. The publications "Environmental Criteria for Electric Transmission Systems," published by the U.S. Departments of the Interior and Agriculture, and "Environmental Guidelines," published by Western Systems Coordinating Council, are used as guides for the system design. Design of the lines will also conform with Chapter 4 of Bureau of Reclamation Design Standards No. 4, "Power Systems," in effect at the time of final design of each line.

A more detailed discussion of load requirements as they relate to power entitlements may be reviewed in the final environmental statements for the Navajo Project, FES 72-1, and the Central Arizona Project, FES 72-35.

The 230-kV backbone delivery system connecting the power source terminals was chosen because it will be most compatible with the existing systems to which it will be interconnected. Voltage ratings of the radial transmission lines were based on load requirements at the individual pumping plants.

The following discussion covers the elements of the transmission system, including power source, load requirements, substations and transmission line segments.

a. Power Source and Terminals

1-3, 24, 25, 29, 127-129

The Bureau of Reclamation is a participant in the 2,250-MW Navajo Generating Station under construction near Page, Arizona. The Bureau of Reclamation's entitlement to electricity from the generating station is 24.3 percent of the plant capacity, or 546,750 kilowatts. In addition to supplying power for operation of the CAP, the Navajo Generating Station will provide needed power for the non-Federal participants to supply load demands in other parts of Arizona and to portions of Nevada and California. The non-Federal participants and their percentages of participation are:

Salt River Project	21.7
Los Angeles Department of Water and Power	21.2
Arizona Public Service Company	14.0
Nevada Power Company	11.3
Tucson Gas and Electric Company	7.5

The Navajo Generating Station, a thermal coal-burning facility, consists of three units, each with a designed net output of 750,000 kilowatts. To meet the load requirements of the participants, the first unit was placed in commercial operation on May 31, 1974, while the second unit is scheduled for April 1975 and the third for April 1976. Because the inservice dates of the Navajo generating units occur prior to the Bureau of Reclamation's need for CAP pumping power, the Bureau entered into contracts with the Navajo Project participants and the

Southern California Edison Company for interim sale of the United States' entitlement to Navajo Project power. These contracts remain in effect for 20 years, or until power is needed for CAP purposes.

Approximately 775 miles of 500-kV transmission lines will be used to deliver power from the Navajo Generating Station to the two delivery points. One 500-kV line runs west for a distance of 275 miles from the generating station to the McCullough Switching Station near Boulder City, Nevada. Two 500-kV lines each run 250 miles south and link the generating station with the Westwing Substation in the Phoenix area by way of Moenkopi Switchyard near Cameron, Arizona. These 775 miles of Navajo transmission lines are separate from those covered in this statement and are discussed in detail in the final environmental statement for the Navajo Project, FES 72-1. An existing 230-kV intertie connects the Westwing Substation to the Liberty Substation. The McCullough Switching Station and the Liberty Substation are the delivery points for the power from the Navajo Generating Station that will serve the Granite Reef Aqueduct pumping plants.

b. Load Requirements [1-3, 25, 127]

Table 3 lists presently anticipated power requirements in horsepower and megawatts at each CAP pumping plant on the Granite Reef Aqueduct. Data are included for the project with Granite Reef Aqueduct capacity of 3,000 cubic feet per second (ft^3/s). Total estimated CAP pumping loads for the Salt-Gila and Tucson Aqueducts are also indicated on the table to give a total CAP pumping load.

Table 3
POWER REQUIREMENTS FOR THE GRANITE REEF AQUEDUCT

Pumping Plant	Pumping Efficiency (Percent)	Location (Miles)	Total Dynamic Head (Feet)	Discharge (ft^3/s)	Horse-power	MW Demand at High Voltage Side of Bus 1/
Havasu	85.6	0.0	820	3,000	326,400	285
Bouse Hills	87.7	20.0	105	3,000	40,800	35
Little Harquahala	87.7	50.1	105	3,000	40,800	35
Hassayampa	92.0	117.2	175	3,000	65,000	56
Total						411
Estimated other CAP pumping load 2/						69
Total CAP pumping load						480

1/ The demand at the high-voltage side of the bus was obtained by converting horsepower to megawatts - then dividing by 0.90 to allow for pump manufacturer's overbuilding to meet warranties, extra capacity to cover wear, etc. This answer is again divided by 0.95 to allow for motor efficiency and power transformer and station auxiliary losses.

2/ Another pumping plant, not listed above, called the Orme-Granite Reef Pumping Plant, will be required. This plant is designed to pump releases from Orme Reservoir to the Salt-Gila Aqueduct when the aqueduct is not carrying Colorado River water to full capacity. It would therefore, not be used when the aqueduct system was operating at maximum capacity and would not add to the maximum power demand.

The Orme-Granite Reef Pumping Plant is designed to pump releases from Orme Reservoir to the Salt-Gila Aqueduct when the aqueduct is not carrying Colorado River water to full capacity. It would, therefore, not be used when the aqueduct system was operating at maximum capacity and would not add to the maximum power demand.

The total megawatt demand at the high-voltage side of the bus was multiplied by 1.09 to allow for transmission system losses. For the 3,000-ft^3/s, the 480-MW demand (disregarding the Orme-Granite Reef Pumping Plant) at the high-voltage side of the bus at the pumping plant requires a 523-MW output at the power source.

To meet the estimated CAP load, the Secretary of the Interior, in 1969, contracted for an entitlement of 24.3 percent of the then 2,310-MW capacity of the Navajo Generating Station, or 561 megawatts. Subsequent to this contract, however, the generating plant station service load requirements have increased to operate wet-scrubbers and other items of equipment for environmental protection. The present plant rating is 2,250 megawatts and the 24.3-percent entitlement of this capacity is 546.75 megawatts.

c. Substations and Switchyards

Existing substations, switchyards, and switching stations will be terminals for segments of the system and will have additional facilities constructed onsite to accommodate the new interconnections. One new substation named Harcuvar will be required approximately 8.5 miles north of Wenden, Arizona.

(1) McCullough Switching Station

The McCullough Switching Station (Figure 8), located about 20 miles southwest of Boulder City, Nevada, in Clark County, is owned and operated by the Los Angeles Department of Water and Power (LADWP) and is the western terminal and delivery point for power from the Navajo Generating Station. At this facility, the voltage from the Navajo Project will be reduced from 500 kV to 230 kV. Terminal facilities including 500-kV and 230-kV circuit breakers, transformers, disconnect switches and associated steel structures will be installed as part of the system. The design and location of the equipment will be compatible with the existing structures and will be installed with the approval of LADWP.

(2) Mead Substation [34]

The Mead Substation (Figure 9), located about 3 miles south of Boulder City, Nevada, in Clark County, is owned and operated by the Bureau of Reclamation. The black line at the top of Figure 9 indicates the alinement of the McCullough-Mead interconnection. The other line represents the beginning of the Mead-Davis transmission line. Additions to Mead Substation will consist of terminal facilities for the Mead-Davis 230-kV line and McCullough-Mead 230-kV interconnection. New equipment will consist of three 230-kV power circuit breakers along with associated steel structures, disconnect switches, and buses.

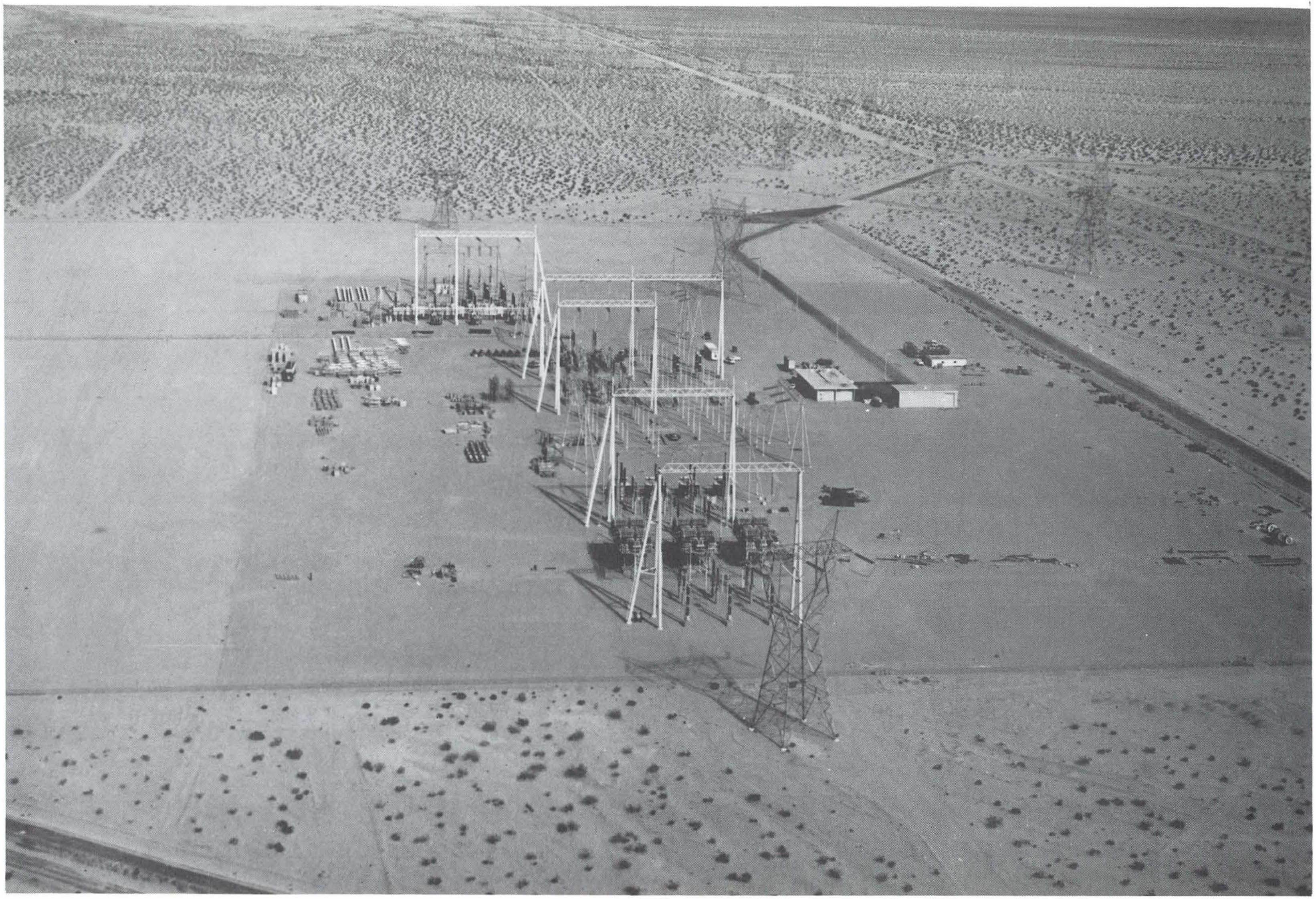


Figure 8
McCullough Switchyard--View northeast showing the switchyard and existing transmission lines--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01281NA

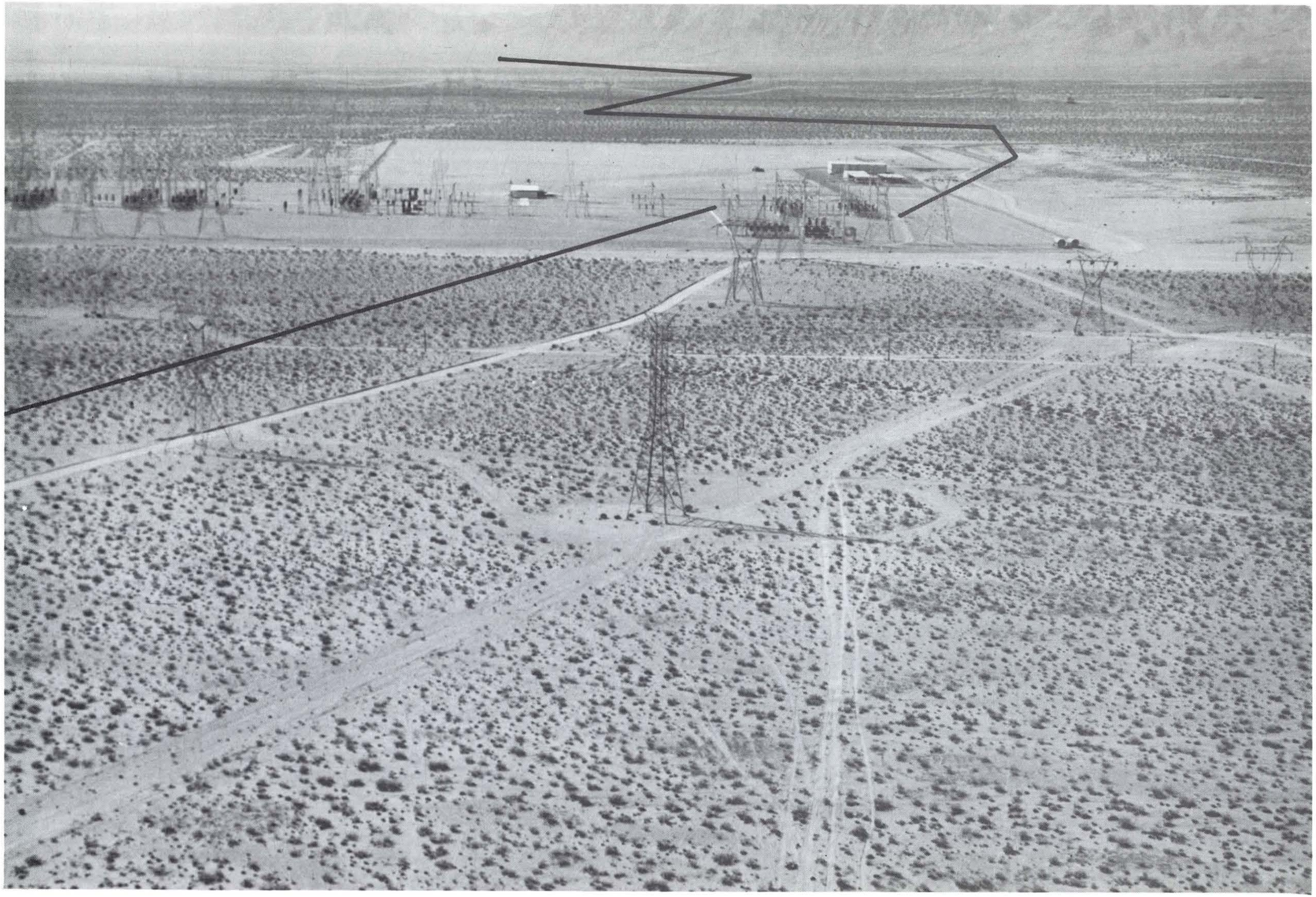


Figure 9
Mead Substation--View west in northern part of Eldorado Valley showing transmission alinement and substation--The vegetation is sparse creosote and scattered bursage and Mohave yucca--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01233NA

The additions will be located in spare bay positions inside the existing substation and will be compatible with the existing low profile design. Paints of various hues will be used at this substation to identify the types of electrical equipment and to express their functions as well as to enhance the overall esthetic appearance of the station. Some typical colors for substation equipment are: Desert Beige, Almond Green, Stainless Steel Blue and Glacier Green. International Orange is used to identify energized portions of equipment.

(3) Davis Switchyard [34, 118]

The Bureau of Reclamation owns and operates the Davis Switchyard as part of the Federal power system. Additions to the switchyard, which is located in Mohave County, Arizona, near Bullhead City, will consist of terminal facilities for the Mead-Davis 230-kV and Davis-Parker 230-kV No. 2 Lines (Figure 10). A sectionalizing breaker will also be added to improve reliability. The new lines will require the relocation of numerous approach spans into the Davis Switchyard to avoid the use of high towers for crossovers. The original construction of this switchyard provided space for additions and it is this portion of the yard that will be used. Additions will be of the lattice-steel-box type similar to the existing steel structures. The existing fence will be extended and two new bays will be installed. The extension of the fence will encompass approximately 47,000 square feet.

In addition to relocating the approach spans to present a more pleasing overall appearance, equipment and structures will be

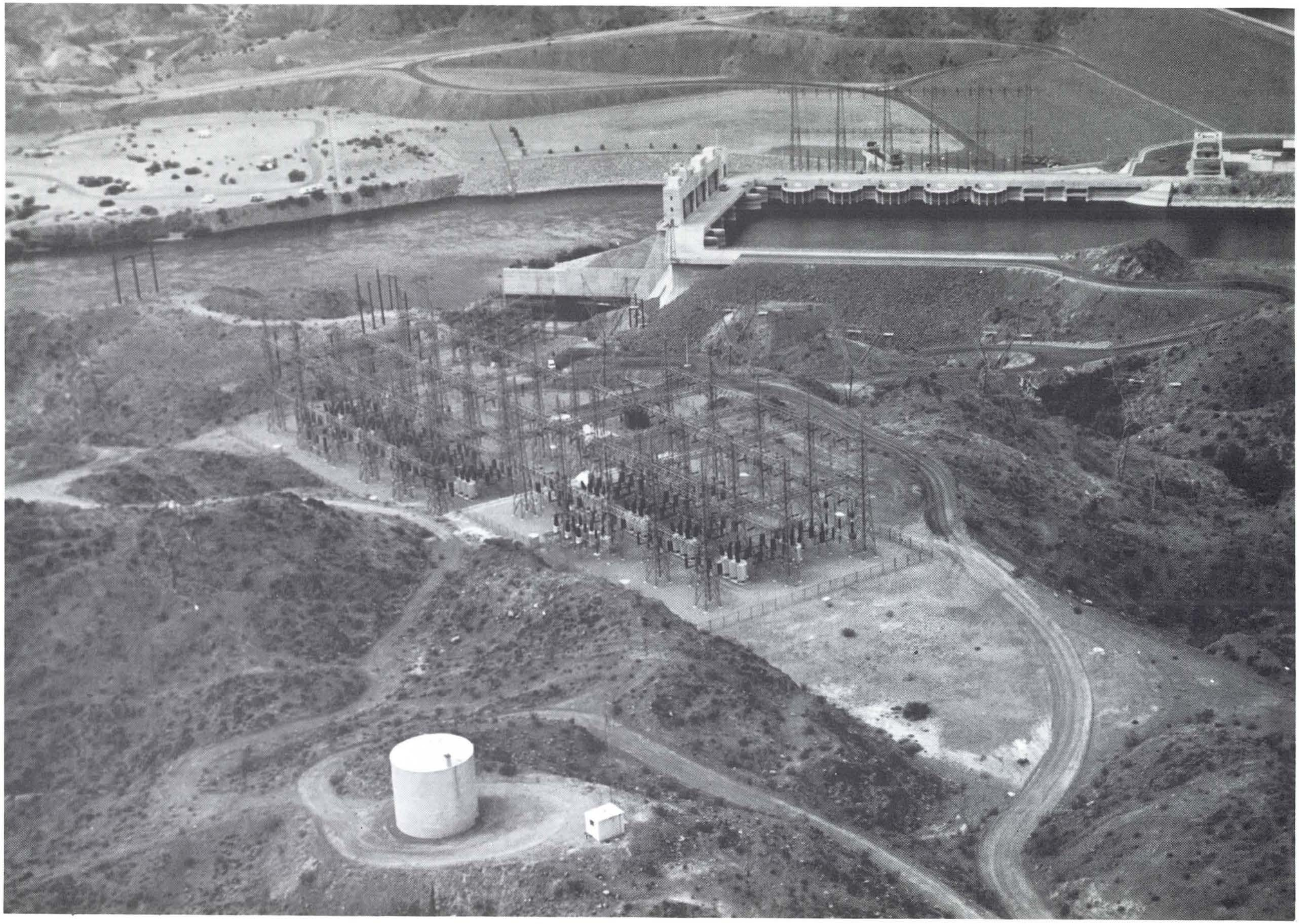


Figure 10
Davis Switchyard--View northwest showing the 230-kV switchyard--
Transmission System, Granite Reef Aqueduct, Central Arizona Project--
Photo No. P344-300-01279NA

painted to identify its functions and improve its appearance as described for Mead Substation.

(4) Parker Switchyard [34, 130]

Construction at the Parker 230-kV Switchyard will consist of adding terminal facilities for the Davis-Parker 230-kV No. 2 Line, Liberty-Harcuvar-Parker 230-kV line, and Parker-Havasu Pumping Plant 230-kV line, as well as a 230-kV sectionalizing breaker and a 230-kV bus tie breaker together with associated buses and switches.

The existing switchyard, operated by the Bureau of Reclamation as a part of the Federal power system, is located in San Bernardino County, California, just west of the Colorado River near Parker Dam.

Space was provided for future additions when this switchyard was constructed. The additions will be located within the existing fenced area.

Within the switchyard, extensions of the conventional lattice-type galvanized steel structures that are compatible with the existing installation (Figure 11) will be used. Painting of equipment will be similar to that described for Mead Substation.

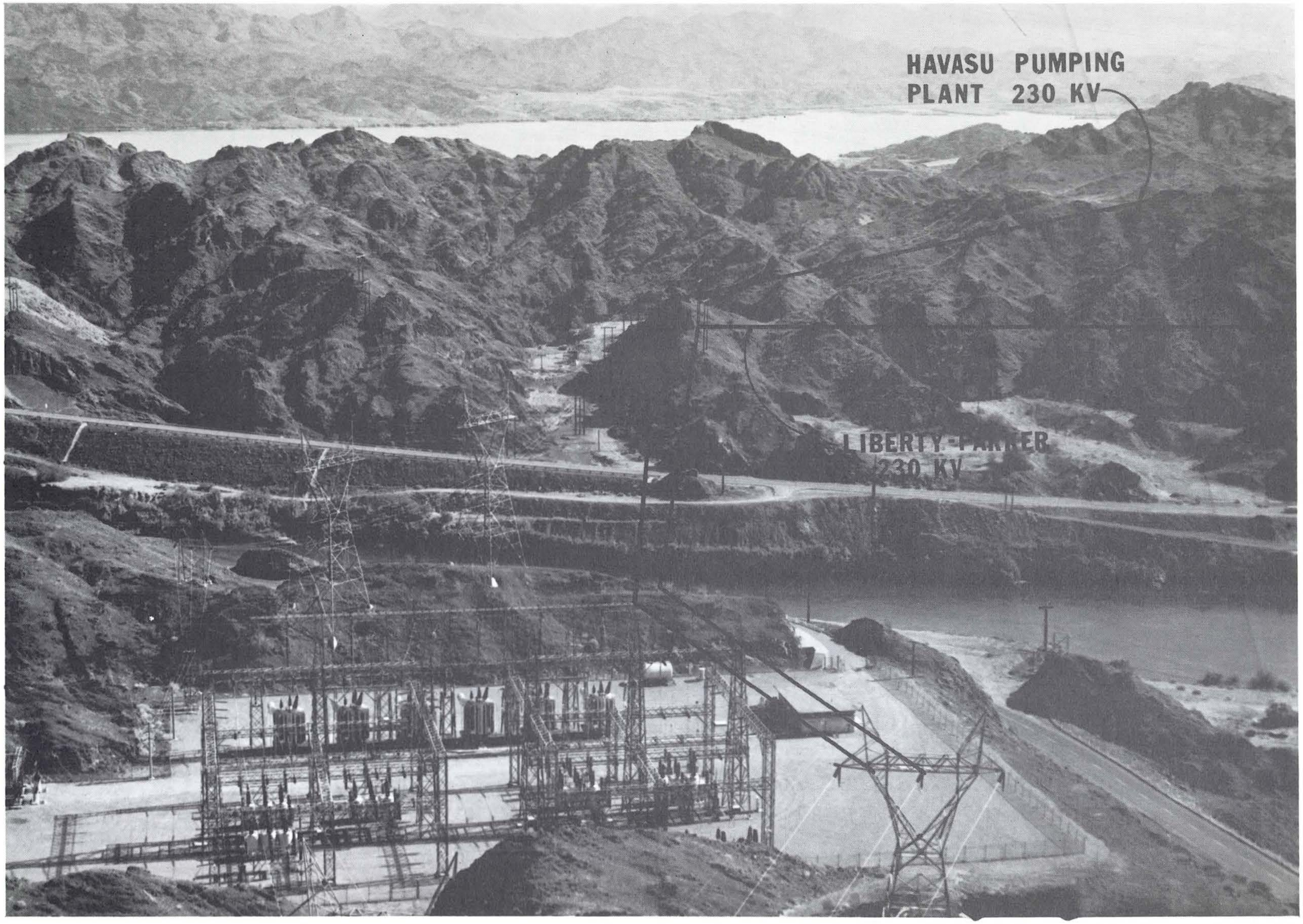


Figure 11
Colorado River Crossing from Parker Switchyard--View east showing the the alinement of the Parker-Liberty 230-kV line and the Havasu Pumping Plant 230-kV feeder line--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01160NA

(5) Harcuvar Substation

The Harcuvar Substation will be a new substation owned by the Bureau of Reclamation and will be required to reduce the system line voltage from 230 kV to 115 kV to provide power to the Bouse Hills and Little Harquahala Pumping Plants. From this substation, radial transmission lines will be routed to the Bouse Hills and Little Harquahala Pumping Plants.

A 10-acre site (Figure 12) has been selected approximately 8-1/2 miles north of Wenden in Yuma County, Arizona, in Section 17, T. 7 N., R. 12 W., that permits the use of existing landforms for screening from public view. Preparation for the site by leveling will require approximately 5 feet of excavation on one side to provide the material for a 5-foot embankment on the other side. Surfacing will be gravel. Approximately 3-1/2 acres of additional land will be needed for a 1-mile-long access road to connect to an existing road.

Approximately 7 acres of the site will be fenced to enclose the equipment including 230-kV and 115-kV circuit breakers and transformers and a control building approximately 20 feet by 60 feet.

Storage facilities for equipment oil may be required and will possibly consist of two storage tanks of about 20,000 gallons each. Provisions for spill protection for the storage tank and oil-using

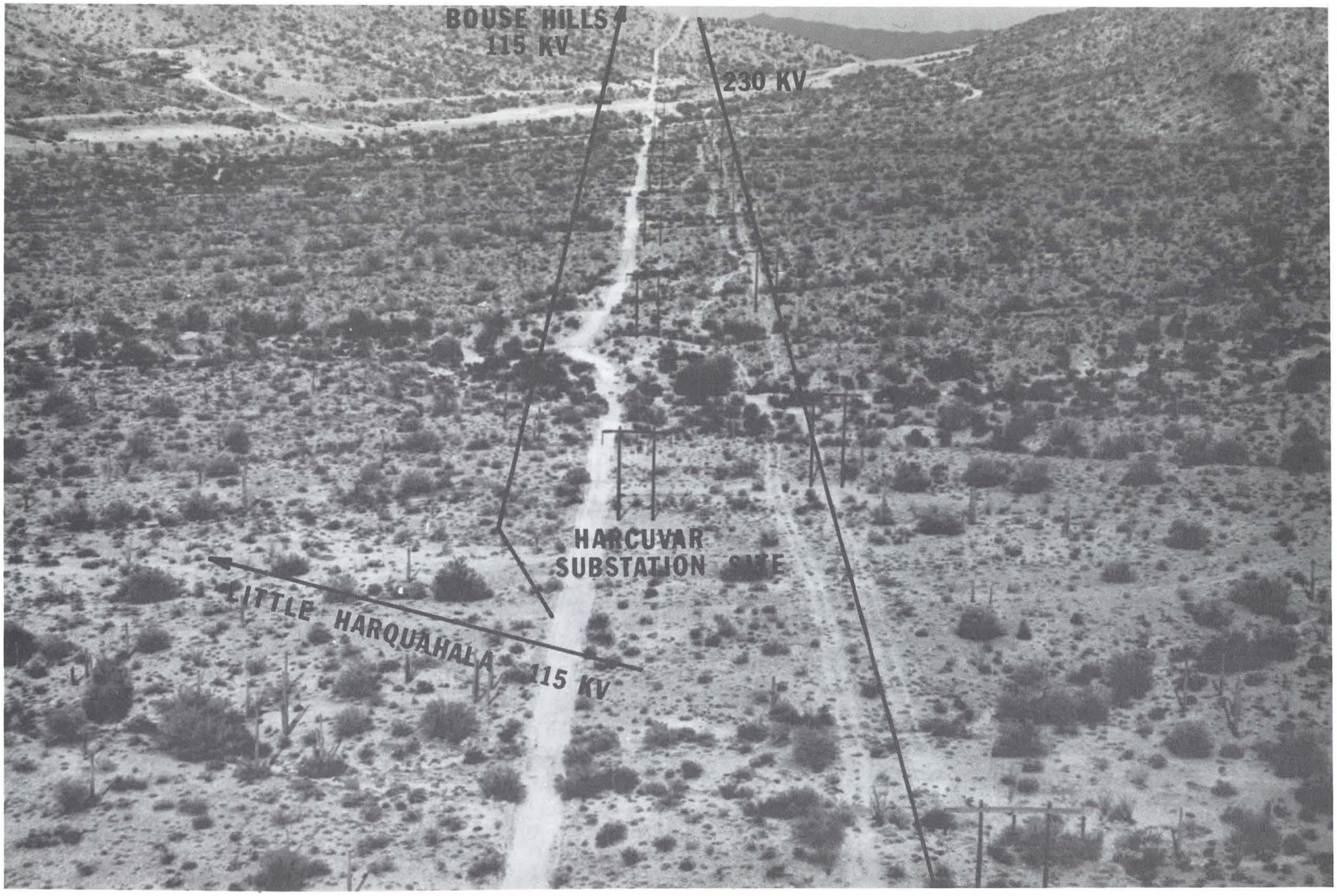


Figure 12
Harcuvar Substation Site--View northwest toward Cunningham Pass showing the 230-kV replacement transmission system, the Bouse Hills and Little Harquahala 115-kV pumping plant lines, and substation location--The vegetation of this area is saguaro cacti, creosotebush, ocotillo, grasses and forbs--The substation site will require minimum earthwork and vegetation removal--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01138NA

euqipment areas will be incorporated into the design even though the tanks will normally be empty except during maintenance periods. A spill prevention control and countermeasure (SPCC) plan will be prepared within 6 months after operations have begun to comply with the Oil Pollution Prevention Regulation.

The structures and equipment will be of the low-profile design, such as shown in Figure 12A, in order to enhance the overall appearance of the facility, and the control building will be designed to be architecturally compatible with its surroundings. Although the substation will be unattended, sanitary facilities will be provided for maintenance personnel. These facilities will meet local health standards. Painting of electrical equipment will be similar to that described for Mead Substation.

(6) Liberty Substation[34]

The Bureau of Reclamation's Liberty Substation, located in Maricopa County about 20 miles west of Phoenix, Arizona, is the southern terminal of the Pacific Northwest-Pacific Southwest Intertie system. It connects the Phoenix area to Mead Substation with a 345-kV transmission line and to Navajo Generating Station through the Westwing Substation by a 230-kV line.

The Liberty Substation, like the Mead Substation, is one of the first to be designed and constructed using compact, low-profile

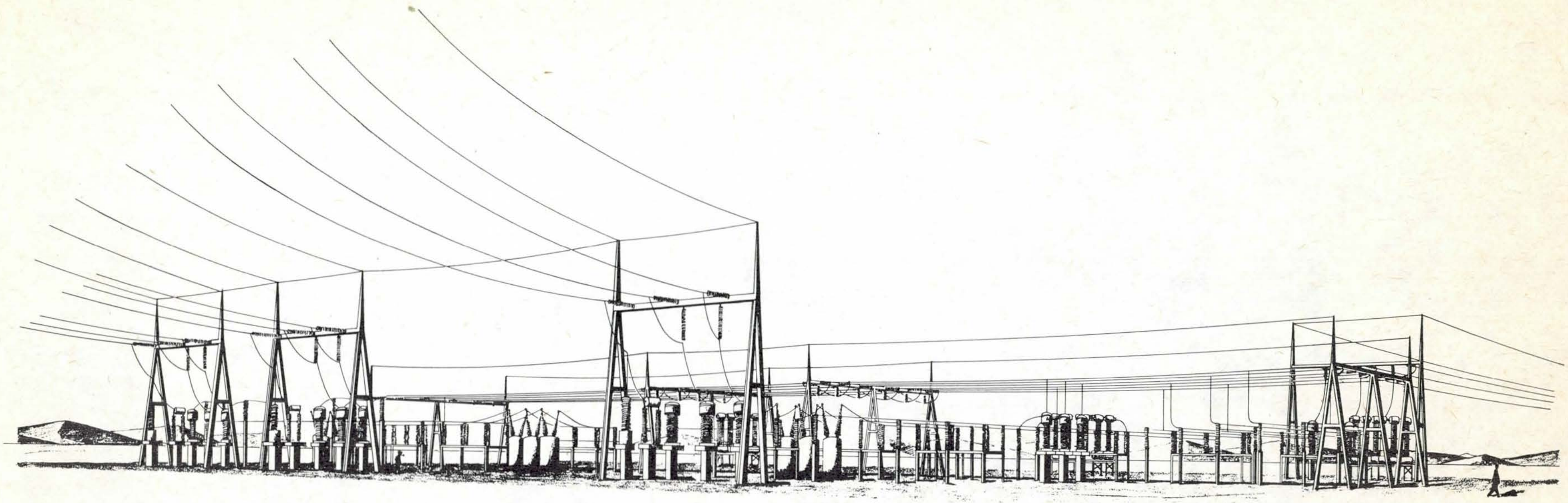


Figure 12A
Typical low profile design of the type that may be used for the Harcuvar Substation--Transmission System, Granite Reef Aqueduct, Central Arizona Project.

equipment and structures as shown in Figure 13. The additions will be compatible with the existing equipment and will be painted various colors to identify and express its functions as well as enhance its appearance, such as described for Mead Substation.

This substation will be the terminal for a 230-kV delivery system and the terminal for power delivery through a 115-kV radial transmission line to the Hassayampa Pumping Plant. Equipment will include 230-kV circuit breakers and a 230/115-kV transformer. All the additions will be constructed within the existing station area in space provided for future expansion.

d. Transmission Lines [129]

Transmission lines will connect each of the substations (or switching stations and switchyards) along the interconnected delivery system. This discussion will describe the lines and routing between stations beginning at the McCullough Switching Station and terminating at the Liberty Substation.

The system will generally use towers constructed of free-standing, lattice steel with a galvanized finish as shown in Figure 14. The average span between towers will be 1,200 feet and each tower will range from 80 to 130 feet in height, depending on the terrain. The towers will support three phases in a horizontal configuration and two insulated overhead ground wires. The ground wires, which are mounted at

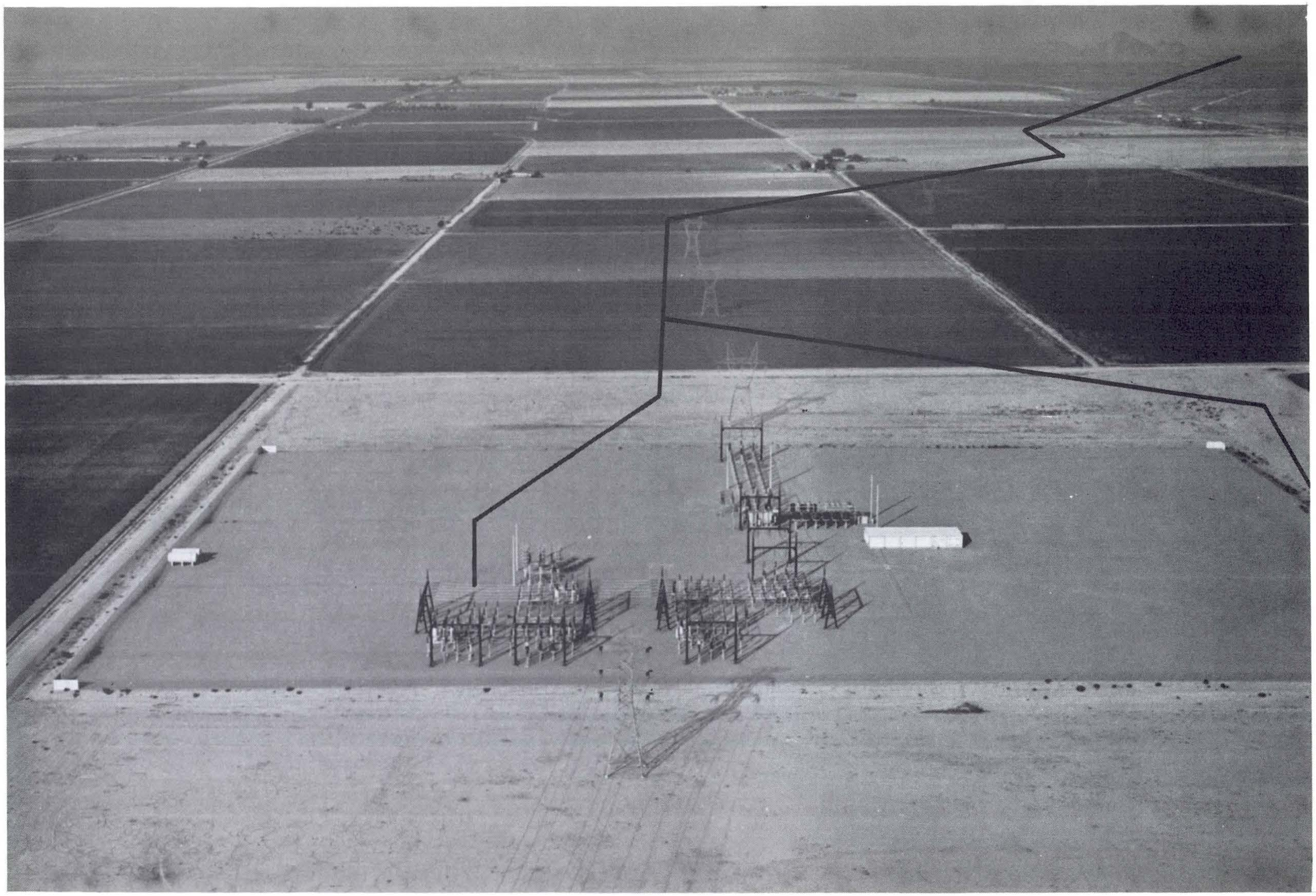
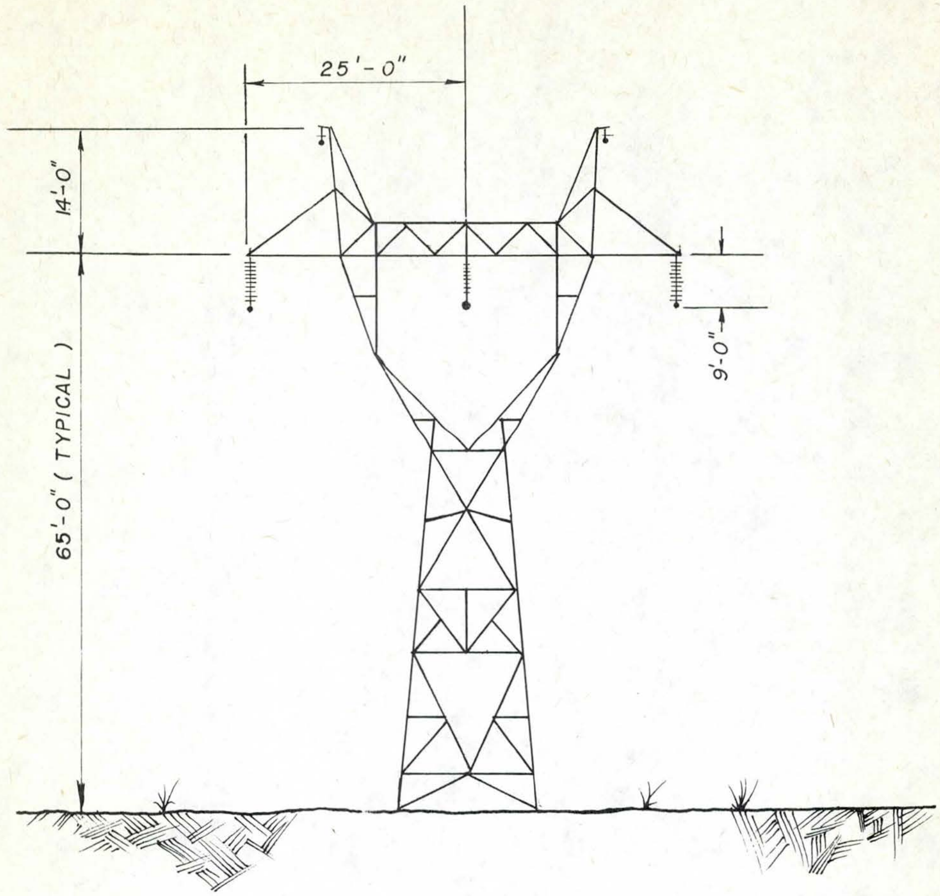


Figure 13
Liberty Substation--View west showing the transmission system alinement crossing irrigated agricultural lands--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01117NA



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

230KV TRANSMISSION LINE
SINGLE CIRCUIT
HORIZONTAL CONFIGURATION
STEEL LATTICE STRUCTURE

DRAWN ________ SUBMITTED ________
TRACED ________ RECOMMENDED ________
CHECKED ________ APPROVED ________

PHOENIX, ARIZONA MAY, 1974 | 344-330-T-288

Figure 14

the top of the towers, are to provide protection from lightning and a communication channel.

(1) McCullough Switching Station to Mead Substation

The first segment of the transmission system begins at McCullough Switching Station and terminates at Mead Substation. The 15-mile-long route parallels transmission lines owned and operated by Southern California Edison Company, Nevada Power Company and the City of Los Angeles over an area of generally flat terrain. The routing from the McCullough Switching Station runs north about 3 miles, then northeast for 7 miles where it crosses U.S. Highway 95 and a buried gasline owned and operated by the Southwest Gas Corporation. From the highway crossing, the route proceeds northeast for 1 mile and then east approximately 4 miles to Mead Substation.

The map on Figure 3, indicates the route as described, and Figure 15 shows a view of the area.

(2) Mead Substation to Davis Dam Switchyard

The first 18 miles of this transmission line route are southwest through Eldorado Valley from the Mead Substation and parallel to the existing Bureau of Reclamation Mead-Davis 230-kV transmission line No. 1 (Figure 16), crossing Nevada State Highway 60 west of Nelson, Nevada. The next 18-1/2 miles are south paralleling Metropolitan Water District lines and across State Route 68 west of Searchlight, Nevada,

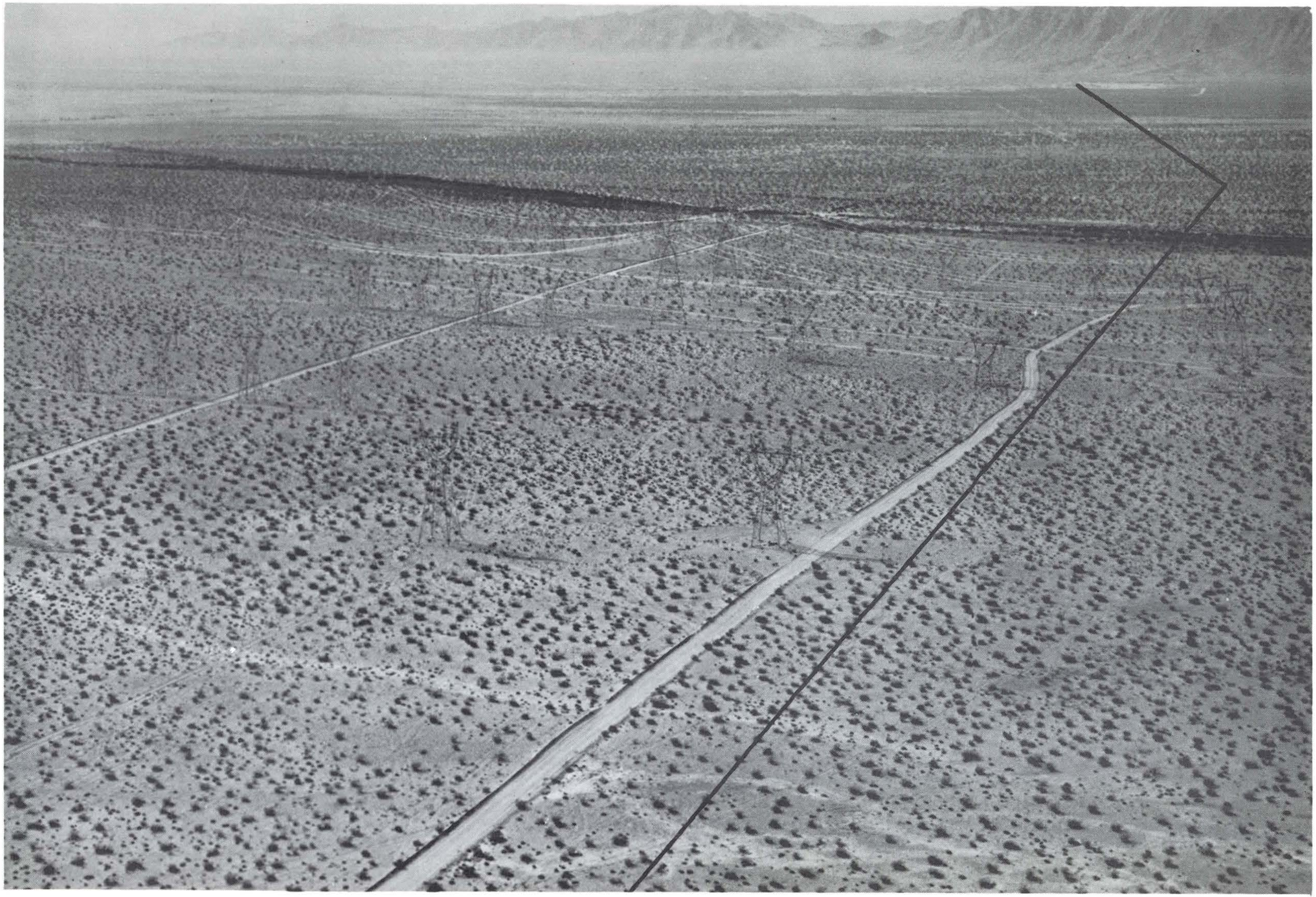


Figure 15
Northern Eldorado Valley--View of the alinement southwest toward the Eldorado Mountains showing existing transmission lines--In a creosote-bursage vegetation community--Mead-Davis 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01286NA

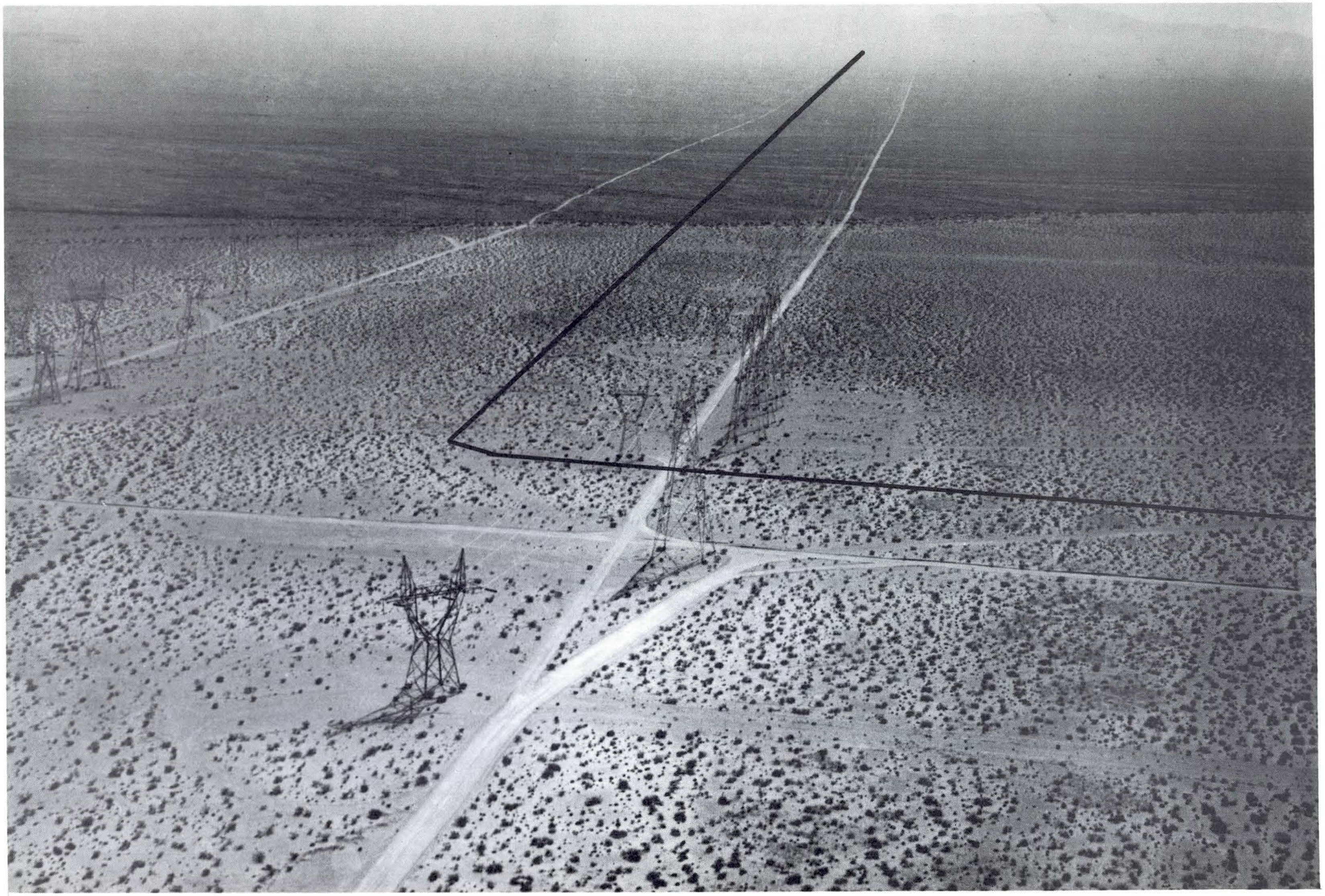


Figure 16
Eldorado Valley--View south of the alinement where the line will parallel the two Metropolitan Water District 230-kV lines and the USBR Mead-Davis 230-kV No. 1 line--Mead-Davis 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01237NA

through an area of low, gently rolling foothills (Figure 17) of decomposed granite.

As the terrain begins to level (Figure 18), the route follows the lines owned by the Southern California Edison Company, southeasterly for 19.3 miles, then due east for 7-1/2 miles. From here, the route is not paralleled by other transmission lines for the remaining 5 miles. Two of these miles are across Reclamation-withdrawn land at the southern tip of the Lake Mead National Recreation Area, which is administered by the National Park Service. The river crossing site provides a suitable location to place the tower for the Colorado River crossing, and the span will meet the Corps of Engineers' safety requirements for the navigation clearance. After the river crossing, the line extends about 1 mile to the Davis Dam Switchyard in Mohave County, Arizona, near Bullhead City.

The National Park Service is proposing that portions of the Lake Mead National Recreation Area be designated as a Wilderness Area but have provisions for existing and future transmission lines. This proposal is described in the NPS draft environmental statement on the Proposed Wilderness Areas, Lake Mead National Recreation Area, Arizona and Nevada, DES 74-3.

(3) Davis Dam Switchyard to Parker Dam Switchyard

From the Davis Dam Switchyard, the 71-mile Davis-Parker 230-kV No. 2 segment will parallel the existing Bureau of Reclamation

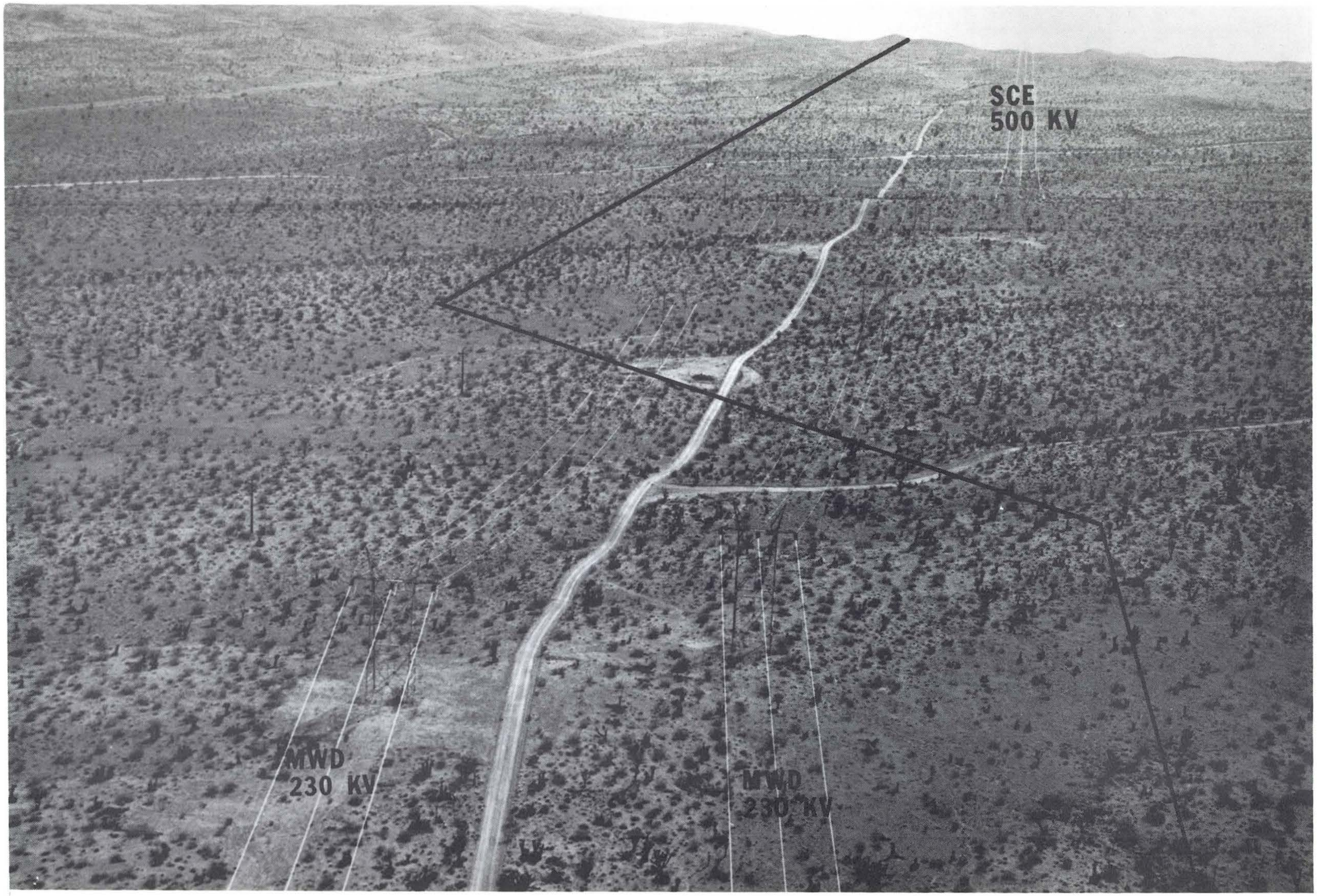


Figure 17

Crossing Under the Two Metropolitan Water District Lines--View south of Searchlight, Nevada, showing the other transmission systems in the area--Mead-Davis 230-kV No. 2 Lint--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01252NA

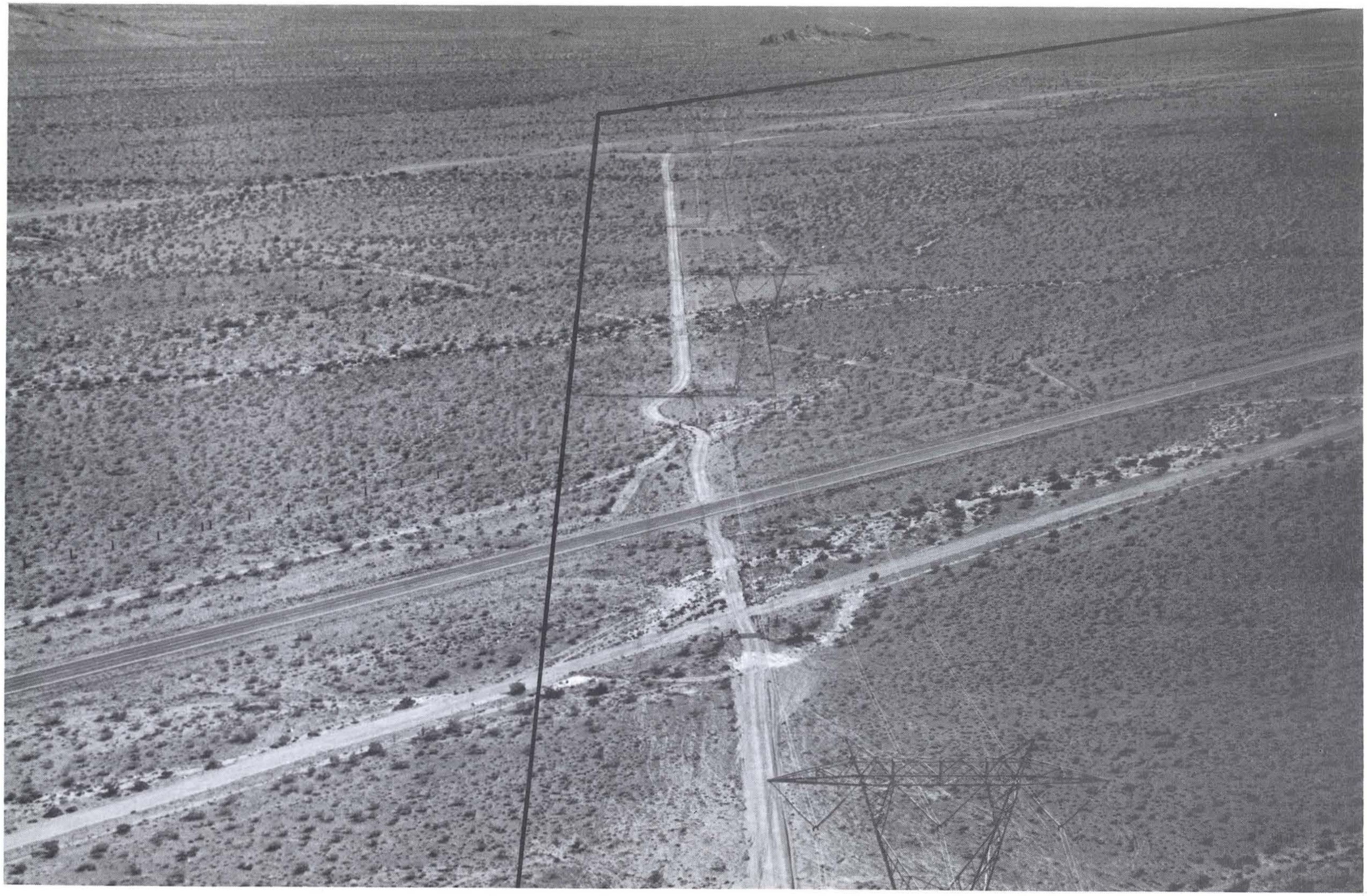


Figure 18
Piute Valley--View southeast where alinement crosses U.S. Highway 95 south of Searchlight, Nevada parallel to the Southern California Edison 500-kV line--The principal vegetation of the area is creosote-bursage with scattered acacia and Joshua trees--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01260NA

Davis-Parker 230-kV No. 1 transmission line (Figure 19) to the proposed Citizens Utilities Company's (CUC) Lake Havasu City Substation approximately 3 miles north of Lake Havasu City, Arizona.

From CUC's proposed Lake Havasu City Substation, the Davis-Parker No. 2 line route is due east for a distance of approximately 4 miles where it turns southeast along the foothills of the Chemehuevi Mountains. Portions of this section of the alinement are very rough, with high rocky ridges and boulder-strewn canyons that restrict vehicular travel in the area. Large, wide washes and steep, narrow ridges with rocky outcrops will permit the use of washes as access to the line for construction and maintenance (Figure 20). This route was selected to bypass Lake Havasu City to avoid additional impacts on the residents of the community.

Approximately 6 miles southeast of Lake Havasu City, the line will parallel the existing line and utilize the present access roads. Approximately 4 miles north of Parker Dam, the alinement crosses a travel trailer park (Figure 21), parallels U.S. Highway 95 for a short distance, then is routed to the east shore of Lake Havasu. Approximately 4 miles of the line between Lake Havasu City and the Lake Havasu crossing enters Lake Havasu State Park, which is on Federal land administered by the State of Arizona. The lake crossing into California (Figure 22) and to the Parker Dam 230-kV Switchyard will be adjacent to the existing Davis-Parker 230-kV No. 1 transmission line and the CUC's Lake Havasu City 69-kV transmission line in an established transmission line lake crossing.

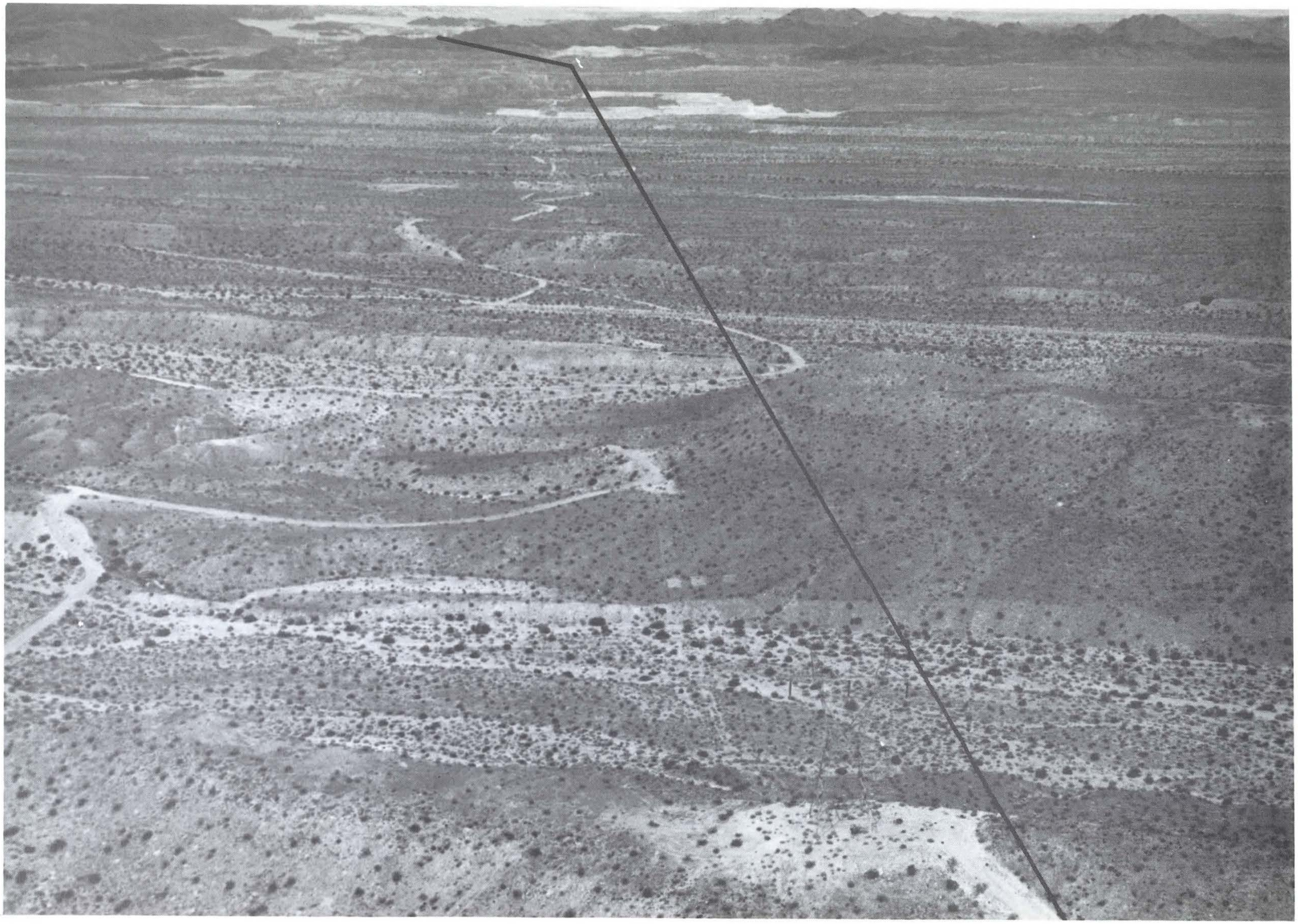


Figure 19
Davis Dam to Silver Creek Wash Area--View north toward Lake Mohave--Showing a creosote, bursage and cane cholla vegetation community--Acacia can be observed along the washes and arroyos--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01194NA

Figure 20
Lake Havasu Bypass Alinement--View northwest toward Chemehuevi Mountains--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01213NA

Figure 21
Lake Havasu Travel Trailer Village Area--View north showing the alinement through the village and parallel to Arizona State Highway 95--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01226NA.

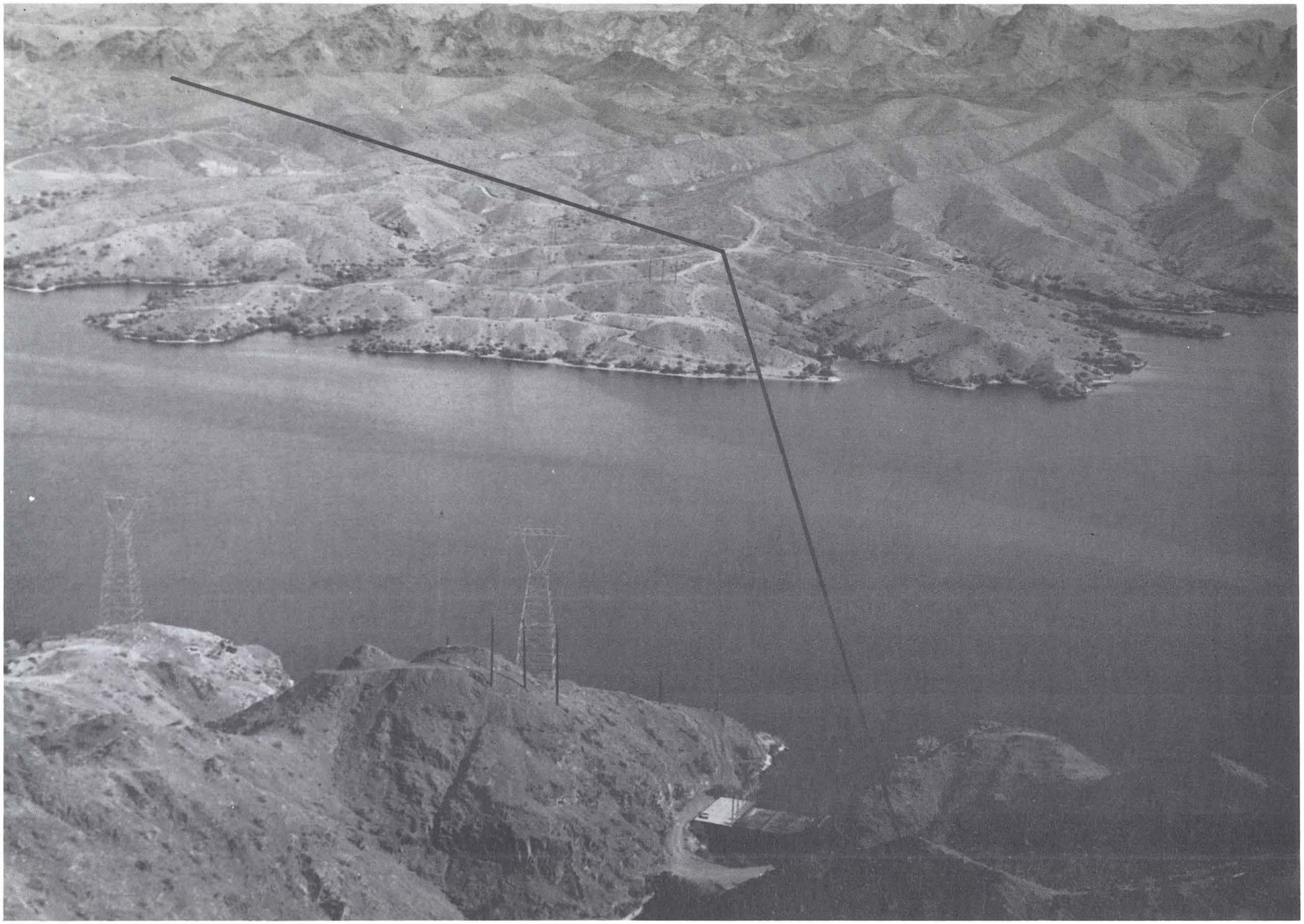


Figure 22
Lake Havasu Crossing--View northeast showing the lake crossing before entering California and Parker Switchyard--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01230NA

After the lake crossing, the line proceeds in a southerly direction for approximately 1.2 miles and terminates into an existing bay position at the Parker 230-kV Switchyard.

(4) Parker Dam Switchyard to Liberty Substation via Harcuvar Substation

The 230-kV transmission line that will extend from the Parker Dam Switchyard to the Liberty Substation near Phoenix, will be interconnected with the substation at Harcuvar. The 121-mile-long line will replace the existing Parker-Phoenix 161-kV line No. 1 that is 137 miles long, utilize its right-of-way and parallel the existing 161-kV Parker-Phoenix No. 2 line. The differences in line lengths are due to termination of the new line at Liberty Substation instead of Phoenix Substation which is further east and the last 19 miles of right-of-way for the line at the Liberty end will follow a new alinement. That portion of the Parker-Phoenix No. 1 line right-of-way between Phoenix Substation and Liberty Substation will be retained for use of a future line between Phoenix and Liberty. The portion of Parker-Phoenix No. 1 line right-of-way between a point north of Liberty Substation to where it meets the Liberty-Parker 230-kV line will be allowed to return to other land uses. Approximately 25 feet of additional right-of-way width will be acquired where the new line utilizes existing right-of-way.

From the Parker Dam Switchyard in California (Figure 11), the route crosses the Colorado River into Arizona near the Parker Dam

Powerplant. After paralleling Highway 95 for approximately 1-1/2 miles where it passes through an existing mobile home park, the line will cross the Buckskin Mountains through Giers Wash (Figure 23) across the Cactus Plain and Butler Valley paralleling the existing 161-kV line. About 8 miles north of Wenden, Arizona, in the foothills of the Harcuvar Mountains, the line will be connected to the Harcuvar Substation (Figure 12). From this substation, the line will traverse the McMullin Valley and cross the Hassayampa Plain paralleling the existing 161-kV Parker-Phoenix No. 2 line until it meets the 345-kV Mead-Liberty line.

At this point the line crosses over the 161-kV Parker-Phoenix No. 2 line and parallels it for 18 miles on the south side on double circuit structures along with the 115-kV Liberty-Hassayampa Pumping Plant line. When the alinement meets the 345-kV Mead-Liberty line approximately 1 mile northwest of Liberty Substation, the alinement continues into Liberty Substation paralleling the 345-kV line on the south side, utilizing double-circuit structures. The last 2 miles of this alinement will cross irrigated farmland.

Approximately 100 miles of this line from Parker Dam will use towers that were described in Section I.D.3.d. The last 19 miles to Liberty Substation of the Liberty-Harcuvar portion of the transmission line will be of the double-circuit-type construction with an average span of 800 feet between towers. This type of tower, as shown in Figure 24, will be the free-standing, lattice-steel type, ranging in height from 85 to 150 feet, depending on the terrain. The

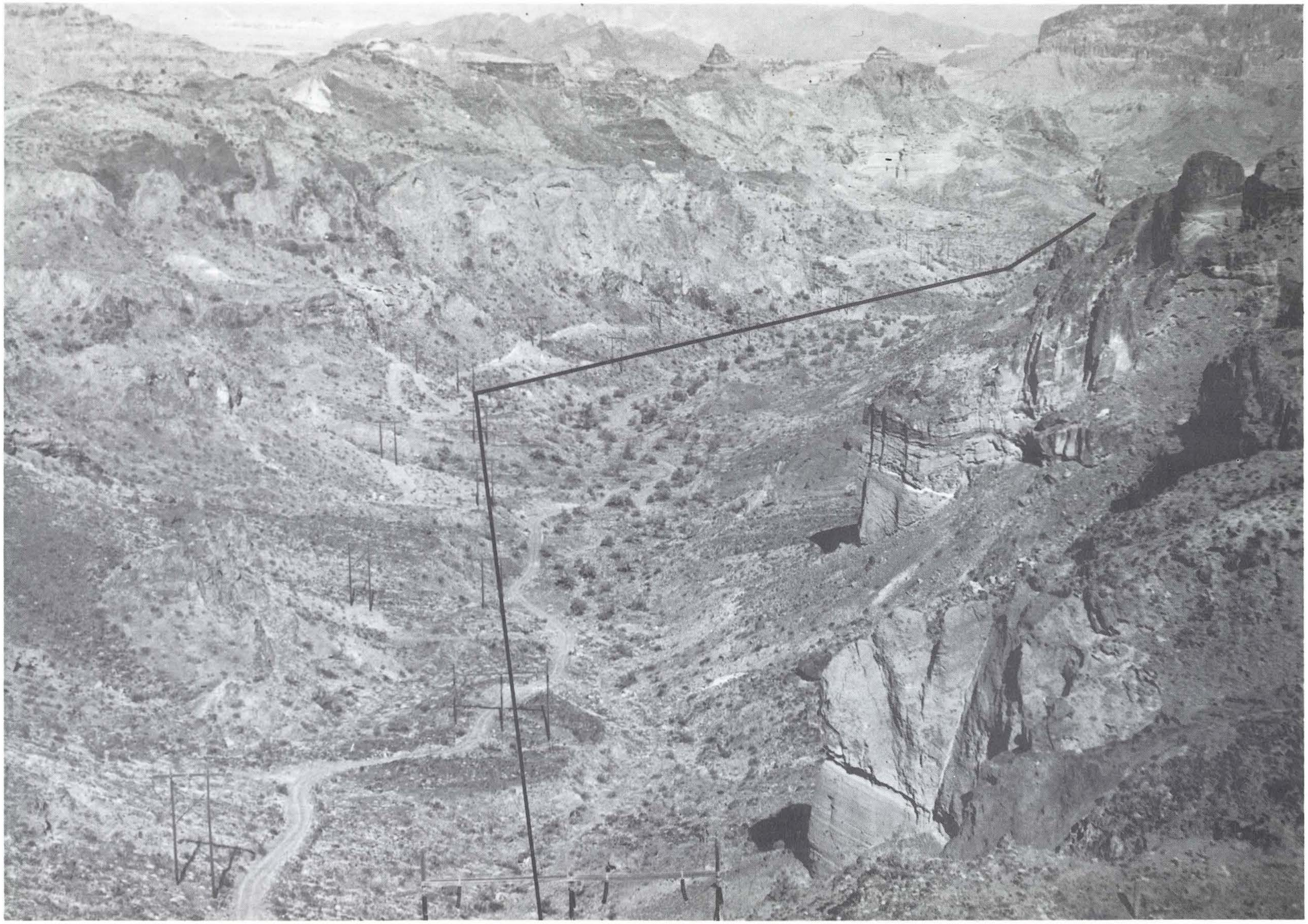
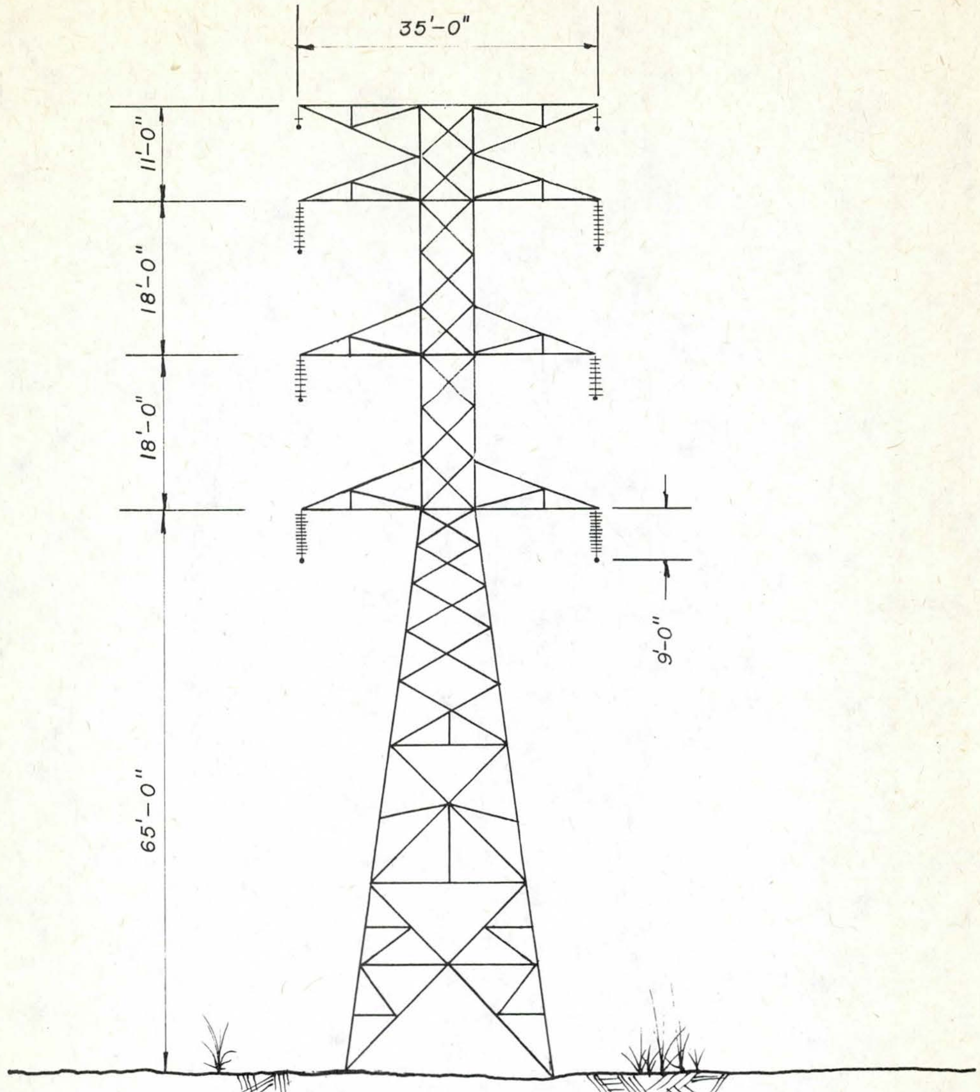


Figure 23
Buckskin Mountains--View northwest showing the transmission system alinement--Sparse vegetation is principally creosotebush, scattered paloverde, and ocotillo--Parallel to the Parker-Phoenix 161-kV No. __ Line--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01151NA



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

230KV TRANSMISSION LINE
DOUBLE CIRCUIT
VERTICAL CONFIGURATION
STEEL LATTICE STRUCTURE

DRAWN *Bill Roger*	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED

PHOENIX, ARIZONA   MAY, 1974   344-330-T-289

Figure 24

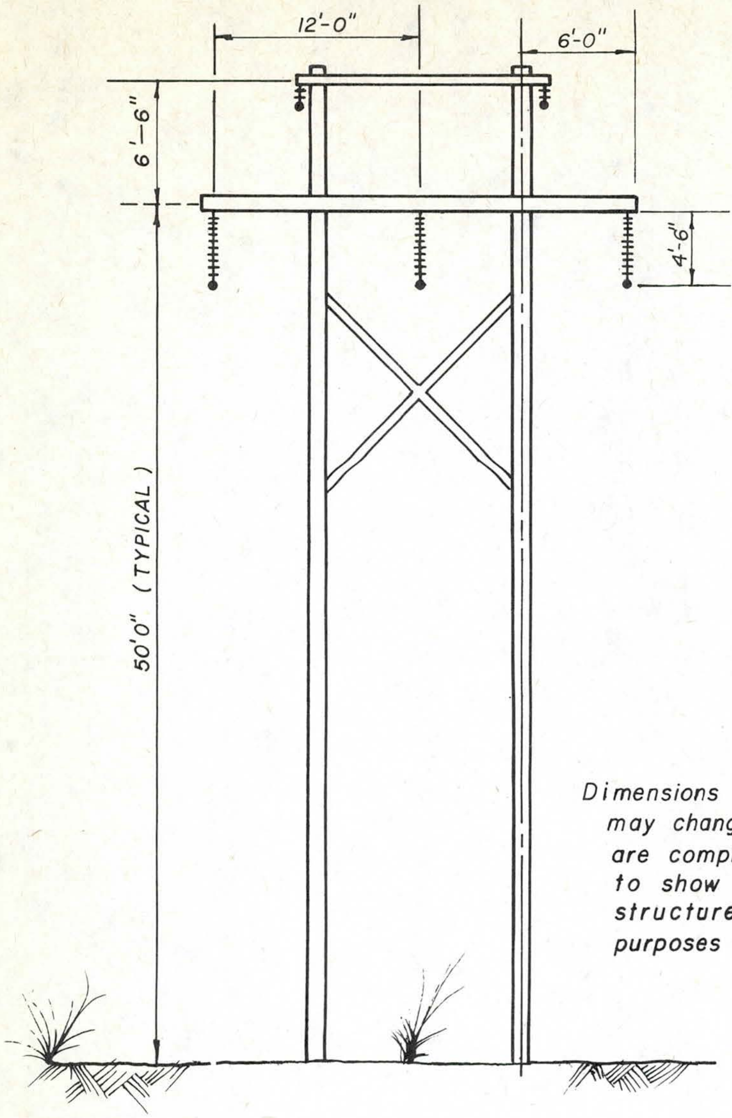
Liberty-Parker line will be carried on one side of the towers in a vertical configuration and the 115-kV Liberty-Hassayampa line will be carried on the other side in a vertical configuration. Two insulated overhead ground wires will be installed on top of the towers.

The routing of this portion of the transmission system was selected because it will: (1) utilize an established right-of-way for most of its distance; (2) replace a line that has been in service for approximately 40 years and which requires a great amount of maintenance; and (3) allow use of existing access roads for construction and maintenance.

e. Radial Transmission and Check Structure Distribution Lines [3]

The locations of the pumping plants can be identified from the map on Figure 1. The power for each of these plants will be delivered through radial transmission lines from the nearest substation on the interconnected 230-kV backbone delivery system. Power to the majority of the check structures located at intervals of 6 to 10 miles will be delivered by buried cable from the pumping plants.

The Bouse Hills and Little Harquahala Pumping Plants will receive power from Harcuvar Substation via radial 115-kV wood-pole or steel-structure type transmission lines. If wood-pole structures are used, they may be of the two-pole, "H-Frame" type similar to those shown in Figure 25 or of the one-pole "Wishbone" type structure as shown in Figure 25A. Wood poles will be treated to prevent



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK **SAFETY**

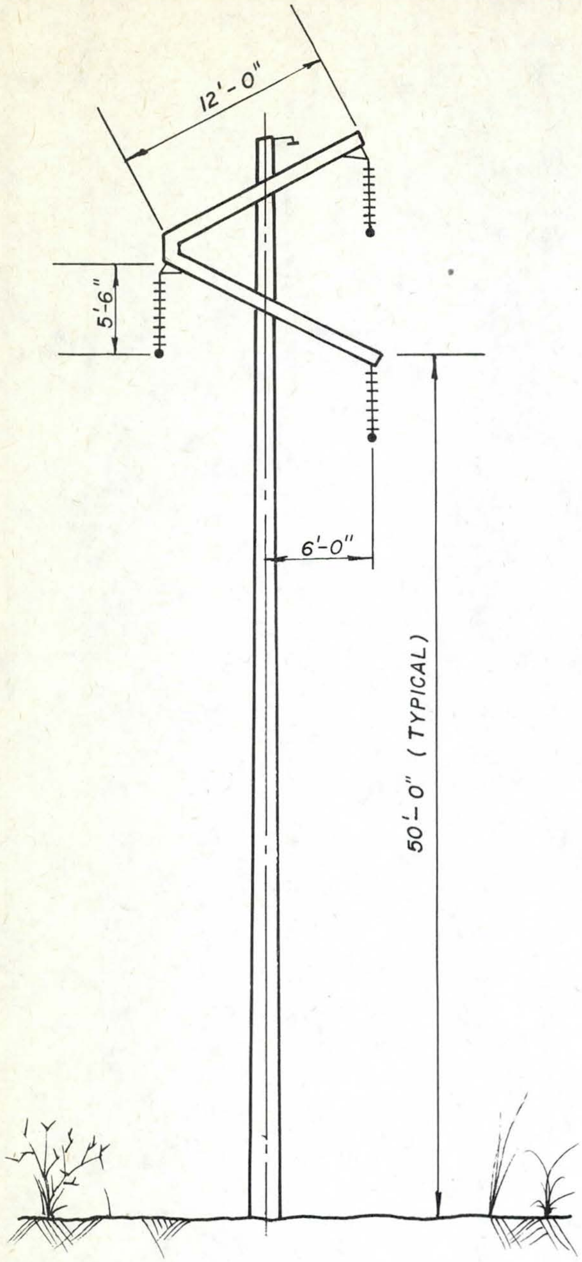
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT—H-FRAME
WOOD POLE STRUCTURE

DRAWN	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED

PHOENIX, ARIZONA MAY, 1974 344-330-T-290

Figure 25



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT
WISHBONE WOOD POLE STRUCTURE

DRAWN [illegible] SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

PHOENIX, ARIZONA MAY, 1974 | 344-330-T-297

Figure 25A

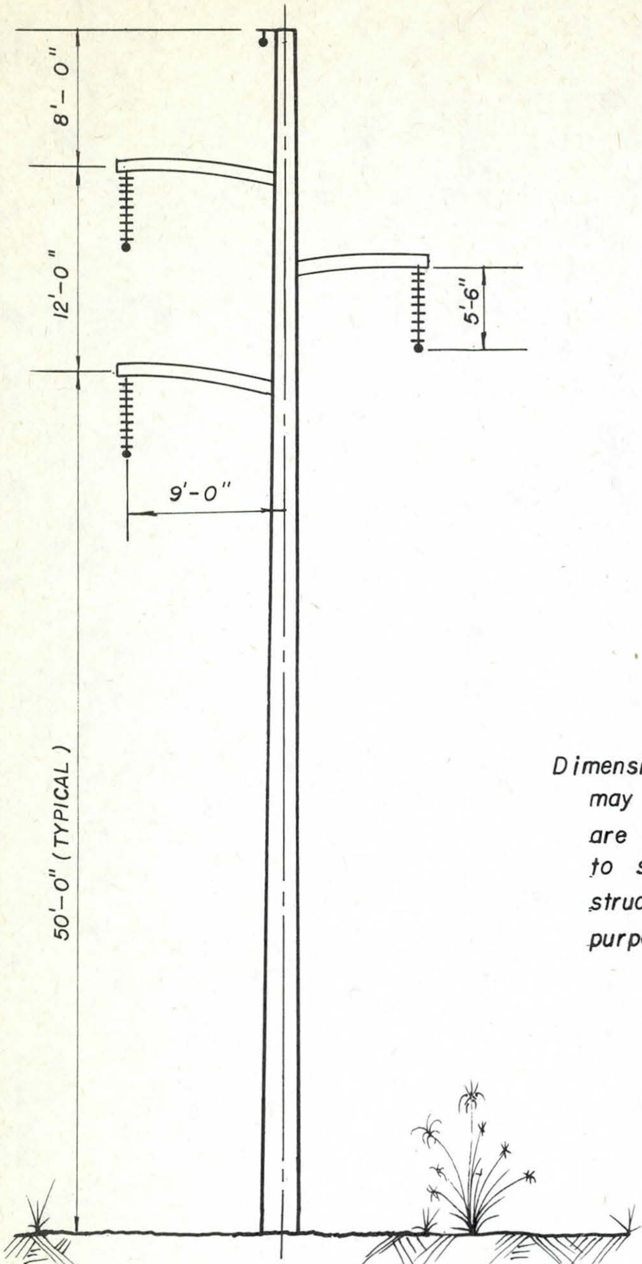
deterioration from weathering effects, and will be of color to be compatible with the natural color of the area traversed by the transmission lines. If steel-type structures are used, they may be of the types shown in Figures 26, 27, or 28. Each of the three phase conductors will be one ACSR (aluminum conductor, steel reinforced) conductor. The phase conductors will be supported by suspension insulators attached to the crossarms of the structures. Two insulated 3/8-inch overhead ground wires will be installed near the tops of the poles.

(1) Parker Dam Switchyard to Havasu Pumping Plant [1, 2, 126]

A 230-kV radial transmission line will supply power to the pumps at the Havasu Pumping Plant and will be 2.2 miles long.

The route will begin at the Parker Dam 230-kV Switchyard in California, cross the river below Parker Dam, and parallel a portion of the Bureau of Reclamation's existing 69-kV line between Parker Dam and Bagdad, Arizona. For 1.6 miles, the conventional lattice-steel, free-standing towers will be used similar to those that will be used on the main backbone 230-kV system (Figure 14).

Since the pumping plant is adjacent to Route 95 and Lake Havasu, the remainder of the line will consist of 0.6 mile of underground cable. For the transition from overhead carrier to underground, a cable spreading yard will be constructed southwest of the pumping plant in an area which is screened by natural landforms. The



NOTE

Dimensions shown are typical and may change when final designs are completed. . They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT
TUBULAR STEEL STRUCTURE

DRAWN Bill Rogers SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

PHOENIX, ARIZONA MAY, 1974 344-330-T-291

Figure 26

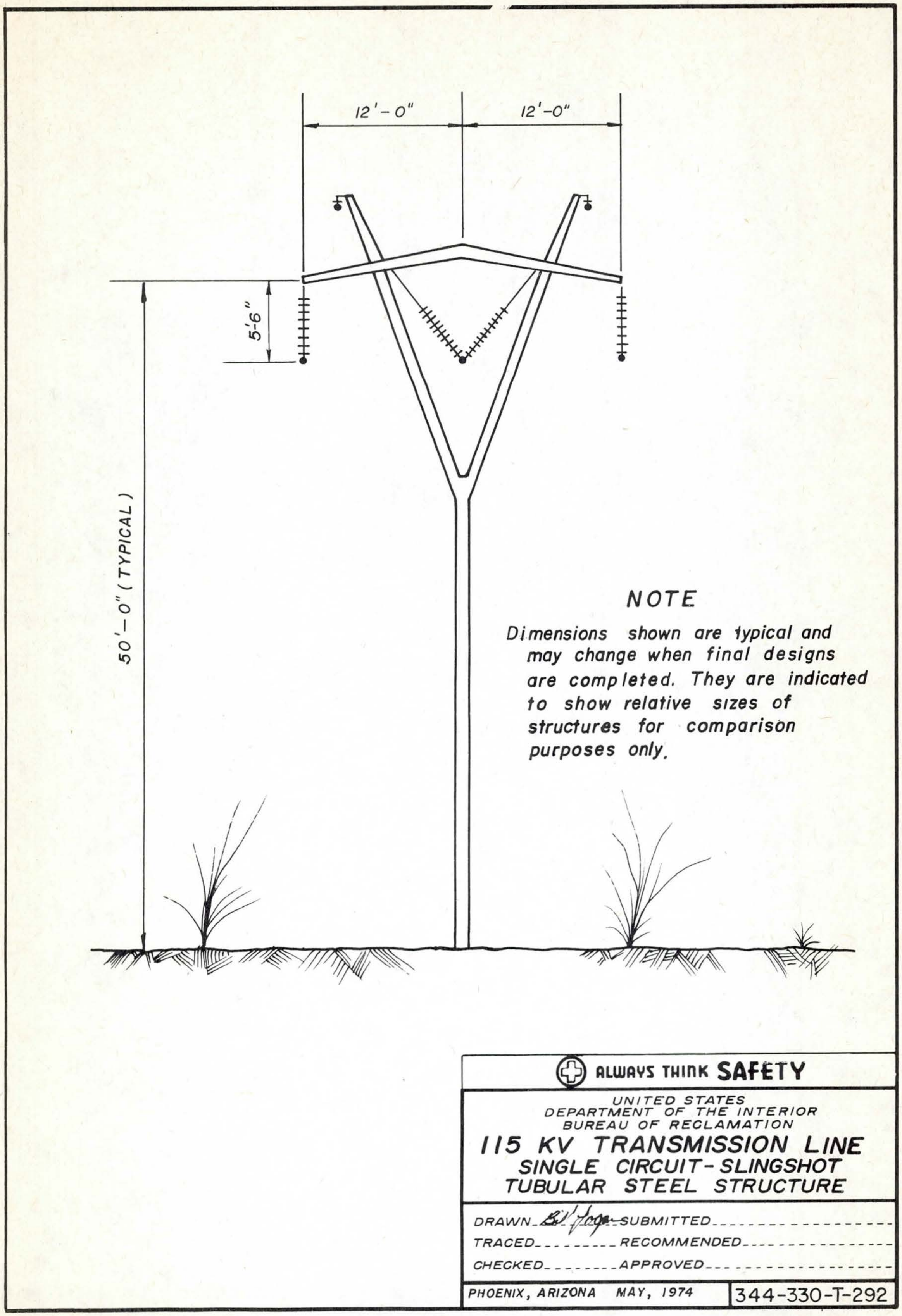
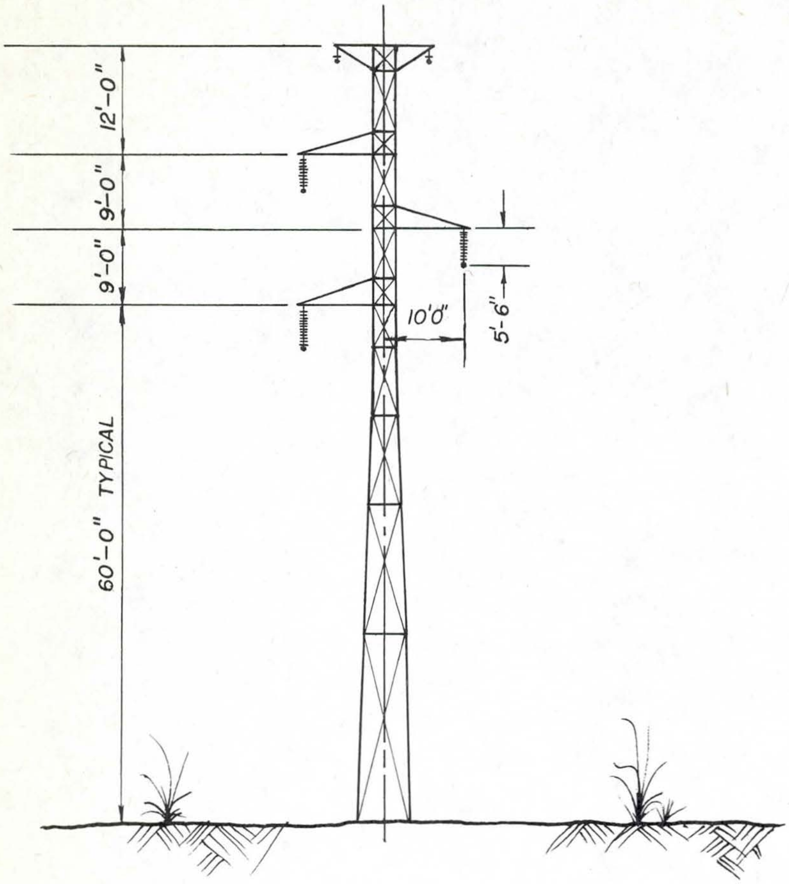

12'-0"
12'-0"
5'-6"
50'-0" (TYPICAL)
NOTE
Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.
ALWAYS THINK SAFETY
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
115 KV TRANSMISSION LINE
SINGLE CIRCUIT-SLINGSHOT
TUBULAR STEEL STRUCTURE
DRAWN
SUBMITTED
TRACED
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA MAY, 1974
344-330-T-292

Figure 27



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT-NARROW BASE
STEEL LATTICE STRUCTURE

DRAWN Bill Hogan SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED

PHOENIX, ARIZONA MAY, 1974 344-330-T-293

Figure 28

area will be occupied by pothead and takeoff structures as well as grounding switches and lightning arresters. The underground cables will utilize the most feasible technology available at the time they are installed. Cables with extruded insulation are now under development and may offer cost and installation advantages over oil or gas types by the time the Havasu cables are needed. Two underground circuits will be required to prevent an extended outage should a cable fail. Each circuit will be in a separate trench. By using underground cable for this short distance, the esthetic impact on travelers of Highway 95 and boaters on Lake Havasu from the use of overhead conductors and towers will be minimized.

(2) Harcuvar Substation to Bouse Hills Pumping Plant

The remote location of the Bouse Hills Pumping Plant near Cunningham Wash makes it possible to screen from sight approximately 22.6 miles of radial transmission line from any public highway. The first 6.3 miles of the line northwest of Harcuvar Substation will parallel the Parker-Phoenix 161-kV line and the existing access road will be utilized for construction and maintenance. The remaining 16.3 miles will be in an isolated area of desert terrain (Figure 29) and will require minor clearing for the construction of a new access road. New right-of-way from 75 to 105 feet in width, depending on the types of structures used, will have to be acquired.

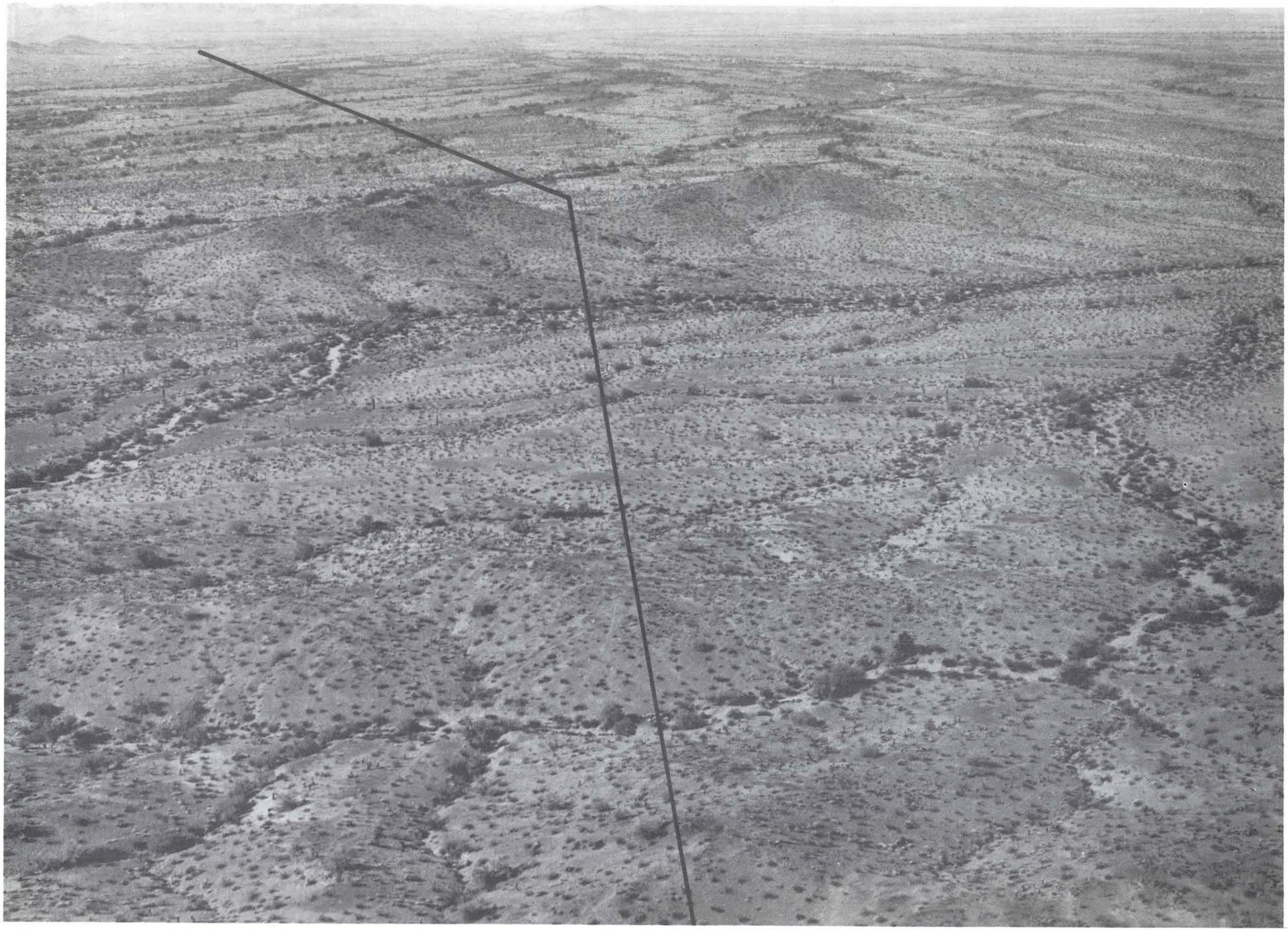


Figure 29
Bouse Hills 115-kV Alinement--View to the west showing the transmission system alinement in a creosote, paloverde, and cholla vegetation community--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01183NA

(3) Harcuvar Substation to the Little Harquahala Pumping Plant

The second 115-kV radial transmission line from the Harcuvar Substation will deliver power to the Little Harquahala Pumping Plant located south of Interstate 10 on the southwest slopes of the Little Harquahala Mountains. This route is approximately 27 miles long and runs from the substation along the foothills on the south side of the Harcuvar Mountains (Figure 12) through the Granite Wash Pass. It crosses the Atchison, Topeka and Santa Fe Railroad and U.S. Highway 60 between Hope and Harcuvar south along the west slopes of the Little Harquahala Mountains (Figure 30) and then across Interstate 10 (Figure 31) to the pumping plant.

Except for the highway crossings, the route is in isolated desert terrain and access road construction will require some clearing of cacti, creosote bush and paloverde trees along the foothills of the Harcuvar Mountains. When the line parallels U.S. Highway 60, it will be routed to make optimum use of the terrain features to avoid high visual impact from the highway. New right-of-way will have to be acquired with widths of 75 to 105 feet, the same as for the Harcuvar-Bouse Hills line. The line will cross Interstate Highway 10 next to the Granite Reef Aqueduct and proceed on separate right-of-way to the Little Harquahala Pumping Plant generally following the canal alinement.

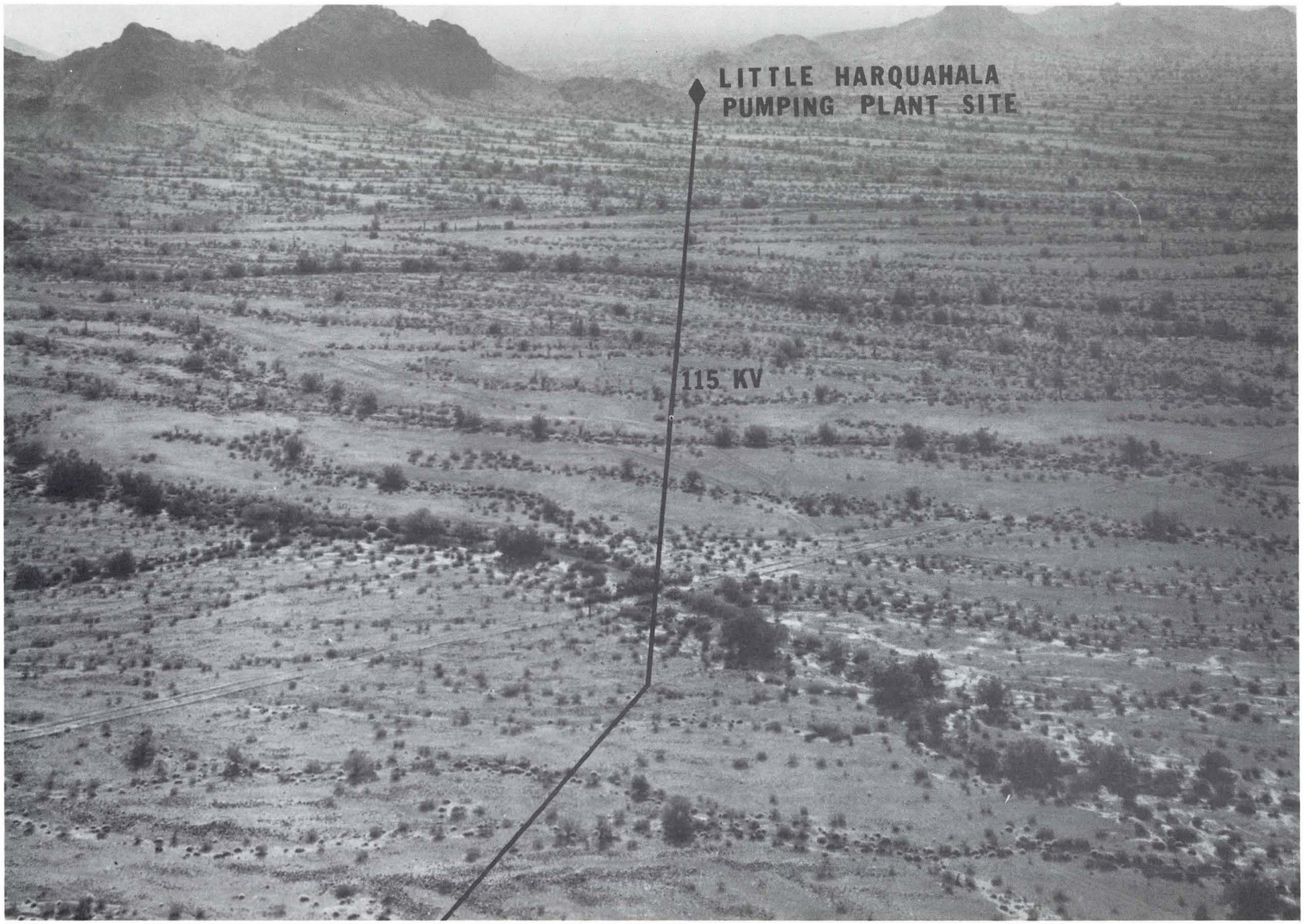


Figure 30

Little Harquahala Mountain Pumping Plant Site--View southeast showing the transmission system alinement in a creosote-bursage community with paloverde along the washes--Harcuvar-Little Harquahala Mountains 115-kV--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01176NA

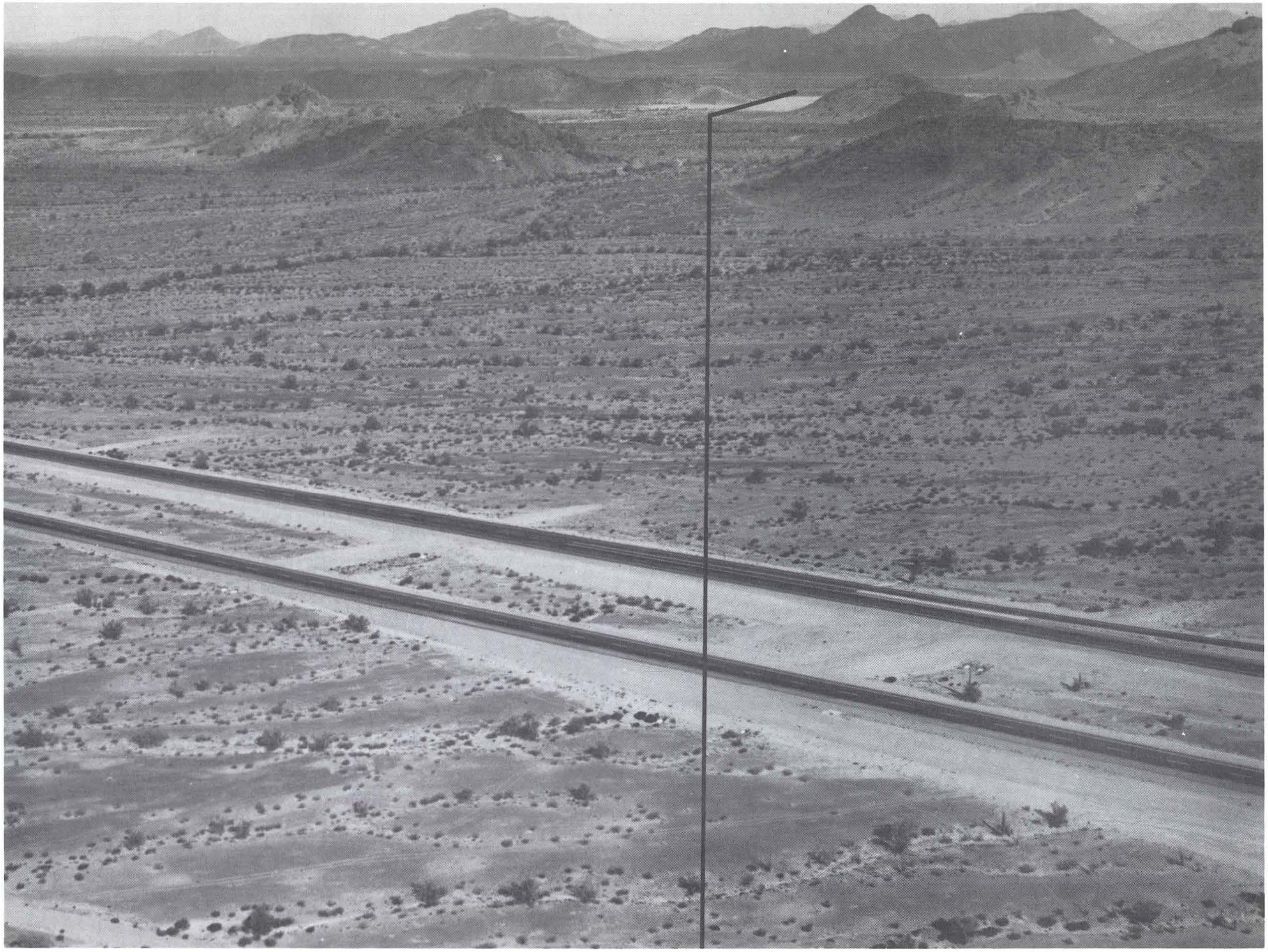


Figure 31
I-10 Crossing--115-kV Harcuvar-Little Harquahala Mountains pumping plant feeder line alinement through the Little Harquahala Mountains--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01175NA

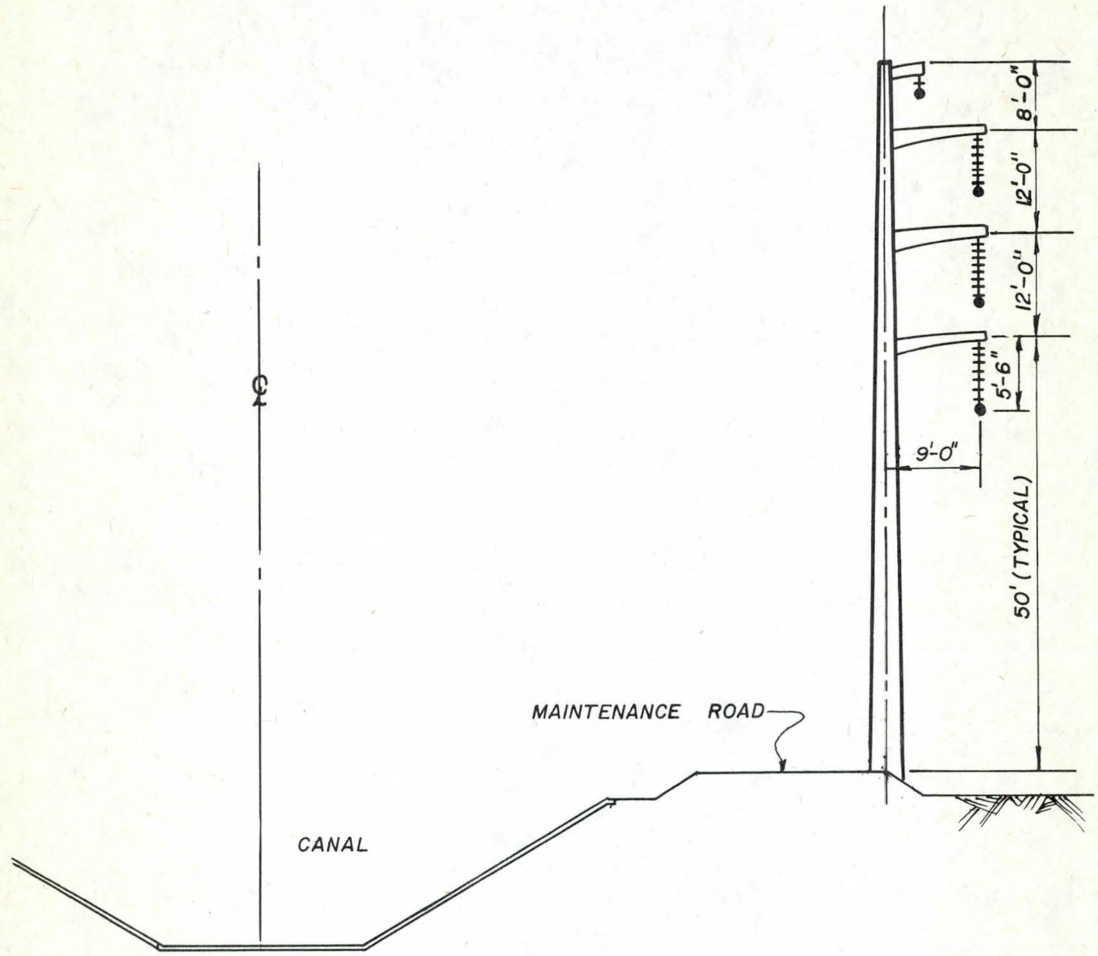
(4) Liberty Substation to Hassayampa Pumping Plant

The route for the 115-kV connection from the Liberty Substation to the Hassayampa Pumping Plant is approximately 25.5 miles long.

The routing of the first 19 miles of line northwest of Liberty Substation will be the same as described previously for the first 19 miles of the Liberty-Parker 230-kV line since both lines utilize the same double circuit towers for this portion of line. At the point where the double circuit line meets the 345-kV Mead-Liberty line and the 161-kV Parker-Phoenix No. 1 line right-of-way, the 115-kV Liberty-Hassayampa line becomes a single circuit line and crosses under the Parker-Phoenix No. 2 line and Mead-Liberty line and proceeds to Hassayampa Pumping Plant. The last 6.5 miles of this line will be single circuit and routed as shown in Figure 6. The first 4.2 miles of single circuit line will cross native desert while the last 2.3 miles will follow the canal maintenance road on the aqueduct right-of-way. Figures 32 and 33 show the possible structure arrangement in relationship with the aqueduct and maintenance road.

(5) Check Structure Distribution Lines [3]

Check structures will be installed at 6- to 10-mile intervals in the aqueduct. Power to the structures will be provided by either 34.5-kV or 13.8-kV buried cables placed along the canal



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

This design may be used for approximately five miles on 115 KV Liberty—Hassayampa line.

ALWAYS THINK **SAFETY**

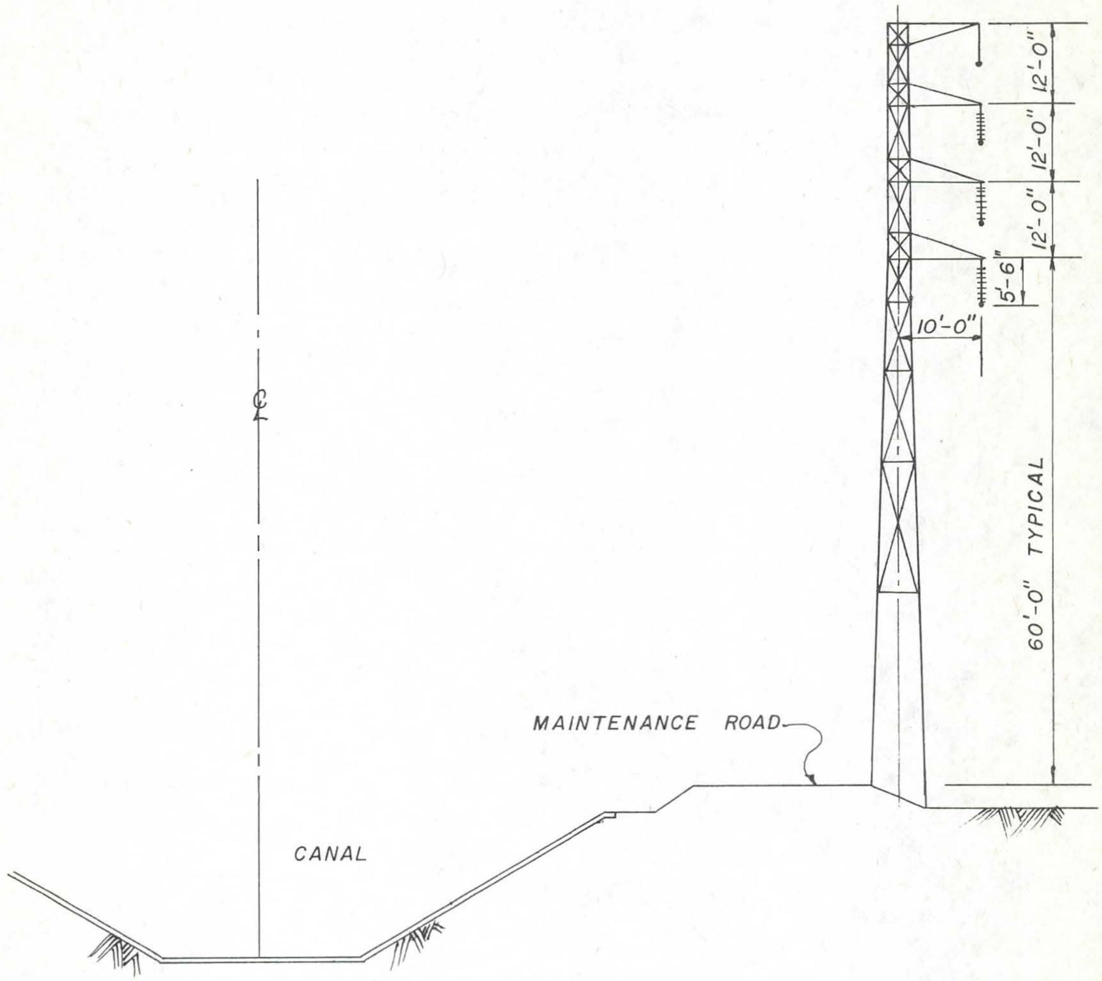
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT
TUBULAR STEEL STRUCTURE

DRAWN [illegible] SUBMITTED
TRACED ------- RECOMMENDED
CHECKED ------- APPROVED

PHOENIX, ARIZONA MAY, 1974 344-330-T-294

Figure 32



NOTES

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

This design may be used for approximately five miles on 115KV Liberty – Hassayampa line.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

115 KV TRANSMISSION LINE
SINGLE CIRCUIT–NARROW BASE
STEEL LATTICE STRUCTURE

DESIGNED __________ SUBMITTED __________
DRAWN Bill Logan RECOMMENDED __________
CHECKED __________ APPROVED __________

PHOENIX, ARIZONA MAY, 1974 | 344-330-T-298

Figure 33

approximately 5 feet under the operation and maintenance road. The feeder cables will terminate at the Bouse Hills, Little Harquahala, and Hassayampa Pumping Plants. An automated standby power source of either a motor-generator set or a battery bank will be provided at each check structure for use in the event of an emergency. These will be located inside a small control building at each check structure. Existing distribution lines will be utilized in the more populated areas where they presently exist although the feeders to the check structures will be buried from the point where they tap an existing overhead line to the check structure.

4. Construction Schedule

Initial construction of the integrated transmission system is expected to start in mid-1975 and take 10 years to complete. The following construction sequence is presently proposed in constructing the transmission system:

		Inservice Date
1.	Davis-Parker 230-kV No. 2 Line	May 1, 1977
2.	Liberty-Harcuvar-Parker 230-kV Line	July 1, 1979
3.	Mead-Davis 230-kV No. 2 Line	January 1, 1981
4.	McCullough 230-kV Interconnection	January 1, 1982
5.	Parker-Havasu Pumping Plant 230-kV Line	January 1, 1983
6.	Liberty-Hassayampa Pumping Plant 115-kV Line	January 1, 1983
7.	Harcuvar-Bouse Hills Pumping Plant 115-kV Line	January 1, 1983
8.	Harcuvar-Little Harquahala Pumping Plant 115-kV Line	January 1, 1983

Substation and switchyard additions along with the new Harcuvar Substation will be constructed along with their appropriate transmission lines. As the power system will be integrated with USBR facilities which are already constructed, the above construction sequence will allow the new lines to be built with a minimum of power interruptions. Also, each line will be placed in service upon its completion so as to add to the reliability of the existing system even though it will not be required to feed CAP loads until completion of the Granite Reef Aqueduct, tentatively scheduled for 1985.

The scheduling for construction of the transmission system is subject to change and adjustment depending on Congressional appropriations of construction funds and unforeseen delays. The length of each construction contract will vary from a 1- to 2-year period for the individual substations and switchyards and to about 3 years for the individual transmission lines.

E. Rights-of-Way and Access Roads

1. Right-of-Way Requirements [113, 124]

The approximate right-of-way widths required for the various types of construction are shown on Table 4. These widths are needed to meet the electrical clearance requirements of the National Electrical Safety Code. These widths are necessary to provide working space for construction and maintenance and to provide protection from electrical hazards under the most extreme wind conditions to buildings or

Table 4
Required Right-of-Way Widths

Type of Transmission Line Construction	Ruling Span (feet)	ROW Width (feet)
Double-Circuit with 230-kV on One Side and 115-kV on Other Side	1,200	120
230-kV Single-Circuit	1,300	155
115-kV H-Frame Wood	700	75
115-kV Single-Pole or Single-Mast Type with Two Conductors on One Side and One Conductor on Other Side	700	70
	1,000	85
	1,200	105
Same as Above Except All Conductors on One Side	700	50
	1,000	65
	1,200	85

other structures that might be near the right-of-way. In general the right-of-way acquired for the Granite Reef Aqueduct transmission system will be no less than those widths specified. Approximately 25 feet of right-of-way width will be added to the 100 feet now used for the 161-kV line that will be replaced by a 230-kV line between Parker and Liberty.

A total of approximately 4,116 acres of additional right-of-way will be required, including roadways, the substation site at Harcuvar and the transmission lines. Approximately 1,235 acres of existing right-of-way will be used for the new 230-kV Liberty-Harcuvar-Parker line.

2. Landownership

Ownership of the land for the right-of-way includes approximately 285 acres of Arizona State land, 409 acres of land reserved for the State of Nevada under P.L. 85-339 but still under the jurisdiction of the Bureau of Land Management, 463 acres of private land, and 2,959 acres of Federal land. Landownership for the various segments of line is as shown on Table 5.

3. Land Acquisition

Land required for the proposed transmission line right-of-way is expected to be acquired in the form of a perpetual easement. The

Table 5
Transmission Line Lengths and Land Status (Miles)

Line	Federal	Federal Recreation	State Recreation	State (Arizona)	State (Nevada)	Private	Total
McCullough - Mead	4.8	--	--	--	10.5	--	15.3
Mead - Davis	54.0	2.0	--	--	11.3	1.0	68.3
Davis - Parker	46.5	--	4.0 1/	6.5	--	14.0	71.0
Parker - Harcuvar - Liberty	79.4	--	--	25.1	--	16.4	120.9
Parker - Havasu Pumping Plant	2.2	--	--	--	--	--	2.2
Harcuvar - Bouse Hills Pumping Plant	16.9	--	--	4.0	--	1.7	22.6
Harcuvar - Little Harquahala Pumping Plant	24.6	--	--	2.2	--	--	26.8
Liberty - Hassayampa Pumping Plant	5.2 2/	--	--	1.3	--	--	6.5
TOTALS	233.6	2.0	4.0	39.1	21.8	33.1	333.6

1/ The 4.0 mile of State Recreation Land is BLM land controlled by the Arizona State Parks Board.

2/ Liberty-Hassayampa line is double circuit for 19.0 miles and not included here since it is included under the Parker-Harcuvar-Liberty line.

landowner will grant to the United States, its successors and assigns a perpetual easement to construct, reconstruct, operate, and maintain the transmission line across the right-of-way. The landowner is paid just compensation based upon an appraisal or negotiated settlement satisfactory to both parties. When a satisfactory settlement cannot be secured through negotiations, condemnation action may be necessary. The same procedure will be used for acquiring access road easements for construction, and operation and maintenance that are off the transmission line right-of-way. Access to transmission line right-of-way for project-related activities will be on existing roads.

Easements will be acquired through State-owned lands by the same procedures as used on privately owned lands.

Right-of-way through Federal lands will be acquired through coordination with the appropriate administering agency.

The land required for the proposed Harcuvar Substation is Federally owned and a withdrawal application for the required 10 acres will be made through the Bureau of Land Management.

4. Land Use [33, 132, 133]

The present use of the land that will be occupied by the transmission line route between McCullough Switching Station in Nevada and the Liberty Substation near Phoenix, Arizona, is as varied as the land through which the line passes. The route has been planned, however, to minimize any permanent effects on this use and will in some instances enhance the utilization.

The McCullough-Mead and Mead-Davis lines will cross land in Eldorado Valley (Nevada), presently under the administration of BLM, but reserved under Public Law 85-339 to the State of Nevada. The State has not exercised its option to buy this land, as a plan of development is being prepared. Close coordination is being maintained with the State to assure that the routing of these lines will be compatible with its plan.

The Mead-Davis line will cross the right-of-way used by the Southwest Gas Corporation and parallel it for about 16 miles in Nevada. Mine access roads will be crossed near Searchlight, Nevada. The route will have no restrictions or infringements upon these uses.

The right-of-way for the Mead-Davis line will run just north of the southern boundary of the Lake Mead National Recreation Area for 1 mile on the Nevada side of the Colorado River. The present land use and access restrictions on recreation now imposed by the National Park Service will not change as a result of the transmission line.

Between the Davis Dam Switchyard and the Parker Dam Switchyard, the line will follow a course that is generally parallel to the Arizona side of Lake Havasu. This portion crosses the rights-of-way of underground users including AT&T, Black Mesa Pipeline, Inc., Four Corners Pipeline Company, Transwestern Pipeline Company and El Paso Natural Gas Company. Overhead powerlines that will be crossed by the proposed transmission lines are owned by the Citizens Utilities Company, Southern California Edison Company, Metropolitan Water District of Southern California, Arizona Public Service Company, Nevada Power Company, and City of Los Angeles Department of Water and Power.

Between Parker Dam and Lake Havasu City, a right-of-way strip 6,000 feet long and 155 feet wide will be required through the Lake Havasu Travel Trailer Village and the line will cross 4 miles of the Lake Havasu State Park. The State Park is Federal land administered by the State of Arizona for recreation purposes and is subject to Reclamation project requirements.

Primarily, the land between the Parker Switchyard and the Liberty Substation that the route will occupy is used for recreation and cattle grazing. The line will cross a portion of a mobile home residential area near Parker Dam (Figure 34) on the same right-of-way now used by the 161-kV line that will be replaced.

At the eastern end of the transmission line system, near Liberty Substation, the alinement parallels other existing lines through approximately 2 miles of irrigated agricultural land. Land use for agricultural purposes affected by the tower construction will vary from the total area within the perimeter formed by the tower legs of

Figure 34
Parker Dam--View northwest of the transmission system alinement through a mobile home residential area south of Parker Dam on Arizona Highway 95--Parker Dam in upper center area--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01157NA

about 1,600 square feet, to the area occupied by the leg footings of about 20 square feet each, depending on the cropping pattern and farm practices.

The transmission lines will make several crossings over State and U.S. highways. At these locations, no change in the use of roadways will be made except possibly for some unforeseen minor delays to the highway users during the time of the crossing construction.

The private landowner will have the right to cultivate, use and occupy the acquired right-of-way for any purposes which will not constitute a hazard to human life or interfere with the rights and privileges granted to the United States. Compatible use of the right-of-way through Federal lands will be at the discretion of the administering land-use agency.

The Bureau of Reclamation is responsible for damage occurring to crops or other necessary improvements within the right-of-way as a result of construction and operation and maintenance of the transmission line.

5. Access Roads

Existing access roads will be used wherever new lines utilize existing right-of-way or parallel existing transmission lines. Short spur roads may be required to tower sites for construction purposes.

New access roads will be required for those lines that do not parallel existing lines, such as the 115-kV and 230-kV lines to the pumping plants and where the Davis-Parker 230-kV line is routed around Lake Havasu City. Access roads will also have to be constructed for minor portions of the Liberty-Parker 230-kV line and the Mead-Davis 230-kV line where they deviate from paralleling existing lines or access is impossible from the existing access roads because of terrain features. These roads will not only be used for construction but may also be used throughout the life of the transmission lines for operation and maintenance activities. There will be approximately 70 miles of new access road required for the complete integrated transmission system additions covered in this report. Approximately 265 miles of existing access roads will be utilized.

Access roads will be routed to minimize damage to existing terrain and vegetation. Where the roads cross dry wash beds they will be constructed as fords unless culverts are required for drainage purposes. F.C.?

The access road grades and alinements will follow the contour of the land with smooth, gradual curves when possible in order to reduce erosion and sedimentation. Where drainage problems are evident, the roads will be improved by providing side drainage ditches and culverts if necessary. After construction activities, the access roads will be repaired for maintenance use or, if not needed for maintenance, will be allowed to return to natural state after obliteration.

F. Operation and Maintenance

The Granite Reef Aqueduct power transmission system will be integrated into the Federal power system. Primarily, it connects the Navajo Generating Station delivery points to the pumping plants and other loads associated with the aqueduct system. It is anticipated that the Parker-Davis Project (Bureau of Reclamation), which operates the existing Federal transmission system, will regulate the power requirements of the Granite Reef Aqueduct through coordination with computerized control systems controlling the water aspects of the aqueduct.

Operating procedures for the Granite Reef Aqueduct will be established to optimize the revenues from intermittent power sales. This can best be done by pumping water during offpeak periods so that power is available for sale during peak periods. It has been assumed that determinations of annual quantities of water available for diversion to CAP can be reasonably made several years in advance, and that water will be diverted at a uniform rate throughout the year subject to water and power system maintenance and interruptions.

Typical summer operation of the Granite Reef Aqueduct will be 102 hours per week at rated capacity and 66 hours per week at a reduced capacity to be fixed by water availability and the master delivery schedule. Typical winter operation of the Granite Reef Aqueduct will be 102 hours per week at approximately two-thirds rated capacity and 66 hours per week at a lesser capacity to be fixed by water availability and the master delivery schedule. Operations may be continuous except for emergencies, for as long as 5 or more years.

Under maximum water supply conditions, during years of surplus water, the aqueduct will be operated 168 hours per week throughout the entire year at its rated capacity of 3,000 ft^3/s. Under minimum water supply conditions, all pumping will be accomplished offpeak.

Capacity and energy not required for CAP pumping will be sold as commercial energy to provide funds for repayment of Central Arizona Project costs. The proposed transmission system described herein may be used to deliver such excess capacity and energy to appropriate delivery points.

The operation of the Granite Reef Aqueduct Transmission System and the existing transmission system will be performed by Parker-Davis Project personnel on a coordinated basis that will monitor the automated aqueduct operation continuously. Should an adverse situation occur on the aqueduct system or transmission system, steps will be taken to minimize any disturbances which may affect the interconnected power system. The Navajo Project Agreements allow for pump dropping upon loss of a Navajo generating unit to satisfy spinning reserve requirements.

The maintenance of the transmission system will be performed by Parker-Davis Project personnel in the manner and schedule presently employed for the existing system. Monthly surveillance by helicopter of the lines and weekly inspection of the substations will be utilized to indicate the type and schedule of maintenance crew work.

G. Interrelationship and Coordination with Other Systems [29, 116, 120, 121]

The integrating of additional transmission system facilities between McCullough Substation and Liberty Substation is required to (1) serve CAP pumping loads of the Granite Reef Aqueduct system and (2) provide an adequate transmission system for reliability.

The mutual interrelationship of the integrated CAP system with the other systems operating in the same area is such that benefits to CAP will result from elimination of duplicate transmission facilities, right-of-way requirements, and operation and maintenance expenses. Other systems operating in the area will benefit from a more reliable system operation.

Power flow and stability studies run to determine the effect of outages and faults on the CAP transmission system indicate no adverse effect on other adjacent systems. The power system remained stable for three-phase line faults at all major line terminals which resulted in disconnecting a line section. Under normal system conditions, the transmission system has sufficient capacity to serve the CAP loads without relying on any other system. This meets the Bureau of Reclamation and Western Systems Coordinating Council design criteria for providing sufficient transmission capacity within the system to serve the loads and meet transmission obligations to others without relying on or imposing an undue degradation of reliability on any other system.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

II. DESCRIPTION OF THE ENVIRONMENT

A. General [1-3, 82-99]

This chapter describes the environmental setting of the transmission system for the Granite Reef Aqueduct from its beginning at McCullough Switching Station in Nevada to its terminus at Liberty Substation in Arizona, and the radial transmission lines from the substations to the pumping plants. This area lies within the Mohave and Sonoran Desert sections of the Basin and Range Physiographic Province (Figure 35). The environmental factors discussed include climate, topography, soils, geology, vegetation, wildlife, land use, and historical, archeological, sociological, and cultural aspects. The area through which the transmission system will pass has been used by man for his welfare during prehistoric and historic times.

Figures 3 through 7 indicate the more prominent evidence of man's past and continuing presence. It is virtually impossible to find any segment of the transmission system route from which specific evidence of man's presence and use of the area cannot be found within a distance of a few miles. The sounds of man's activities cannot be avoided except for short periods of time at any location along the transmission system.

The Bill Williams River is generally referred to as the division between the Sonoran and Mohave Deserts. The surrounding area is a transitional zone between the deserts. A mixing of the biota occurs in this area.

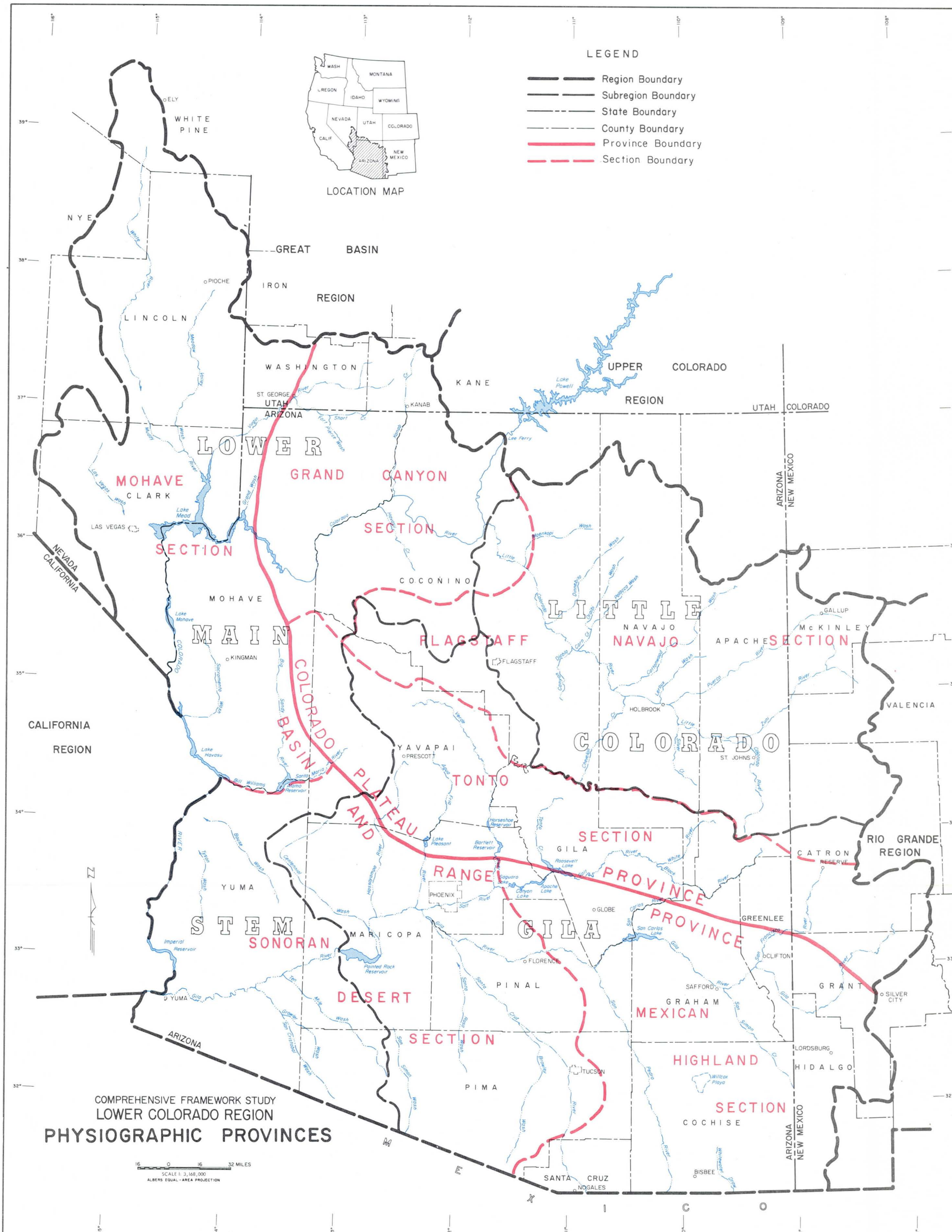

LEGEND
Region Boundary
Subregion Boundary
State Boundary
County Boundary
Province Boundary
Section Boundary
LOCATION MAP
WASH
MONTANA
OREGON
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIF
ARIZONA
NEW MEXICO
GREAT BASIN REGION
UPPER COLORADO REGION
CALIFORNIA REGION
RIO GRANDE REGION
LOWER MAIN STEM
LITTLE COLORADO
GILA
MOHAVE SECTION
GRAND CANYON SECTION
FLAGSTAFF
NAVAJO SECTION
TONTO SECTION
COLORADO PLATEAU PROVINCE
BASIN AND RANGE PROVINCE
SONORAN DESERT SECTION
MEXICAN HIGHLAND SECTION
WHITE PINE
NYE
LINCOLN
IRON
WASHINGTON
KANE
CLARK
MOHAVE
COCONINO
NAVAJO
APACHE
McKINLEY
VALENCIA
YAVAPAI
YUMA
MARICOPA
GILA
PINAL
PIMA
SANTA CRUZ
GRAHAM
GREENLEE
COCHISE
CATRON
GRANT
HIDALGO
ELY
PIOCHE
ST GEORGE
KANAB
LAS VEGAS
KINGMAN
FLAGSTAFF
HOLBROOK
ST JOHNS
GALLUP
PRESCOTT
PHOENIX
GLOBE
FLORENCE
TUCSON
NOGALES
SAFFORD
CLIFTON
SILVER CITY
LORDSBURG
BISBEE
YUMA
RESERVE
UTAH
ARIZONA
COLORADO
NEW MEXICO
NEVADA
CALIFORNIA
M E X I C O
Lake Powell
Lee Ferry
Lake Mead
Lake Mohave
Lake Havasu
Imperial Reservoir
Painted Rock Reservoir
Roosevelt Lake
San Carlos Lake
Willcox Playa
Horseshoe Reservoir
Bartlett Reservoir
Lake Pleasant
Saguaro Lake
Canyon Lake
Apache Lake
Alamo Reservoir
COMPREHENSIVE FRAMEWORK STUDY
LOWER COLORADO REGION
PHYSIOGRAPHIC PROVINCES
SCALE 1: 3,168,000
ALBERS EQUAL-AREA PROJECTION
16 0 16 32 MILES

Figure 35

The Mohave Desert of the northern part of the system is a transitional desert between the cooler Great Basin Desert to the north and the hotter Sonoran Desert to the south. The Mohave Desert is typically a series of unchained basins separated by mountain ranges with broad, gently sloping alluvial plains. The closed basins (playas) generally have high concentrations of salinity and alkalinity in the soil. In the Mohave Desert, the transmission system will traverse the Eldorado and Paiute Valleys and the Mohave and Buckskin Mountain ranges.

Eldorado Valley in the Mohave Desert is a closed basin with no drainage outlet, whereas Paiute Valley drains into the Colorado River. Many ephemeral washes in the Mohave Desert drain into the Colorado River. Silver Creek, Standard Wash, and Sacramento Wash are the principal drainages crossed in the Mohave Desert that drain into the Colorado River. These outlets have no surface flow in the area of the transmission system except during infrequent periods of heavy rain.

The Sonoran Desert section is located in the southwest portion of Arizona and is the lowest in elevation and the hottest desert in the State. This desert is characterized by a series of mountain chains separated by alluvial valleys with drainage outlets. Significant mountain ranges and valleys along the transmission system include the Buckskin Mountains, Cactus Plain, Butler Valley, Harcuvar Mountains, McMullen Valley, Harquahala Mountains, Hassayampa Plain, White Tank Mountains and Buckeye Plain.

The Sonoran Desert mountains and valleys are drained by numerous ephemeral desert washes and rivers which drain directly into the Colorado or Gila Rivers. These include Osborne, Cunningham, and Bouse Washes and the Bill Williams River which drain in a westerly direction to the Colorado River. Major drainage south to the Gila River system includes Centennial Wash and the Hassayampa River. Those drainages in the vicinity of the transmission system have no surface flow except during infrequent periods of heavy rain.

Elevations along the route of the transmission system vary from a minimum of about 400 feet near Parker Dam to a maximum of about 3,600 feet in an area between the Eldorado and Paiute Valleys near Searchlight, Nevada.

B. Climate [1-3, 30-32, 84, 87, 134]

The climate of the area is typical of the deserts of the arid Southwestern United States. It is characterized by long, hot summers, short, mild winters, sparse rainfall, low relative humidity, and high evaporation rates. These conditions promote sparse vegetal cover and poorly defined drainage patterns. Sheet runoff, flash flooding and erosion are typical problems to be encountered at various locations along the transmission system. Table 6 is a summary of climatic data for the area.

Temperatures show little variability at any point in time over the transmission system. There is a difference of about 6 degrees in mean temperature between Boulder City, Nevada, and Buckeye, Arizona

TABLE 6
CLIMATIC DATA
TRANSMISSION SYSTEM - GRANITE REEF AQUEDUCT
CENTRAL ARIZONA PROJECT

Location	Years of Record	Annual Precipitation (inches)				Annual Temperature (°F.)		
		Highest	Lowest	Mean	Snow	High	Low	Mean
Boulder City, Nevada	22	10.52	1.98	5.43	3.6	112	11	63.6
Searchlight, Nevada	17	18.34	1.83	7.75	3.4	111	6	66.8
Parker, Arizona	58	12.42	0.70	4.83	Trace	127	9	70.4
Salome, Arizona	48	16.75	2.99	7.96	0	118	15	67.1
Buckeye, Arizona	61	21.80	1.40	7.52	0	121	11	69.0
Davis Dam	11	--	--	3.37	0	121	20	72.2

(Liberty Substation). During the summer season beginning about mid-May and ending in October, maximum readings of 120°F. have been recorded and readings in excess of 100°F. are common. Winter temperatures in the desert typically reach daily maximums in the mid-60's to 70's. Only occasionally do temperatures drop below freezing but lows of 10° to 15°F. have been recorded throughout the area. Sunshine occurs during about 85 percent of the daylight hours.

The characteristically clear skies and dry atmosphere permit intense surface heating during the day and active radiational cooling at night, resulting in daily temperature variations averaging 30°F. and sometimes exceeding 40°F. The combination of high temperatures and low humidity also produces high rates of evaporation and transpiration.

Precipitation on the Mohave Desert is sparse and originates from the Pacific Ocean. Winter storms are gentle and little or no runoff occurs. Snow falls at some points along the transmission line each year but seldom stays on the ground for more than a few hours. The low rainfall during the winter months is best illustrated by the sparse vegetation of this desert. During the summer and late fall, thunderstorms often cause localized flooding.

Sonoran Desert rainfall is biseasonal from two distinct moisture sources. Winter precipitation is associated with moisture moving into the area from the Pacific Ocean, while the Gulf of Mexico supplies moist air for most of the region's summer rains. Rainfall may occur throughout the year but is more prevalent during July through September and again during December through March. Winter rains, sometimes lasting for several days, usually occur as gentle showers over a large area. Summer thunderstorms which can be very localized are generally of high intensity and short duration and produce many of the destructive flash floods, which are typical in the Southwest. Snow is a rarity, melting rapidly when it does occur.

The mean annual precipitation varies from approximately 5 inches along the Colorado River to about 10 inches near Buckeye. Annual precipitation may vary from as little as .70 inch (recorded at Parker in 1947) up to 18 inches (recorded at Buckeye in 1941). Figure 36 shows the normal annual precipitation for the area.

Winds of high velocity occur frequently throughout the year. Prolonged winds are most common in the spring when they may last several days. As they sweep through the valleys, these winds carry considerable sand and dust, greatly reducing visibility by raising the airborne particle levels to the point that driving on highways, roads, or streets is often delayed for safety purposes. Higher velocity winds occur during summer and are most frequently associated with thunderstorm activity. Very heavy dust and sand contents are experienced during some of these storms.

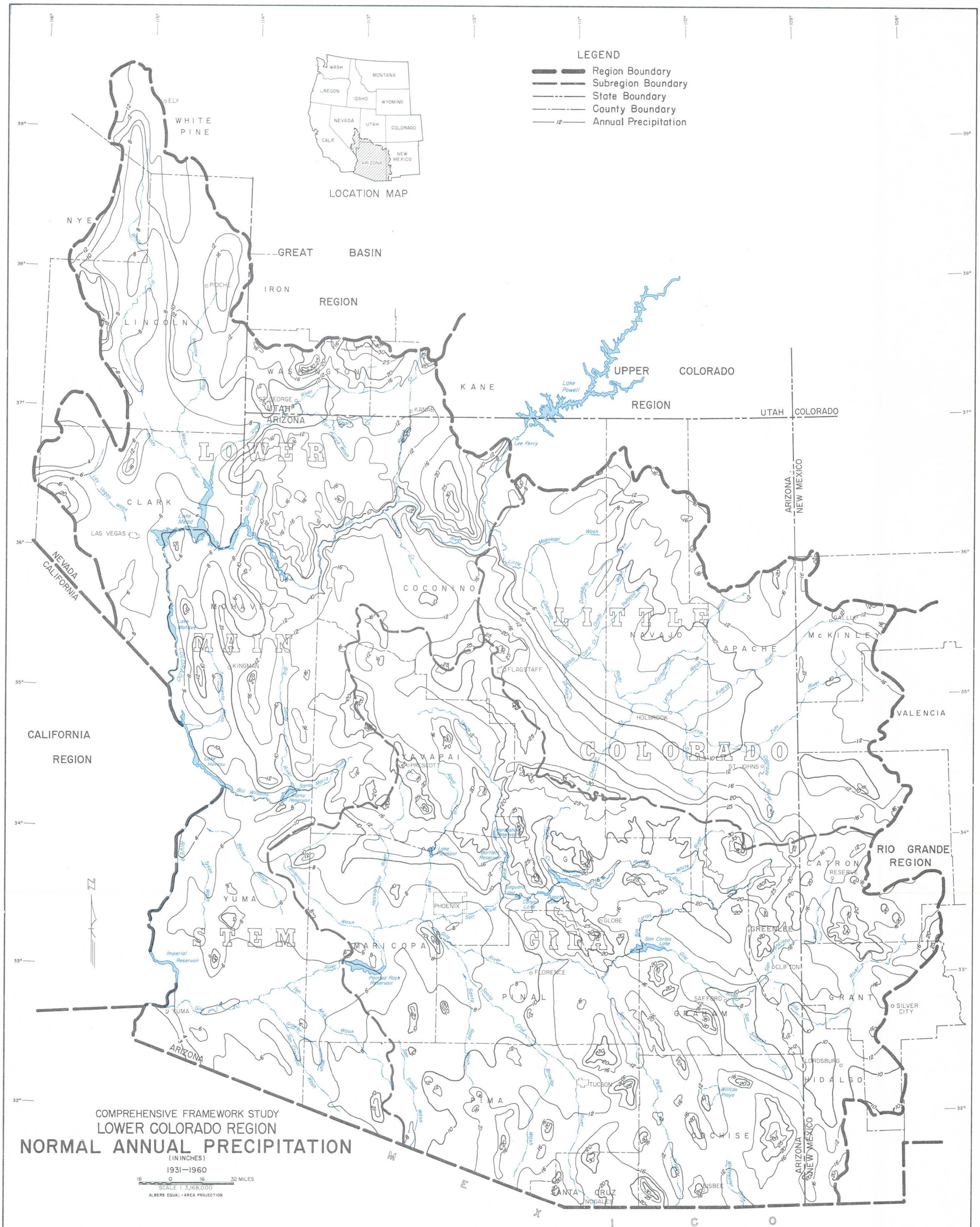

COMPREHENSIVE FRAMEWORK STUDY
LOWER COLORADO REGION
NORMAL ANNUAL PRECIPITATION
(IN INCHES)
1931–1960
16 0 16 32 MILES
SCALE 1:3,168,000
ALBERS EQUAL-AREA PROJECTION
LEGEND
Region Boundary
Subregion Boundary
State Boundary
County Boundary
12 Annual Precipitation
LOCATION MAP
WASH
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
COLORADO
CALIF
ARIZONA
NEW MEXICO
GREAT BASIN REGION
UPPER COLORADO REGION
CALIFORNIA REGION
RIO GRANDE REGION
LOWER MAIN STEM
LITTLE COLORADO
GILA
WHITE PINE
NYE
LINCOLN
IRON
WASHINGTON
KANE
CLARK
MOHAVE
COCONINO
NAVAJO
APACHE
McKINLEY
VALENCIA
YAVAPAI
YUMA
MARICOPA
PINAL
GILA
GRAHAM
GREENLEE
GRANT
CATRON
HIDALGO
PIMA
SANTA CRUZ
COCHISE
ELY
PIOCHE
ST. GEORGE
KANAB
LAS VEGAS
KINGMAN
FLAGSTAFF
HOLBROOK
ST. JOHNS
GALLUP
PRESCOTT
PHOENIX
GLOBE
FLORENCE
SAFFORD
CLIFTON
SILVER CITY
LORDSBURG
TUCSON
BISBEE
NOGALES
YUMA
Lake Powell
Lee Ferry
Lake Mead
Lake Mohave
Lake Havasu
Imperial Reservoir
Painted Rock Reservoir
San Carlos Lake
Roosevelt Lake
UTAH ARIZONA
UTAH COLORADO
ARIZONA NEW MEXICO
NEVADA CALIFORNIA
ARIZONA
MEXICO

Figure 36

C. Geology and Soils 1-3, 38, 39, 42-46, 84, 87-89, 110-112

1. General

The new transmission lines and substation are, in general, on the same alinement and right-of-way of or located next to existing transmission systems. Deviations from existing alinements are minor and involve geologic situations similar to those encountered along existing systems.

Generally, the alinement will be in the basins with soil foundations for the footings; however, in a few places it crosses mountain ranges and the foundations will be in rock. The Parker-Havasu segment of the line, including the short underground portion, will be nearly all on gneiss, sandstone, conglomerate, and volcanic rocks.

The soils crossed by the transmission system are generally of alluvial origin and are typical desert soils. They have developed from various parent materials under arid conditions and have little or no horizon development. On the basis of age and morphology there are three groupings; old valley fill, recent alluvial, and residual soils. Many of the soils contain high concentrations of soluble salts or exchangeable sodium. Generally the soils are strongly calcareous and in many areas this has become cemented to form caliche. The soils are low in organic material and highly susceptible to wind and water erosion.

Ground water occurs in the thick alluvial deposits and bedrock margins of the desert basins. Depth to ground water is mostly in the range of 100 to 500 feet.

Land subsidence occurs in basins where large-scale pumpage for agriculture has led to significant declines in the water level. Earth fissures commonly appear along the periphery of subsiding areas. The transmission line generally passes through undeveloped areas upslope from the areas of major ground-water pumping, and no problems have been experienced with existing transmission lines along the proposed alinement.

Existing structures indicate that adequate foundation is available for the new transmission line and substations. Individual footings for the towers are designed to accommodate the local situations, as are foundations for the switchyards. Existing structures and transmission systems indicate that few geologic problems will be encountered in the construction of this system.

2. Geology and Topography

The transmission line routes will traverse mountains and alluvium-filled valleys of the Basin and Range Physiographic Province (Figure 35). The mountains or ranges are commonly narrow and elongated, and rise hundreds of feet above the surrounding nearly flat valley floors. The ranges trend generally northwest-southeast except for an area east of Parker, Arizona, where a few ranges trend northeast-southwest. The valleys or basins are generally connected and are drained by washes and intermittent streams into the Colorado River and its tributaries, the Bill Williams and Gila Rivers.

The present topography was formed by Tertiary Age block faulting. Areas that are now basins were gradually displaced downward, often a thousand feet or more with respect to the ranges. The basins were subsequently deeply filled at first by lake deposits and then by alluvial fan material from erosion of the surrounding mountains. Thus, only the tops of the upthrown blocks extend above the alluvium as mountains. Alluvial fans also lap up on the sides of the mountains and cover rock benches known as pediments. Near the surface, alluvium in the basins generally consists of clay, silt, and sand of various mixtures. Near the edges of the basins in the upper part of the fans, the material is commonly coarser with silty gravel, cobbles, and boulders. Caliche cementation is common near the edges of the basins particularly in soils derived from volcanic rocks.

The mountains or ranges are generally composed of Precambrian granite and metamorphic rocks in places overlain by Paleozoic to Mesozoic metasediments, Cretaceous to Tertiary sandstone, mudstone, and conglomerate. The older rocks are in places intruded by granitic rock of Laramide age and fine-grained intrusives ranging from rhyolite to basalt. These rocks range in age from Cretaceous to Quaternary, with acid rocks the oldest and basic rocks the youngest. In many places, these fine-grained rocks came to the surface and were extruded as flows of rhyolite, andesite, basalt, and intermediate rock types. Additionally, pyroclastic tuffs and volcanic breccias are commonly interlayered with the flows. Many of the ranges are capped by these volcanic rocks.

3. Mineralization [89]

The mountain ranges in the vicinity of the transmission facilities have been heavily prospected. While traces of copper, gold, iron, silver, manganese, and lead are common, most notably in the Searchlight, Nevada, area there has been little production of metallic ore due to the low grades, limited size of ore bodies, and high production costs. There has also been minor local extraction of nonmetallic minerals, including sand and gravel, fluxing quartz, rough building stone, semiprecious gemstone, and calcite for lime production. The existing transmission lines have caused no problems to mineral production or prospecting, and no problems are expected with this new system.

D. Vegetation [51-55, 79, 88, 90, 109, 112, 115, 117, 131]

The transmission system will traverse two distinctly different Southwestern deserts with differing vegetal communities. North of the Bill Williams River, the system will cross the northeastern part of the Mohave Desert, and in the Bill Williams River area will cross a transition zone between the Mohave and Sonoran Deserts of the southern part of the system. The Mohave Desert is predominantly shrubby, whereas the Sonoran Desert is characterized by a large percentage of trees, large shrubs, and more diverse cacti. This vegetation difference is primarily due to the higher summer rainfall of the Sonoran Desert.

The effect of seasonal precipitation, or lack thereof, is very pronounced and dramatic upon the vegetation found along the transmission system and within the lower Sonoran life zone. Numerous winter, spring, and summer grasses and forbs respond to rainfall by germination from dormant seeds. In years of above-normal rainfall, a green and flowering desert is evident. During dry years the seeds and plants on the desert remain dormant except for the highly prominent species of trees, bushes and cacti. This dramatic effect of spring vegetation was observed in 1941 and again in 1973. In 1974, due to lower rainfall, the lack of vegetation growth provides a graphic illustration of the annual differences possible. Following the growing season when abundant rainfall has resulted in the growth of grasses and forbs, the dry plants are in some areas dense enough to carry wildfire. This is an exceptional condition to the usual forage and fuel availability that normally is insufficient to carry fire. The typical conditions are readily observed in the illustrative photographs.

The Arizona portion of the route will pass through areas where the plants are protected under the Arizona Native Plant Act (Arizona Revised Statutes, Sec. 3-901, et. seq. - 1972 Sup.). Some species of the Liliaceae (lily) and Cactaceae (cactus) families, Fouquieria (ocotillo) genera, Dalea spinosa (smoke tree), and Holacantha emoryi (crucifixion thorn) are the protected plants expected to be found within the area of the transmission system.

The Nevada legislature has authorized the State Division of Forestry to propose a list of flora to be protected. The Division will propose a law similar to the Arizona Native Plant Act to the 1975 legislature.

A list of flora and a native plant protection law is under study by the State of California. At the present time no desert plants are protected in the State of California.

The Federal Government under the Endangered Species Act of 1973, P.L. 93-205, is in the process of developing a list of plants under the provisions of Section 12 of the Act. This list is not available yet, and it is unknown what species will be encountered along the transmission system alinement.

This discussion is oriented toward the prominent or dominant species within areas of dominant-type change. Listings of the plants are included in Appendix C, Tables 4, 5, and 6. In some areas imported or exotic vegetation species have been introduced and are exceptionally prominent during years of above-average precipitation, or when growing next to the Colorado River channel or one of its reservoirs.

The vegetation (Figure 15) of the section from Mead Substation to the Eldorado-Nelson Road is sparse, generally consisting creosote bush with scattered bur-sage and occasional Mohave yuccas. Vegetation in the vicinity of the Eldorado Mountains is sparse and is generally creosote bush and cacti with scattered ephedra a and bur-sage. Stunted acacia (catclaw) are found in the arroyos and washes due to increased moisture. Through the center of Eldorado Valley's south end (Figure 37), the principal plant community is creosote bush/bur-sage with scattered stands of cane cholla and other small cacti. In the area from U. S. Highway 95 in the southern part of Eldorado Valley to Searchlight, Nevada, creosote bush/bur-sage is the principal vegetation with some thick stands of Mohave yucca. Scattered Joshua trees, ephedra, and beavertail cacti can be observed on the higher, drier lands, and acacia (catclaw) grows in or adjacent to numerous washes.

The vegetation in the Searchlight area (Figure 17) is principally a creosote bush/bur-sage community with numerous acacia trees, some Joshua trees, and very large Mohave yucca. From Searchlight to the base of the Newberry Mountains (Figure 38), the desert is a sparse creosote bush/bur-sage community with occasional Mohave yucca. Vegetation adjacent to the Newberry Mountains is a creosote bush/bur-sage community with scattered banana yucca and Mohave yucca. Thick stands of teddybear and cane cholla can be observed. The area between the Newberry Mountains and Davis Dam (Figure 39) is principally creosote bush with scattered bur-sage, cholla and beavertail cacti. Near the base of the Newberry Mountains, creosote bush with willow and acacia in the arroyos can be observed. Some Sego lilies can be observed with the sparse creosote bush on the terrace overlooking the river.

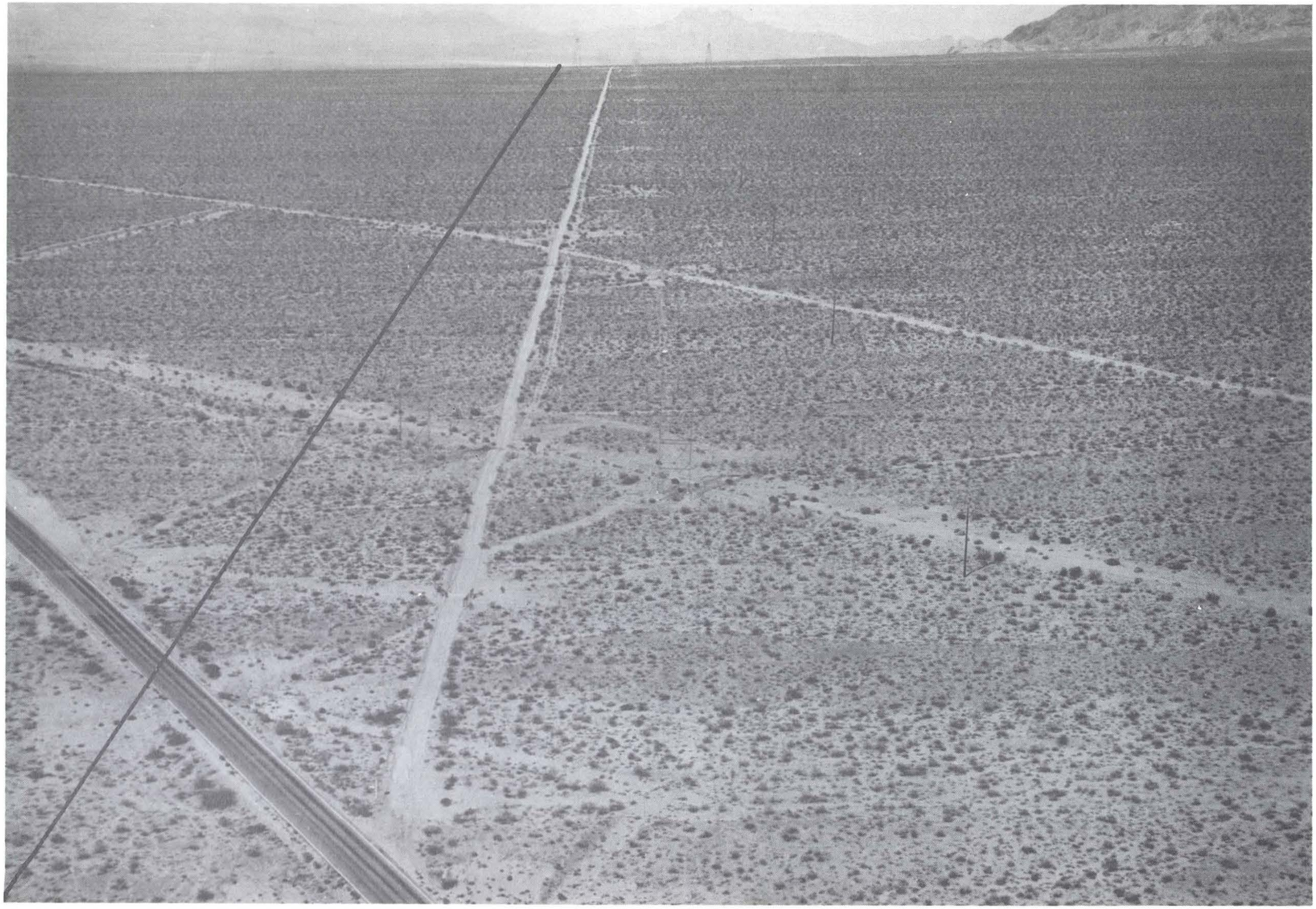


Figure 37
Southern Eldorado Valley--View north of Searchlight, Nevada, at crossing of U.S. Highway 95 showing transmission alinement--The principal plant community is creosote-bursage with scattered stands of cane cholla--The wood-pole lines are much more visible in this area than the steel towers of the Metropolitan Water District existing 230-kV lines--Mead-Davis 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01250NA

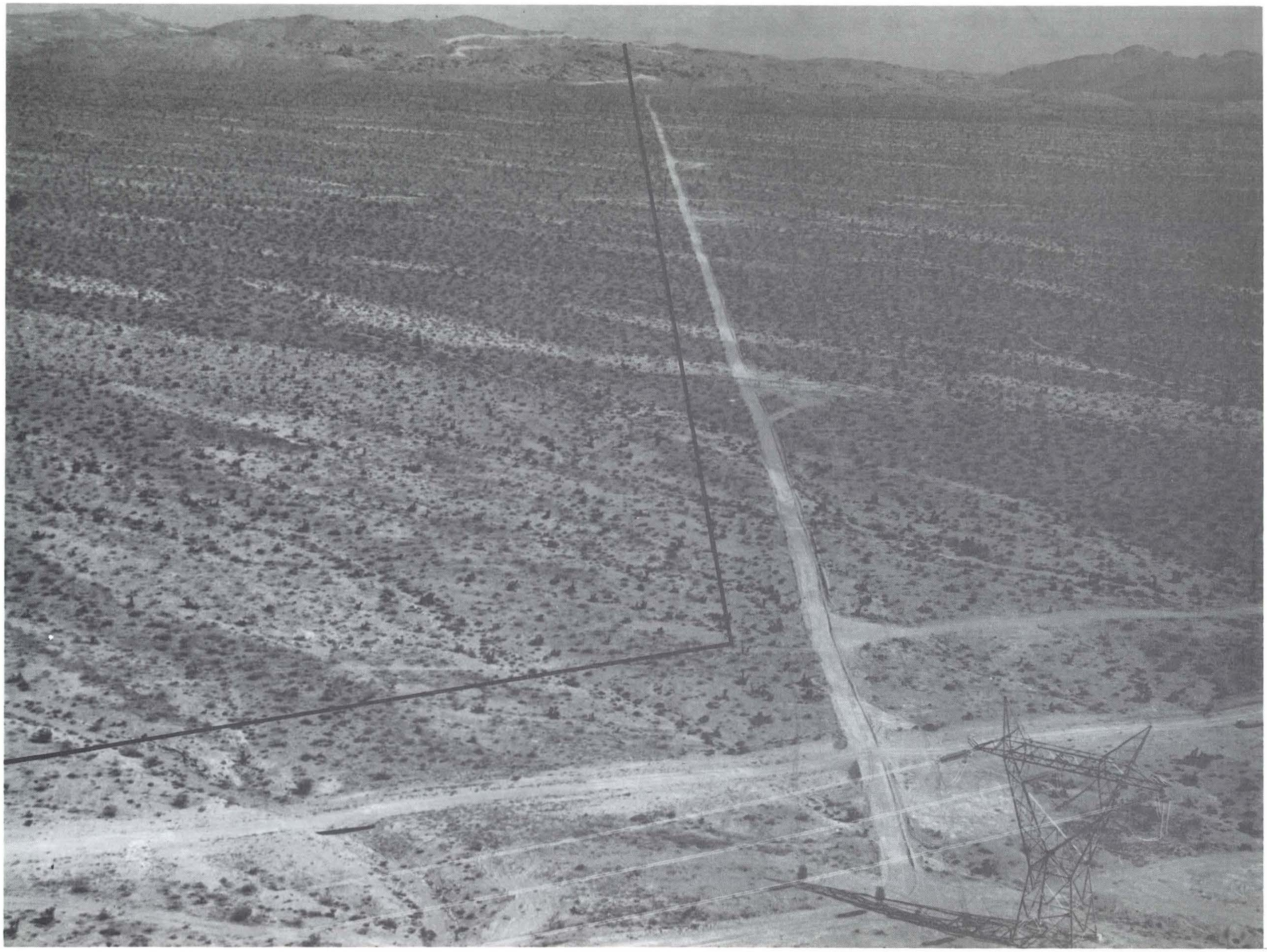


Figure 38
Nipton Road to Newberry Mountain Area--View east of Newberry Mountains showing transmission alinement--This is a sparse creosote-bursage community with occasional Mohave yucca--Mead-Davis 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01266NA

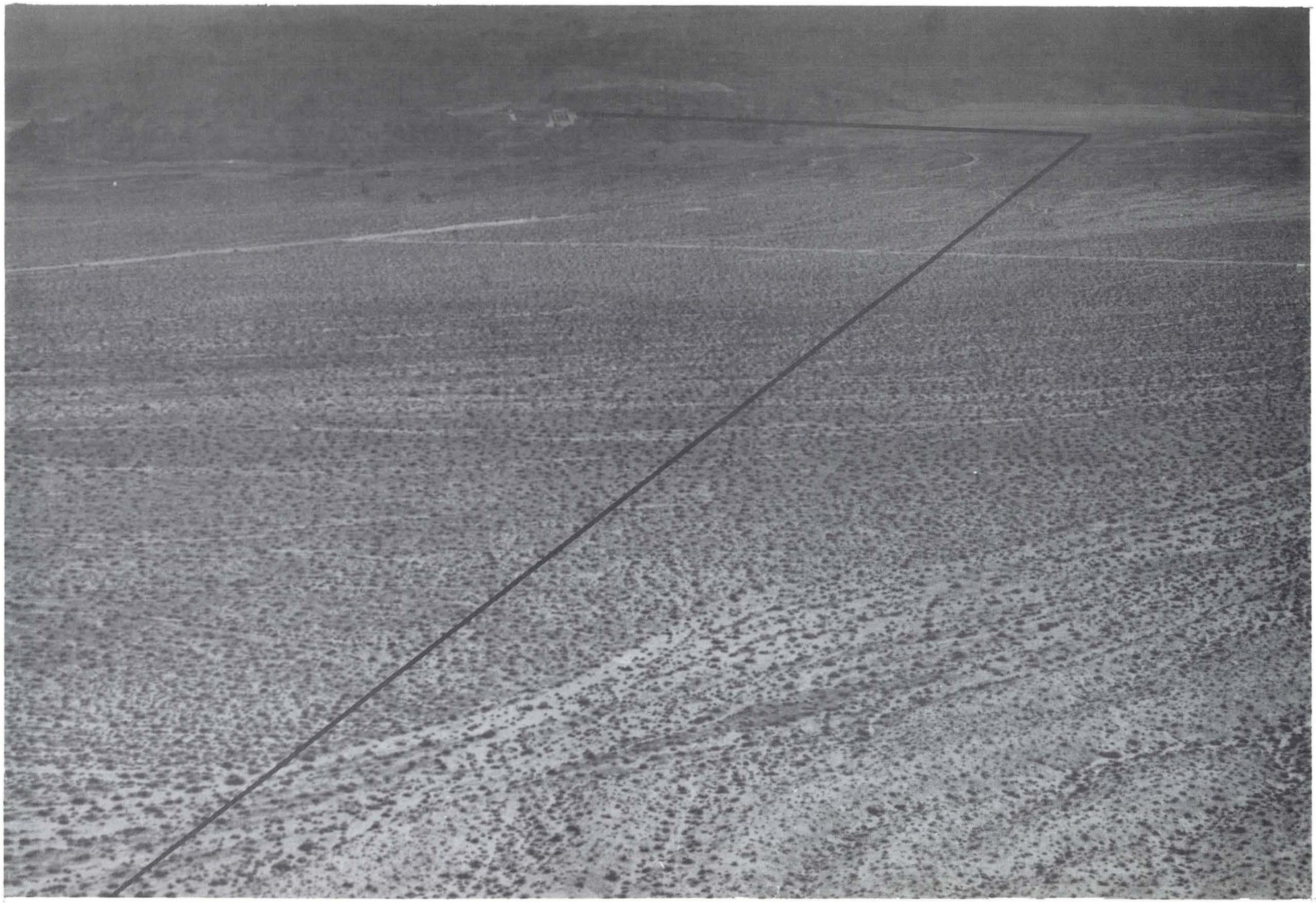


Figure 39
Newberry Mountains to Davis Dam--View northeast toward Davis Dam showing the transmission system alinement--The principal vegetation is creosotebush with scattered bursage, cholla, and beavertail cactus--Mead-Davis 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01273NA

From Davis Dam to Silver Creek Wash south of Bullhead City (Figure 40), the vegetation is creosote bush/bur-sage and cane cholla with scattered acacia in the washes and arroyos. In the Silver Creek Wash area, the vegetation is a typical creosote bush/bur-sage community with occasional stands of Sego lilies and ocotillo in the flat or sandy areas. The washes and arroyos contain paloverde and smoke trees. The vegetation of the mesa beginning at Oatman Road (old U.S. Highway 66) (Figure 40) is predominantly creosote bush and paloverde with scattered barrel cactus, some of which stand 6 feet high. The vegetation density and growth is greater in the canyon bottoms, when a greater amount of water is available annually from runoff.

The vegetation north of Sacramento Wash (Figure 41) is creosote bush/bur-sage with an intermittent stand of ocotillos. The washes of the area contain paloverde and acacia communities. The vegetation from the junction of Sacramento Wash and U.S. Highway 66 leading to Yucca, Arizona, to Arizona Highway 95 is ocotillo, paloverde, scattered teddybear cholla, agaves, and Mohave yucca. The southern half of this area contains saguaro cacti which here become more numerous.

The vegetation of the area through the Aubrey Hills to Parker Dam (Figure 42) is a creosote bush/bur-sage community with scattered bunch grass. The area contains a few scattered saguaro and ocotillo with smoke trees and paloverde trees restricted to the washes.

Figure 40
Oatman Area--View south showing the transmission system alinement along the Davis-Parker 230-kV No. 1 Line, in a creosote-bursage community--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01197NA

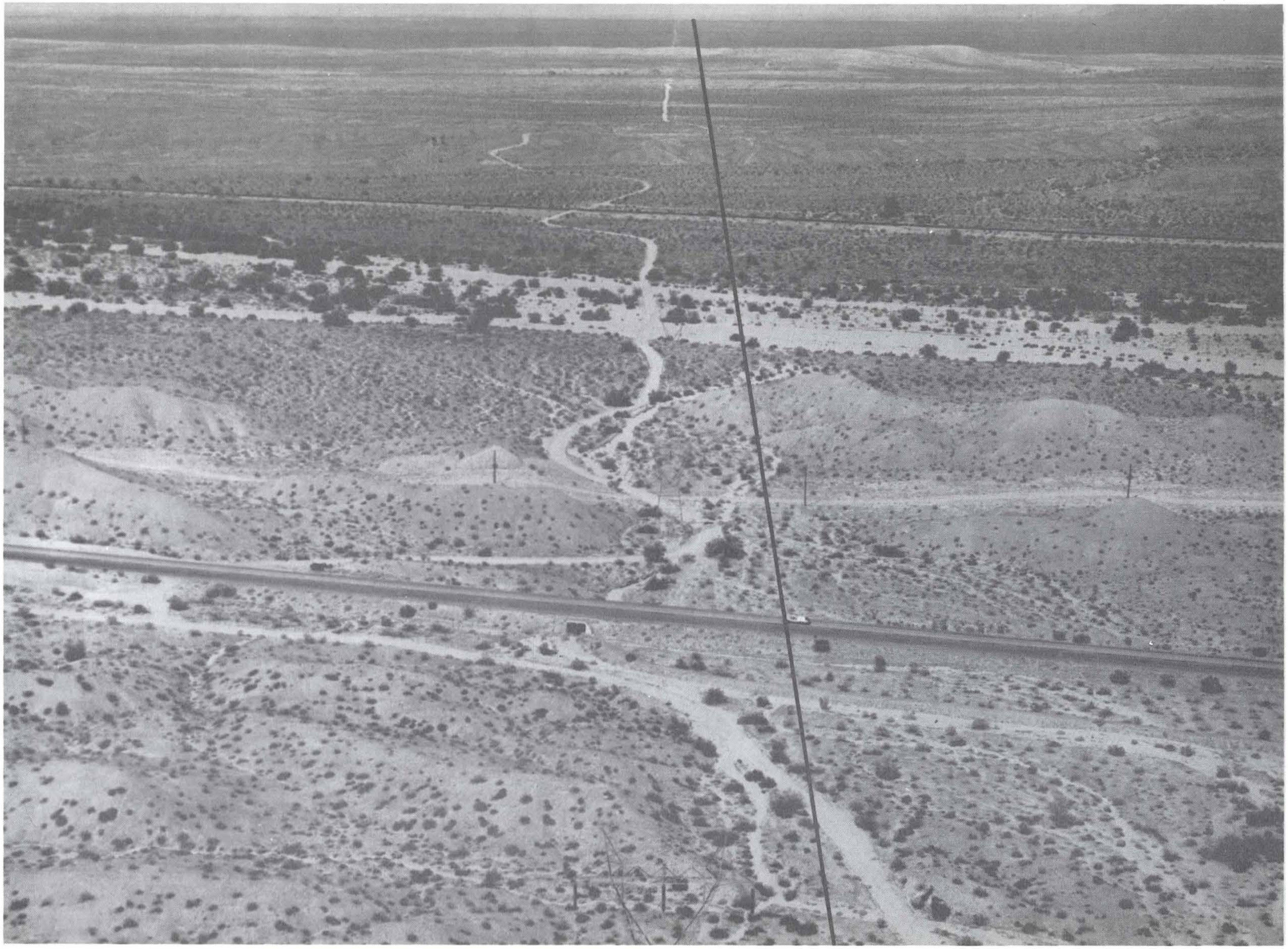


Figure 41
Sacramento Wash Area--View north showing U.S. Highway 66--Sacramento Wash, Santa Fe Railroad, and the transmission system alinement paralleling the Davis-Parker 230-kV No. 1 Line--The principal vegetation is creosote, ocotillo, paloverde with scattered cholla--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01201NA

Figure 42
Aurbey Hills Area--View south toward Parker Dam showing the south of the crossing of Arizona Highway 95 in a creosote-bursage community--The alinement parallels the existing Davis-Parker 230-kV line--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01222NA

Vegetation on the ridges of the Buckskin Mountains (Figure 23) consists primarily of scattered paloverde and ocotillo and creosote bush. Along the base of the range, ocotillo is abundant. In and near the washes are paloverde, ironwood, smoke tree, brittlebush, and bur-sage (Figure 43). Saguaro cacti begin to appear prior to reaching the sand dunes at the Cactus Plain.

The vegetation of the Cactus Plain (Figure 44) is denser than that of the Buckskin Mountains; however, as total ground cover, it is still comparatively sparse. It consists of large paloverde, ironwood, ocotillo, creosote bush, and saguaro, cholla, and hedgehog cacti. Scattered forbs and grasses are found during seasons of above-normal rainfall.

In Butler Valley and through the Harcuvar Mountains, the vegetation is principally a creosote bush community with scattered paloverde, bur-sage, and saguaro cacti. Figure 12 shows the vegetation in the area of the proposed Harcuvar Substation. In the Harcuvar Mountains, the numbers of saguaro cacti increase quite significantly with scattered ocotillo, grasses, and forbs.

On the floor of McMullen Valley, the principal vegetation is creosote bush with scattered paloverde trees, and annual grasses and forbs. Along the numerous washes galleta grass can be found. The alluvial fans of the edge of the valley are dominated by creosote bush/bur-sage, cholla, paloverde and ironwood trees.

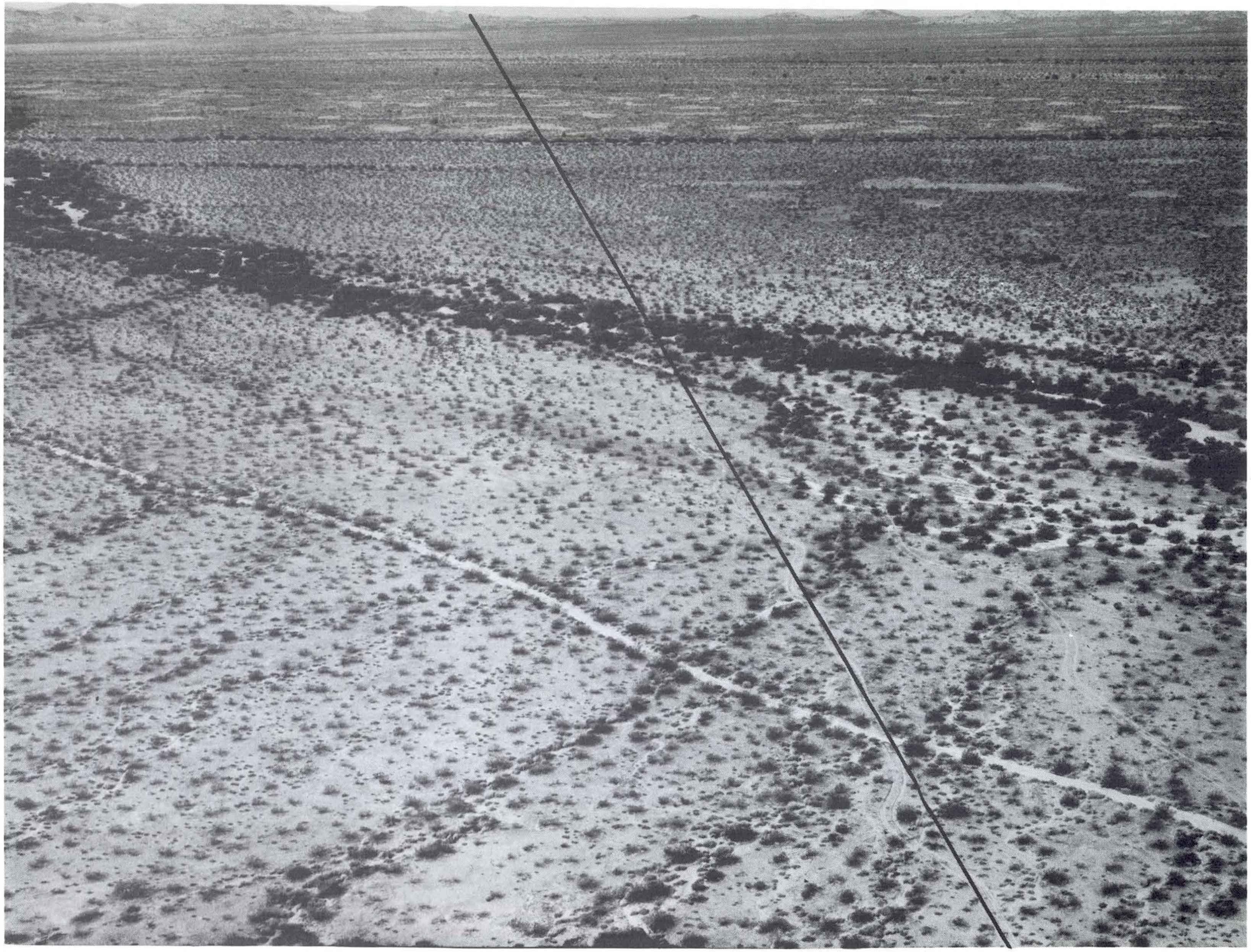


Figure 43
Cunningham Wash Area--View northwest showing the alinement through native desert--Desert reparian vegetation can be observed along the wash--Harcuvar-Bouse Hills 115-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01179NA

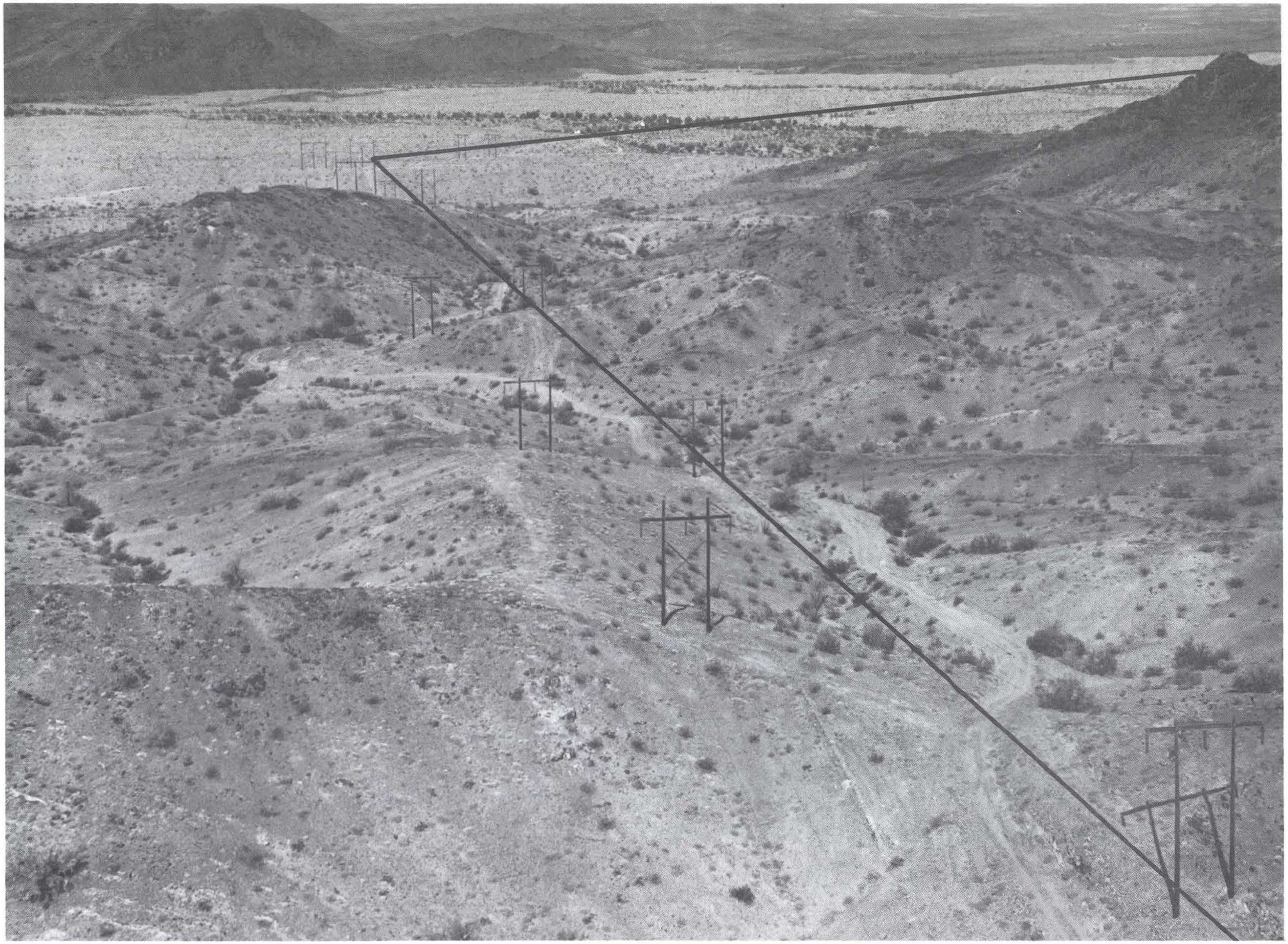


Figure 44
Cactus Plain--View west into Cactus Plain showing transmission system alinement replacing the Parker-Phoenix 161-kV No. 1 Line--This is an area of sparse vegetation principally creosotebush, paloverde, ironwood, ocotillo, saguaro, cholla, and hedgehogs--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01146NA

The vegetation of the area to the Hassayampa River near Aguila (Figure 45) is a sparse cover of creosote bush, scattered mesquite and paloverde trees, annual grasses, and forbs. On both sides of the Hassayampa River (Figure 46), cresote bush and saltbush are the dominant vegetation. In some areas, the vegetation can become quite dense.

The vegetation from the Hassayampa River to the southern end of the White Tank Mountains is principally cresote bush, scattered mesquite and paloverde trees, annual grasses, and forbs. Along the southern end of the White Tank Mountains on the alluvial fans, the vegetation is predominantly a creosote bush community with scattered ironwood and paloverde trees, cholla, annual grasses, and forbs. The transmission system then crosses an area of creosote bush/bur-sage, scattered ironwood and paloverde trees, cacti (including saguaro, cholla, and barrel), ocotillo, annual grasses, and forbs.

The last 2 miles are through highly developed irrigated agricultural lands. The principal crops grown in this area are cotton, sorghum, small grains, and alfalfa (Figure 13).

The 115-kV transmission line from Harcuvar Substation to the Bouse Hills Pumping Plant will pass through the Butler Valley vegetation community into the Bouse Hills.

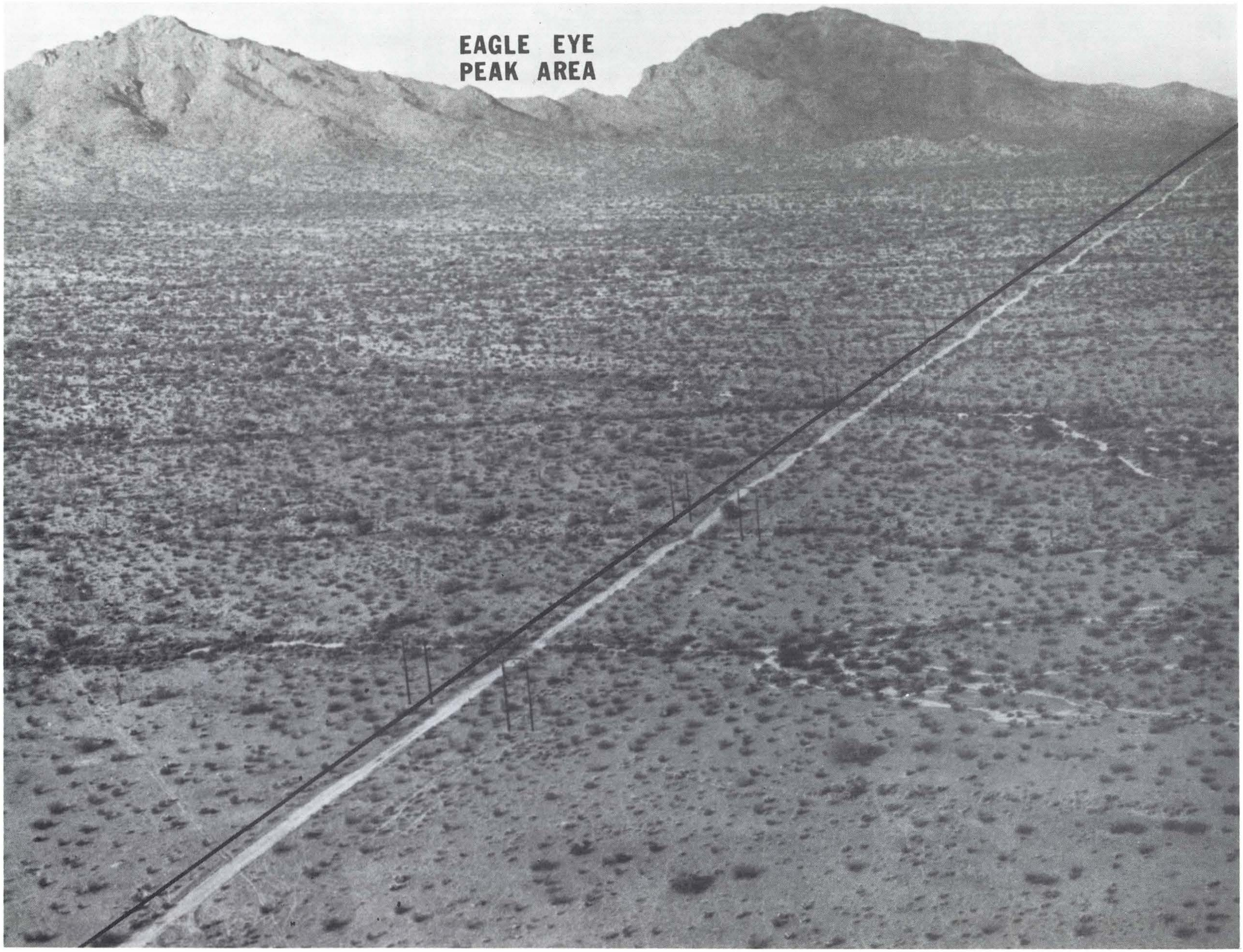


Figure 45
Eagle Eye Peak Area--View northeast showing transmission system alinement on the Parker-Phoenix 161-kV No. 1 Line--A vegetation community of creosote and bursage--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01128NA

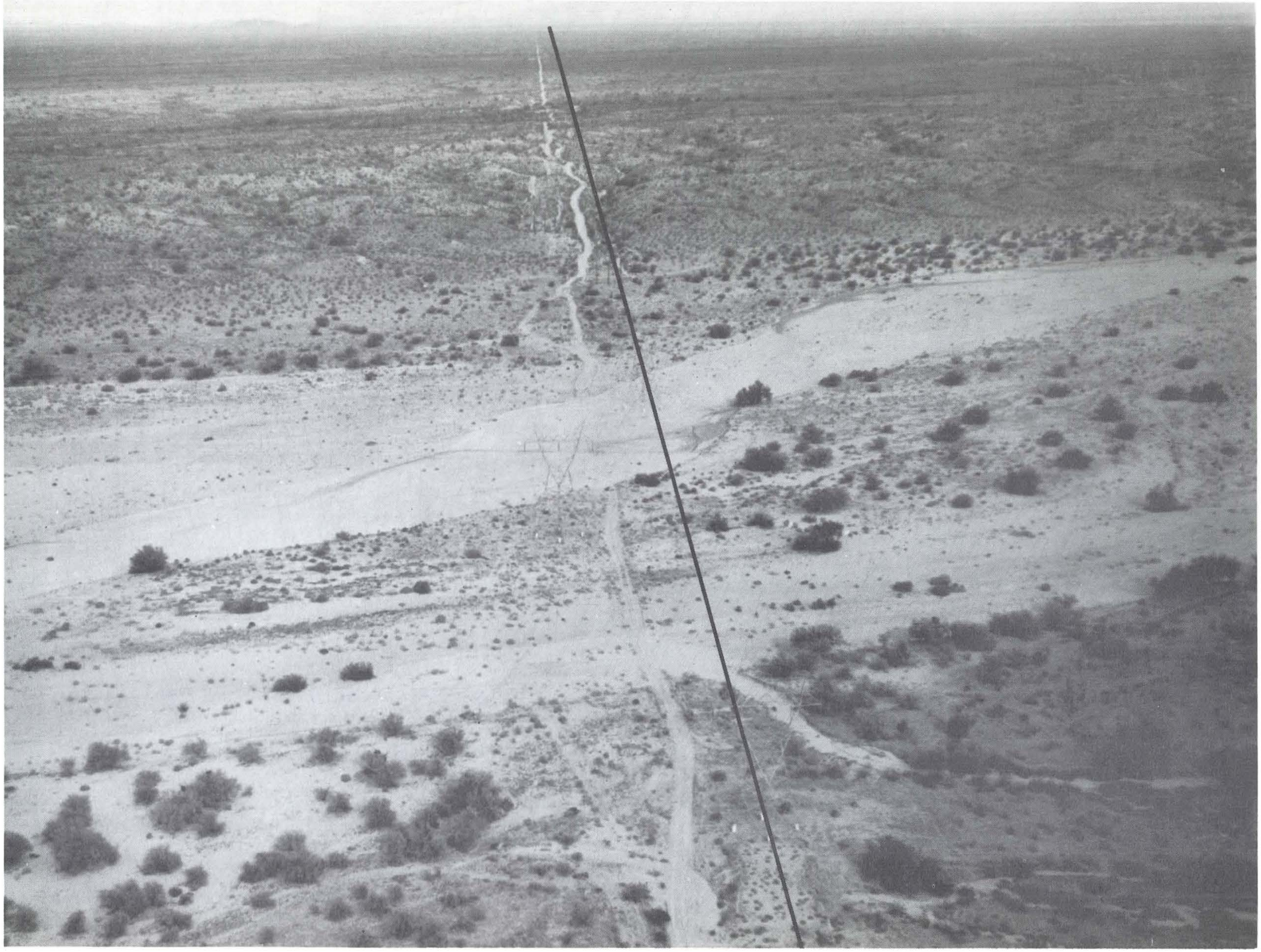


Figure 46
Hassayampa River--View southeast, showing transmission system crossing of Hassayampa River on the existing 161-kV Parker-Phoenix No. 1 Line--The vegetation in this area is creosotebush, paloverde and scattered bursage--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01123NA

At the Bouse Hills area (Figure 29), where the terrain is rugged, the vegetation changes from the paloverde community to predominantly cholla cactus.

The 115-kV line from the Harcuvar Substation to the Little Harquahala Mountains Pumping Plant will pass through the vegetal community of Butler Valley. In the Little Harquahala Mountains, the vegetation is a creosote bush/bur-sage community to paloverde community, interspersed with cholla and saguaro cacti (Figure 30). At the borrow pit used for construction of I-10 at the Salome Interchange, invading saltcedar supported by ponding of rainfall is becoming established.

The Hassayampa 115-kV line that will be routed near the Hassayampa River will be through an area dominated by creosote bush with scattered mesquite and paloverde trees, annual grasses, and forbs.

E. Wildlife [1-3, 56-74, 88, 95]

1. Invertebrates

The invertebrate fauna of the area consists of over 200 orders and thousands of species, most of which are unstudied. The most noticed invertebrates to be found there are various species of scorpions, spiders, earwigs, flies, bees, wasps, termites, ants, butterflies, moths, crickets, and beetles.

An example of the complexity and relative unknown nature of the area's invertebrate fauna is the spider (Order Araneida). Dr. Mont A. Cazier, Professor of Zoology at Arizona State University, indicates that there is no definitive work on the spiders of the area. He further points out that there are several hundred species belonging to about 42 families and over 100 genera in the central Arizona area.

Except for the Colorado River, aquatic invertebrates are essentially absent from the area because of the limited amount of permanent water. Some aquatic invertebrates do exist in catchments, stock tanks, and where temporary ponds are formed after a rain. Some of the more common aquatic invertebrates found in the area are: Mayflies, damselflies, caddiceflies, mosquitos, flatworms, snails, and fresh-water shrimps and clams.

2. Vertebrates

a. Fish [2]

Fish species are present in the Colorado River where the transmission line crosses near Davis and Parker Dams. The major game species include largemouth bass, bluegill, black crappie, channel catfish, striped bass, and rainbow trout. Because no impacts on fish in the Colorado River are foreseen as a result of this project, no listing of fish species is included in the appended material.

b. Amphibians and Reptiles [56]

There are 44 species of amphibians and reptiles in the area, of which 27 are common to very common. Table 1, Appendix C is a list of amphibians and reptiles that are found in the transmission system area. This table indicates the relative abundance of each species listed. The most noticeable types of amphibians and reptiles include toads, various lizards, and snakes. The spring and late fall are the best times to observe them. At other times of the year they go unnoticed since they seek protection from the heat or cold. The Gila monster, which was once abundant in Arizona, is sometimes taken as a pet and is often illegally bought and sold.

c. Birds [57-59, 143]

Table 2, Appendix C, lists the birds that are found in the area that the transmission system will traverse. The abundance of each species in relation to other similar species is indicated. There are about 50 species (two of which have been introduced) of desert residents which use the area for nesting and depend on the desert to provide food. These birds construct their homes in various ways, utilizing the available resources. For example, owls burrow in the ground and build their nests or use flicker scars in saguaro cactus. Doves use desert and wash trees for nests while quail are ground nesters and still others, such as cowbirds, parasitize other birds' nests. The nature of the bird fauna of the Mohave Desert differs from that of the Sonoran Desert. Many species of birds use the Colorado River as a migration flyway and other species use it as a permanent or winter home. The vegetation becomes progressively more dense and diverse in species from west to east in this life zone. The bird fauna changes and also becomes more dense to the east.

White-winged and mourning doves utilize desert and wash vegetation, especially mesquite, for food and nesting. Doves are indigenous throughout the area and are found in higher densities close to agricultural areas such as Centennial Wash where water and grain crops provide more food sources. Mourning doves throughout areas such as the Harquahala Plains and the Buckskin Mountains are relatively sparse when compared to agricultural areas with water and feed grains.

There are 17 species of hawks and hawk-like birds, and 7 species of owls that frequent the area. The most common of these are the Cooper's hawk, red-tailed hawk, common screech owl, and the great horned owl.

d. Mammals [58, 60-62, 64-69]

Table 3, Appendix C lists the names of native and introduced mammals found along the route of the transmission system and indicates the relative abundance of each species. Sixty-five species of mammals are found in the area, of which 38 are common to very common. The types of mammals found in a specific area are influenced by such factors as elevation, soils, vegetation, climate, and topography. Where the soil is fine sand and vegetation is sparse, kangaroo rats, and pocket mice are found. Cotton rats, pocket gophers, and javelina are found in grassy or riparian areas. As the desert type changes between Lake Havasu and Phoenix, the mammal fauna changes. Javelina is a Sonoran species and will be found only in the eastern portion of the route. Numbers of javelina found in this area are relatively low because the environment in the Sonoran Desert and in the Phoenix area is not as conducive to this species propagation due to such factors as less water and vegetal cover than there is further to the southeast. Bighorn sheep, canyon mice, and ground squirrels are historically found in rocky areas like the Buckskin Mountains; antelope ground squirrels, jackrabbits, deer mice, coyotes, ringtails, desert wood rats, badgers, mule deer, and others are found in open desert and mesquite bosque areas of the Harquahala Plains; and javelina, mule deer, rabbits, skunks, wood rats, raccoons, and others are characteristically found in riparian areas such as the Hassayampa River. Like the vegetation, the densities of mammal populations increase in these riparian areas where water is more plentiful. Water is the limiting factor in animal populations and vegetation density throughout the entire area traversed by the transmission system. It is also obvious that the larger species of mammals cannot be characterized and isolated to a specific type of habitat. Examples are the bighorn sheep and mule deer. Of these two species, the bighorn sheep is perhaps the more restricted, and mule deer the less restricted.

The desert mule deer which utilize the desert regions of the area are highly migratory. They respond to weather conditions, moving away from permanent water when rain and wetter conditions allow, but are bound to these permanent waters during dry weather. Lack of water during drought periods is the limiting factor and consequently mule deer populations over the large areas of the desert are quite sparse. Development of water catchments and other manmade watering places, some with a permanent supply, has had the effect of stabilizing and at times increasing a portion of the deer population.

Bighorn sheep populations are estimated by the extent of mountain habitat areas. The Arizona Game and Fish Department estimates the total population of bighorn sheep in the State as 3,000 animals. Only five mountain areas along the transmission system now support resident populations: the Buckskin, Harquahala, and Eagle Tail Mountain ranges in Arizona, and the Newberry and Eldorado Mountain ranges in Nevada. Other ranges historically had sheep but now support only transient individuals. This situation may also be applicable to the Harquahala Mountains.

Another large herbivorous mammal that occurs in portions of the alinement area is the feral burro. There has been much speculation as to the ecological implications of increasing burro populations, especially in relation to bighorn sheep. The burro is protected by Federal Law.

3. Threatened Species [72, 73]

The 1973 Endangered Species Act broadened the scope of the existing program and the responsibilities for participation by all

Federal agencies. The requirements of the Act are being closely followed in environmental studies and construction activities throughout the entire Central Arizona Project. However, there are no known endangered species that will be directly affected by the transmission system.

The line will cross the Colorado River at two points near Davis and Parker Dams. Two species of fish from the Colorado River listed in the Fish and Wildlife Service's (FWS) March 1973 edition of Threatened Wildlife of the United States are the Colorado squawfish (Endangered) and the humpback sucker (Status Undetermined). Both were once abundant in the lower Colorado Basin but are now apparently confined to the upper Colorado. The Arizona Game and Fish Department has plans to reintroduce the Colorado River squawfish into parts of the Colorado River where they are now endangered or extinct.

The Gila monster is listed as status undetermined in the 1973 edition of Threatened Wildlife of the United States.

Among the birds found along the transmission system five infrequently found species are listed as threatened (T) or endangered (E) or status undetermined (SU) by FWS. The peregrine falcon (E) and the prairie falcon (T) are seasonal, transient, or rare inhabitants of the project area. The southern bald eagle (E) and the osprey (SU) are migrant through the area. The Yuma clapper rail (E) breeds in the marshes along the Colorado River.

The spotted bat (T), whose range covers much of the Western United States where it is naturally rare, has been reported four times prior to 1967 in Yuma and Maricopa Counties, Arizona, and is included in the 1973 threatened wildlife list.

F. Air [31, 32, 134]

Air quality in terms of natural and manmade pollution is highly variable along the transmission system. The area in which the system will be located has experienced a progressively noticeable increase in air pollution in the past few years due to the rapidly increasing population of the entire Southwestern United States. In the desert areas west of the White Tank Mountains, the air is clear and generally free of significant levels of unnatural contaminants, though on occasion it is deteriorated by smoke, haze, and odor which drift in from the Phoenix metropolitan area or from the southern California metropolitan area. The air quality of the area is protected under the Clean Air Act (69 Stat. 322, July 14, 1955) as amended and supplemented.

Between the White Tank Mountains and Liberty Substation, the atmospheric quality varies from poor to good depending on daily and seasonal weather patterns. During December, January, February, and March, low inversion layers frequently trap pollutants in the lower atmosphere cutting visibility significantly. In summer, insufficient air movement periodically traps dust and smoke within the Salt River Valley reducing visibility in the Phoenix metropolitan area.

High winds, haboobs and duststorms, including numerous "dust devils" along the entire route of the transmission system, add naturally to deterioration of air quality and visibility. The present levels of ozone produced by the corona effects of the existing transmission lines are undetectable as described in Section III.C.2.b.

G. Water [42]

The portion of the Sonoran and Mohave Deserts in which the transmission system will be located has no perennial streams on the alinement except the Colorado River. Numerous ephemeral desert washes flow only after heavy rainstorms. These storms, with runoff usually lasting less than 1 day, produce flash flooding and erosion. The major drainages are normally dry for long periods. Because of infrequent flow and small quantities of runoff, stream gaging stations have not been installed generally, and hydrologic records are incomplete or nonexistent for attempting to quantify the runoff. The water quality of the rivers in the area is protected under the Act of June 30, 1948 (62 Stat. 1155) as amended and supplemented.

Ground water is available at varying depths, mostly in the range of 100 to 500 feet, in alluvial material along the transmission system. The shallowest depths to water are under and adjacent to major stream channels within the basins. High well yields are prevalent over much of the basin areas with low yields generally found on the margins of the basins. The search for ground water in Eldorado Valley has been unsuccessful.

H. Noise [41, 100, 101, 125]

In open desert areas, natural sound is generated by animals, wind, thunder, and rain. Presently, the most common noises resulting from man's activities in these areas are railroad traffic, the use of the existing highways, an occasional airplane, and off-road vehicles (such as jeeps or motorcycles). The Noise Control Act of 1972 (86 Stat. 1234, October 27, 1972) authorizes the establishment of noise standards for the nation.

Corona creates some slight sounds that are inherent with the overhead transmission of power at high voltage, and this is sometimes noticeable from the existing lines in the area. This sound level is affected by weather conditions due to the air density and is more noticeable during periods of high humidity.

I. Ecological Interrelationships

The transmission system will begin in the Mohave Desert in southern Nevada and end in the Sonoran Desert near Phoenix, Arizona, in the Basin and Range Province of the Southwestern United States. The Mohave Desert is a drier desert than the Sonoran Desert because of a relatively small amount of summer rain. The Sonoran Desert to the south and east is a hotter and more tropical desert that has both summer and winter rainy periods. Owing to the critical dry summer months, the vegetation of the Mohave Desert is predominantly small shrubs while that of the Sonoran Desert is characterized by a high percentage of trees such as paloverde, mesquite and ironwood. The lack of summer moisture is also evident in the more sparse wildlife population of the Mohave Desert.

As the amount of rainfall increases (particularly during the summer months), the vegetation and wildlife of the Sonoran Desert become more dense, and significantly so in or adjacent to washes. The area through which the transmission system will traverse is mostly remote and appears as a relatively natural desert except where livestock grazing reduces the annual forbs and grasses. The public use of this area for hunting, mining exploration, World War II military maneuvers, communication and energy transmission and transportation and general recreational exploring with off-road vehicles has left marks on the remote areas.

Pioneer wagon roads, off-road trails, and modern highways have altered the natural vegetation patterns. The vegetative alteration is characterized by an increase in riparian-type growth in the trail path of wheel ruts or on the upstream side of cross-drainage control structures for the current road system. Below these structures a reduced and confined drainage pattern is reflected in a drier and more sparsely vegetated desert plain. This change in vegetation has also had a marked effect on desert wildlife distribution. In some areas, the erosion control and borrow areas are producing weed seed that are providing more feed for doves and other birds.

Although the desert is a fragile environment, the biotic community has the ability to cope with severe temperature and drought conditions. Rainfall is sparse and unpredictable and the fauna and flora have adapted to long drought periods. Especially well adapted are plants such as the creosote bush which has small waxy leaves and the cactus family which is leafless or in some cases has very small leaves that eventually fall away from new-growing stems. Desert plants, such as mesquite, can adapt their root systems to function as deep watering phreatophytes or shallow-watering xerophytes. Saguaro and barrel cactus have a great capacity to store water permitting survival during droughts. Desert grasses and annuals produce a seed crop that can lie dormant for years or spring to life almost overnight after rains. This occurrence was particularly noticed during the spring of 1973 after the unusually wet winter. The desert grasses and annual forbs have winter and summer seasonal adaptations that require the proper climatic conditions.

Because of a hot, dry climate, many of the desert animals have a crepuscular-nocturnal way of life. These animals include owls and bats, rodents such as kangaroo rats and pocket mice, kit fox, skunk, badger, raccoon, ringtail, and most desert snakes. During the day, these animals are found under rocks, in rock crevices, under branches and logs, in trunks and stumps of trees and cacti, among clumps of desert undergrowth and litter, and in underground holes. Many animals come out of these protective environments only at night to search for food. Other animals, such as the antelope ground squirrel, come out of their holes during the light hours to quickly grab food and return. Most birds and lizards are only active during daylight hours. This day and night shift of desert animal life activity has increased the number of species of desert wildlife by making it possible for various species to exist together in an area without direct competition.

A significant factor in animal distribution and number of particular species is the occurrence of a water supply. In most of the desert area through which the transmission system will cross, the primary natural source of permanent stable water is found in a few adjacent natural tanks, depressions, seeps or springs in mountain areas, or in the Colorado River. Seasonal variations of water in individual tanks and depressions tend to disperse the concentration of wildlife in the vicinity and thus protect the desert from overutilization. In recent years, rainwater catchment and storage reservoirs, wells and windmills, earth tanks, and detention dams have been used. These watering points have encouraged animals to range further from their normal environments around natural water sources.

J. Landownership and Use

The desertland has undergone many changes as the result of man's use and misuse, and the evidence of these uses can be observed nearly everywhere. These land uses are the transmission systems and their maintenance roads, highways, agricultural and mining activities, off-road vehicle use, and urbanization which have permanently changed the desert landscape. These activities have increased the natural erosion processes due to the sparse vegetal cover and low precipitation in the area.

The most natural areas are those most isolated from the communities and include the Buckskin Mountains, Cactus Plain, and portions of the Ranegras Plain and Hassayampa Plain. The land close to the more urban areas has received the most use and misuse.

1. Landownership Status

The required right-of-way for the transmission system and appurtenant facilities falls within a variety of ownerships, including Federal, State and private lands, as shown on Table 5, and Figures 47, 48, 49, and 50.

About 264 miles of the total right-of-way length are parallel to existing transmission line rights-of-way. The Federal land is largely undeveloped and is leased for grazing purposes. Two miles west of Davis Dam the transmission line enters the southern part of the Lake Mead National Recreation Area which is under Reclamation withdrawal and administrated by the National Park Service. The transmission system will cross approximately 21 miles of land in Nevada reserved for the State of Nevada under P.L. 85-339. This land is administered by the Bureau of Land Management until transfer through purchase by the Division of Colorado River Resources, State of Nevada. Most of the privately owned land that will be acquired is in the vicinity of urban and agricultural developments. The major portion of this land is near the Colorado River or the Liberty Substation.

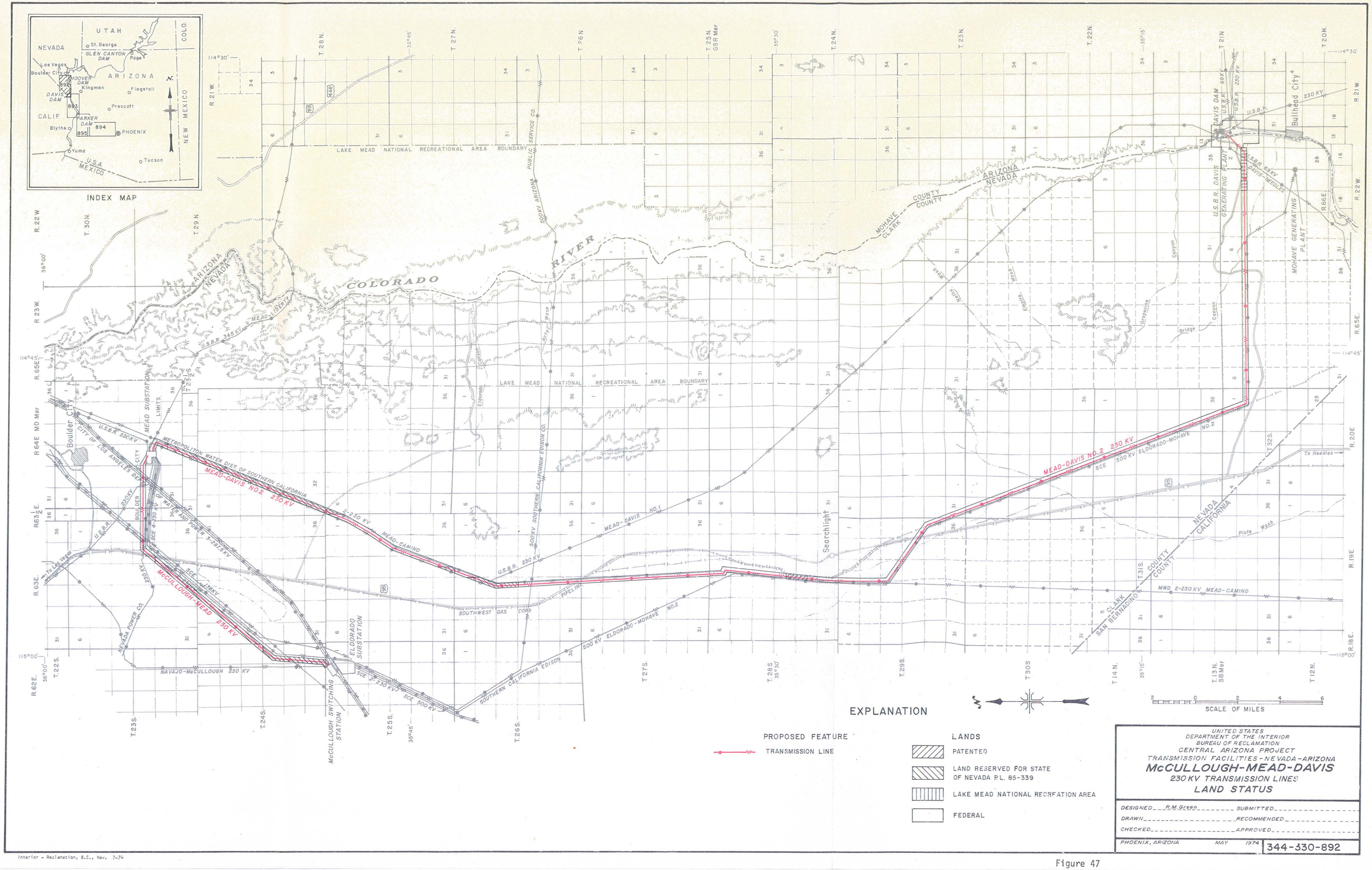
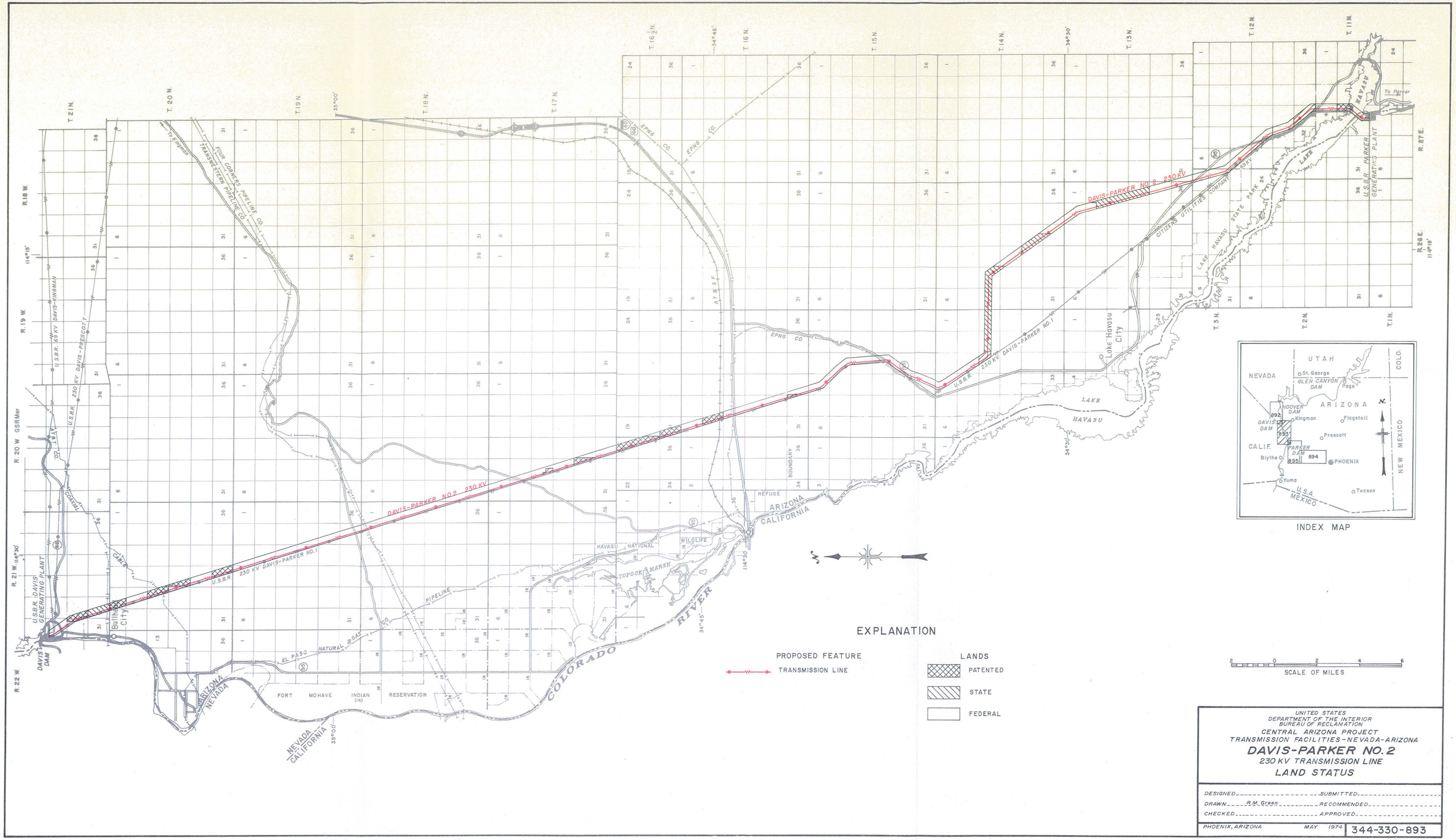

INDEX MAP
COLORADO
RIVER
LAKE MEAD NATIONAL RECREATIONAL AREA BOUNDARY
MEAD-DAVIS NO.2 230 KV
McCULLOUGH-MEAD 230 KV
MEAD SUBSTATION
ELDORADO SUBSTATION
McCULLOUGH SWITCHING STATION
Searchlight
Boulder City
Bullhead City
DAVIS DAM
MOHAVE GENERATING PLANT
EXPLANATION
PROPOSED FEATURE
TRANSMISSION LINE
LANDS
PATENTED
LAND RESERVED FOR STATE OF NEVADA P.L. 85-339
LAKE MEAD NATIONAL RECRFATION AREA
FEDERAL
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES - NEVADA - ARIZONA
McCULLOUGH-MEAD-DAVIS
230 KV TRANSMISSION LINES
LAND STATUS
DESIGNED R.M. Green
SUBMITTED
DRAWN
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA
MAY 1974
344-330-892
Interior - Reclamation, B.C., Nev. 7-74

Figure 47



Interior - Reclamation, B.C., Nev. 7-74

Figure 48

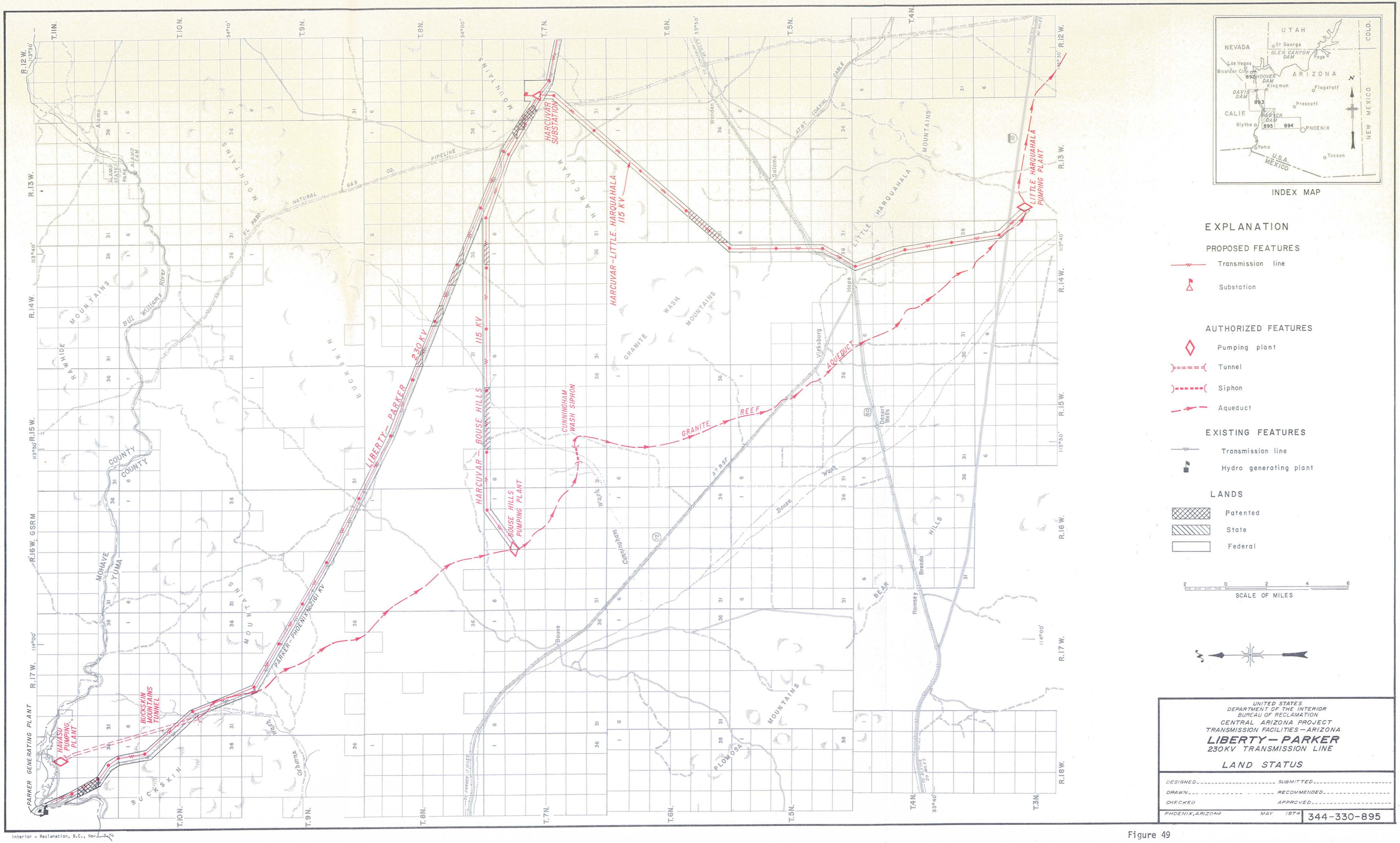

INDEX MAP
UTAH
NEVADA
ARIZONA
CALIF.
COLO.
NEW MEXICO
U.S.A.
MEXICO
EXPLANATION
PROPOSED FEATURES
Transmission line
Substation
AUTHORIZED FEATURES
Pumping plant
Tunnel
Siphon
Aqueduct
EXISTING FEATURES
Transmission line
Hydro generating plant
LANDS
Patented
State
Federal
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES—ARIZONA
LIBERTY—PARKER
230KV TRANSMISSION LINE
LAND STATUS
DESIGNED
SUBMITTED
DRAWN
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA
MAY 1974
344-330-895
LIBERTY—PARKER 230 KV
HARCUVAR—BOUSE HILLS 115 KV
HARCUVAR—LITTLE HARQUAHALA 115 KV
HARCUVAR SUBSTATION
BOUSE HILLS PUMPING PLANT
LITTLE HARQUAHALA PUMPING PLANT
HAVASU PUMPING PLANT
BUCKSKIN MOUNTAINS TUNNEL
CUNNINGHAM WASH SIPHON
GRANITE REEF AQUEDUCT
PARKER GENERATING PLANT
PARKER—PHOENIX 161 KV
EL PASO NATURAL GAS CO. PIPELINE
Interior – Reclamation, B.C., Nev. 7-74

Figure 49

Interior - Reclamation, B.C., Rev. 7-74

Figure 50

a. Range Fire Control

During most years, fire hazard in the area of the transmission system is low due to an insufficient density of dry vegetation to carry a fire.

The range fire control programs for land along the transmission system fall under several jurisdictions as described below:

BLM Land. - Fire control and suppression are generally accomplished by personnel of the Bureau of Land Management aided by the Forest Service or Bureau of Indian Affairs under cooperative agreements. The Bureau of Land Management in Arizona has working agreements with the counties and the Arizona National Guard when additional assistance is necessary to combat a larger fire.

State Land. - Fire suppression on Arizona State land at the present time is being accomplished under a cooperative agreement with the Forest Service under the Clarke-McNary Act (1929), section 2. Many of the fires are controlled by community fire departments although there are no agreements between them and the State. The land reserved for the State of Nevada is administered by the Bureau of Land Management.

2. Land Use Pattern

The pattern of development and land use varies widely from place to place, depending on topography, water supply, mineral areas, and transportation routes.

The main categories of land use in the area through which the transmission system traverses are undeveloped, agricultural and urban areas.

a. Undeveloped Areas

The undeveloped land along the right-of-way is open desert range. The primary economic use of the land is for grazing cattle. The carrying capacity of the desert range increases during wet spring months, but normally averages one cow or less per 400 acres annually.

The principal mineral interests are copper, manganese, gold, silver, lead, titanium, tungsten, pumice, and scoria. Although sand and gravel are available on the transmission line right-of-way, most deposits are small and of low quality, and are remotely located.

b. Urban Areas

The transmission system will pass through the developed urbanized areas with no disturbance to private dwellings. These areas include the Lake Havasu Travel Trailer Village about 4 miles north of Parker Dam and a small residential area of mobile homes south of Parker Dam. The alinement will be routed around Lake Havasu City in an area of low hills to reduce the visual impact on the city.

c. Irrigated Areas

Two miles of the transmission line length are through irrigated land west of the Liberty Substation (Figure 13). This land is intensively farmed in the typical crops of the area.

d. Industrial

Other than mineral claims mentioned earlier in this section, no industrial complex exists within the transmission system right-of-way.

e. Recreational [102, 104-107, 133, 135, 136]

Recreational use of the desert and urban-desert areas through which the transmission system will cross is very light except for the area where the lines approach Davis and Parker Dams and is largely limited to horseback riding, motorcycling, dune buggying, and limited hunting for desert mule deer, varmints, small game and birds.

The Bureau of Land Management has reported an increase in recreational activities on desertland in the Ranegras and Hassayampa

Plains mainly as a result of new BLM roads and the construction of I-10 through the area.

The transmission system will pass through 2 miles of the Lake Mead National Recreation Area in Sections 10 and 11, T. 32 S., R. 66 E., MDM, in Nevada. The legislation establishing the Area provides for a right-of-way for the construction of this transmission system. The route that will be along the remote southern boundary of the recreation area will not disturb the present recreational activities of hiking and motorcycling. The National Park Service has proposed to change the status of this area to a wilderness area designation as described in the draft environmental statement DES 74-3. The change will have no effect on the transmission system under the provisions of the proposal.

The transmission system will also cross the Lake Havasu State Park north of Parker Dam. The crossing in the desert will be in a remote area of no organized recreational activity.

f. Military

During World War II, the United States Army established a desert training area in southeastern California and most of Yuma County in southwestern Arizona. This area was used by foot troops, motorized and mechanized armored vehicles, and air and artillery units. In addition to maneuver use and cross-country traffic, artillery impact areas for live-round artillery practice were established. National Guard maneuvers and training have occasionally used portions of the area along and adjacent to the Colorado River near Parker Dam.

g. Transportation Rights-of-Way

Along the transmission system there are, in addition to the highway and road system rights-of-way that are crossed, transportation rights-of-way for various entities, that include railroads, gaslines, telephone, coal slurry and other electric transmission and distribution lines.

3. Land Use Planning [47, 102, 103, 132, 133, 137]

The proposed transmission line, although primarily located in Arizona, will cross a variety of landownerships and planning jurisdictions in three states. Federal, State and local agencies with planning jurisdiction over portions of the right-of-way have been notified of the proposal pursuant to Office of Management and Budget Circular A-95 and have been sent copies of this statement for review and comment. The following is a breakdown of the jurisdictions involved.

a. Bureau of Land Management [102, 103, 119, 132, 137]

(1) Arizona - The Parker-Liberty segment will cross four BLM planning units: Havasu, Harcuvar, Black Mountains and Vulture.

Liaison is being effected with BLM's Phoenix and Yuma District offices and the Havasu City Planning Office concerning transmission corridors in planning for these units. The Vulture Unit is currently the subject of a BLM planning study, which includes transmission corridors, and Reclamation is coordinating with BLM in this proposal. The existing Mead-Liberty 345-kV line and the Parker-Phoenix 161-kV line cross the Vulture Unit, as will the Granite Reef Aqueduct. In addition, some land in the Vulture Unit is the subject of proposals for various types of development.

The Davis-Parker segment will cross the Havasu and Black Mountains Planning Units. The proposed line will parallel the existing Davis-Parker 230-kV No. 1 line except in the vicinity of Lake Havasu City, where it will detour away from the City to avoid the developing area in and around the existing urban area. A cooperative Federal-State study has identified potential new urban areas along or near the Colorado River. Feasibility for development of such areas over the next 50 years is still under consideration and certain factors, including water supply and wildlife management, are yet to be assessed in this regard. Reclamation is coordinating with Federal, State, and local agencies, since some of these areas under study are crossed or influenced by the existing Parker-Davis No. 1 and/or the proposed line where it detours around Lake Havasu City.

(2) California - Approximately 1.2 miles of transmission line will traverse land in California. This occurs when the Davis-Parker

segment crosses Lake Havasu above Parker Dam enroute to the Parker Switchyard and on the Parker-Liberty segment as the line exits from the Parker Switchyard and crosses the Colorado River below Parker Dam.

This land is presently under the jurisdiction of the Bureau of Land Management but has been permanently withdrawn for Reclamation purposes as part of the security area for Parker Dam. Reclamation is currently making a filing under the provisions of Section 4, Subsection P, of the Act of December 5, 1924 with the Bureau of Land Management to reflect the intention of constructing a transmission line.

(3) Nevada - The McCullough-Mead-Davis segment of the transmission line will cross BLM's Stateline Planning Unit in southern Nevada. Coordination is being maintained with BLM's Las Vegas District Office with respect to alinement of the line. Planning within this unit has reached a point whereby individual resource objectives have been identified in the preparation of a management framework plan. BLM has indicated these individual objectives will now be combined into a draft of an overall management plan which will be available for public review.

b. National Park Service [133]

Approximately 2.0 miles of the McCullough-Mead-Davis line will cross through the Lake Mead National Recreation Area which is administered by the National Park Service. Portions of the recreation area have been proposed by NPS to be declared wilderness areas as described in the draft environmental statement INT DES 74-3.

c. Bureau of Reclamation

The proposed transmission line will traverse Federal land presently withdrawn for Reclamation purposes in the vicinity of Mead Substation, Davis Dam, Parker Dam and Liberty Substation.

d. Arizona [47, 102, 132, 135, 136]

The State Land Department has been studying potential land uses along the Colorado River in cooperation with Federal, local, and other State agencies and has participated in the recent study of potential urban areas in the vicinity of the river. A small amount of State land will be required for the right-of-way and the line will pass near other State holdings. The primary effects on State planning of this acquisition and construction of the line will be felt in the BLM Vulture and Havasu Planning Unit areas. Besides the potential urban development in the Havasu Unit, land in the Vulture Unit area has been the subject of a number of proposals by private groups, educational institutions and the like. The largest area covered by a development proposal is the U.S. Steel proposal for a new town west of the White Tank Mountains in Maricopa County. The proposed transmission line, as well as existing lines, crosses the southern end of the area as covered in the proposal. However, this proposal and other planning suggestions are in preliminary planning stages or are undergoing feasibility analysis, and no definite plans have been developed. Reclamation is continuing to coordinate with the State Land Department in order to minimize transmission line impacts on State planning. In that light, such coordination is also being undertaken with the Game and Fish Department, State Parks Board and State Highway Department so that wildlife areas, State parks, and highway planning will continue to be considered in finalization of the transmission line planning.

The planning and zoning commissions of Maricopa, Mohave and Yuma Counties have been contacted. County land use plans are being developed and will take existing and future transmission and transportation corridors into account in such planning. The Parker-Liberty segment of the proposed line does not appear to affect the planning described in the Maricopa County Planning and Zoning Commission Report on West Central Maricopa County. Reclamation will continue to work with the counties in the development of coordinated land uses.

The Environmental Planning Commission was established by the Arizona Legislature in 1973. The Commission consists of 15 members, 9 appointed by the Governor and 6 legislators selected by the Speaker of the House and the President of the Senate. The legislature also established the Office of Environmental Planning to work with the Commission in developing a State land use plan. The law (A.R.S. §§ 37-161 to 37-163) requires two reports to the Governor, the first of which was submitted in January 1974. The second report is due in January 1975, and the provisions of the law expire by its own terms on June 30, 1975. The Commission has held hearings throughout the State and heard presentations from numerous Federal and State agencies, including Reclamation. A second round of hearings on a regional basis is scheduled for the fall of 1974, focusing on proposals for inclusion in a State land use plan. Reclamation will continue to coordinate with the commission, provide information to it as requested, and comment on proposals developed when asked to do so.

e. California

The transmission line will cross land in California in the vicinity of the Parker Switchyard. As this land is already withdrawn for Reclamation purposes and is part of the safety and security area for Parker Dam, the construction of the proposed transmission line will not have an adverse effect on California land use planning.

f. Nevada

Approximately 21.8 miles of the McCullough-Mead-Davis Line will cross land in Eldorado Valley in southern Nevada that has been reserved for purchase by the State of Nevada.

The State, acting through the Division of Colorado River Resources (formerly Colorado River Commission), has an option to purchase this land pursuant to Public Law 85-339, as amended. The purchase is predicated on the Division developing an acceptable plan for use of the land. As of June 1974, the Division had not exercised its option to purchase this land.

Reclamation has made initial contacts with the Division of Colorado River Resources and will continue to work with that entity to insure that the final location of the proposed transmission line will be compatible with any proposed development plans.

K. Sociological 47-50, 82, 86, 98, 108, 139, 140, 142

The transmission system will be routed through an area very remote from human occupancy except in the area of the Colorado River. The amenities provided by the Colorado River and its lakes provides the impetus necessary for a rapidly expanding urban population. This is especially true in the Lake Havasu City, Arizona area, where in 1963 the McCulloch Corporation established a planned community. This community has gained international recognition as a result of the relocation there of London Bridge.

The area between Parker Dam and Parker, Arizona, is another area of rapidly expanding urbanization due to the recreational activities provided by the river. The town of Parker, Arizona, in Yuma County, was established at its present location in 1905 near a railroad crossing of the Colorado River. The community is presently an agricultural and recreational center located within the Colorado River Indian Reservation which limits the growth capabilities due to a fixed land resource base.

Boulder City, Nevada, was established in 1931 for the construction of Hoover Dam, and much of the present population is related to the activities of the dam or Lake Mead. It contains the offices of the City of Los Angeles Department of Water and Power (the major operating agency for the non-Federal production facilities of the Hoover Powerplant), National Park Service (Lake Mead National Recreation Area), Metropolitan Water District of Southern California, Southern California Edison Company, Bureau of Mines, the Lower Colorado Regional Office of the Bureau of Reclamation, and operating offices of Reclamation for Hoover Dam and the Lower Colorado River.

Searchlight, Nevada, is a historic mining community. Mining activities are continuing at the present time in the Eldorado and Newberry Mountains to the east.

Salome and Wenden, Arizona, are small agricultural communities which have experienced a decline in business activities due to the construction of I-10 which bypasses these communities. Formerly their location on the main Phoenix to Blythe, California, highway brought considerable tourist traffic through the area.

Buckeye in Maricopa County, Arizona, was founded in 1889 as a farm trading center and is presently the agricultural center of the western part of the county.

The 1970 census reports the population for the following incorporated areas and unincorporated areas as:

Community	Population
Buckeye, Ariz.	2,599
Bullhead City, Ariz.	3,200
Lake Havasu City, Ariz.	5,300
Parker, Ariz.	1,948
Boulder City, Nev.	6,066
Searchlight, Nev.	422

L. Historical and Archeological Factors [3, 75-80, 108, 115, 131, 138, 141]

The Bureau of Reclamation programed and obtained an archeological inventory of the transmission system route location in cooperation with the National Park Service (Arizona Archeological Center in Tucson). The survey in July 1973 of the Mead-Davis-Parker portion of the transmission system was contracted to the Southern Branch, Nevada Archeological Survey, University of Nevada, Las Vegas, under the supervision of George A. Bondley, staff member. The survey in February and March 1973 of the Liberty-Parker, Harcuvar-Little Harquahala and Harcuvar-Bouse Hills transmission lines was contracted to the Department of Anthropology, Arizona State University, Tempe, Arizona, with Alfred E. Dittert, Principal Investigator.

The surveys were 200 to 250 feet in width to insure that sufficient area was inspected. The inventory surveys located a total of 6 historic sites and 27 prehistoric sites. None of these sites located is of the quality for placement on the National Register of Historic Places. The researchers believe these sites will add little or no new information to the study of the archeology of the area. Appendix C, Table 7, is a listing of the archeological sites found along the alinement. The State Historic Preservation Officers for Nevada, Arizona and California will comment on the sites located on the alinement. The Granite Reef Aqueduct Final Environmental Statement (FES 72-5) includes the archeological survey information for the areas of the underground power transmission line for operation of the check structures.

CHAPTER III

IMPACTS OF PROPOSED ACTION

III. IMPACTS OF THE PROPOSED ACTION

A. Introduction

To deliver power to the pumps of the Granite Reef Aqueduct, a 333.6-mile transmission line system will be constructed between the McCullough Switching Station in southern Nevada and the Liberty Substation near Phoenix, Arizona. Approximately 84 miles of this line will be within Clark County, Nevada; 249 miles in Mohave, Yuma and Maricopa Counties, Arizona; and 1 mile in San Bernardino County, California. Of the total length, 264.3 miles will be adjacent and parallel to or will replace existing lines and will have a different effect or impact on the environment than the 69.3 miles of new alinement that will be required.

1. Definitions for Impact Evaluation [1-3]

The evaluation of environmental impacts is dependent on definitions, criteria or standards, and an adequate and comprehensive knowledge of the subject. Impacts may be beneficial, adverse, or unquantified. Definitions outlined in the overall CAP statement and also used in this statement to maintain continuity are:

Beneficial environmental impacts are those that directly or indirectly improve the environment.

Adverse environmental impacts are those that directly or indirectly degrade the environment.

Unquantified environmental impacts are those whose effects are unknown, have not been tested, or may be the result of some other action but attributed to this action.

The environment includes the interaction of climate, soil, and biotic factors that act upon any living organism. Environment also includes the aggregate of social and cultural conditions that influence the life of an individual or community.

2. General Statement of Impact [1, 119]

The proposed transmission system will have varied impacts upon a number of different aspects of the environment. For purposes of this section on the overview of feature impacts and as stated in the overall environmental statement on the CAP, the impacts have been divided into two categories: (1) impacts on natural resources; and (2) impacts on people. The impacts on natural resources will have secondary impacts on the human environment as well. Impacts more directly affecting people will in most instances indirectly affect the natural resources in the project area.

This chapter discusses or quantifies the impacts that the construction and operation of the transmission system will have on man and his surroundings.

B. Direct Impacts Related to Construction

1. Impacts on Man [1-3, 47-49, 100, 114, 119]

Powerline and substation erection is considered a specialized activity requiring trained workmen. It is unlikely the local labor force has the skilled manpower to support such an activity, and in all probability most of the workers will be from outside the area.

A typical segment of the transmission line will be scheduled for a construction period of 2 years and will provide employment ranging from about 10 persons in the first 6 months to 70 during the final year. A typical work schedule could be as follows:

a. Six months - tower siting crew

b. Six months - footing construction

c. One year - tower erecting and conductor stringing

A schedule of the nature indicated above would be able to complete approximately 60 miles of line in the 2-year period. Staging is generally on a 15- to 16-mile length basis. Storage, assembly and parking locations are then moved to facilitate the construction program.

During construction of the transmission facilities, minor service interruption may be experienced by power customers of the communities along the route. These outages are scheduled during offpeak hours and should be less than 6 hours in duration.

In locations where the States of Arizona and Nevada, the Bureau of Land Management, and the National Park Service regulations permit use of the desert for recreational purposes, such as driving of off-road vehicles and hiking or hunting, such use will be temporarily restricted for site safety only in the immediate area of the construction.

The Lake Havasu Travel Trailer Village on the Arizona shore of Lake Havasu will have the right-of-way width restricted from building site use. No additional right-of-way will be required in the Parker Dam residential area where the existing line will be replaced. No mines are being worked on the right-of-way. Existing mining claims must be adjudicated and valid claims purchased.

The alinement for the transmission line crosses the right-of-way used for power distribution, communication cables, pipelines and railroads. Above-ground users include Citizens Utilities Company, Southern California Edison Company, Metropolitan Water District of Southern California, Arizona Public Service Company, Nevada Power Company, City of Los Angeles Department of Water and Power and the Santa Fe Railroad. Underground are cables owned by AT&T as well as pipelines operated by Black Mesa Pipeline, Inc., Four Corners Pipeline Company, Transwestern Pipeline Company and El Paso Natural Gas Company. Permission and crossing agreements from present users preclude structure site locations close to crossings.

a. Davis to Parker 230-kV Segment

The initial phase of construction of the transmission system will be for the segment of the system generally east of the Colorado River between Davis and Parker Dams. Seventy miles of the line will be in Arizona and approximately 1 mile in California. Construction activity will temporarily affect the area for a period of approximately 2 years. The influx of construction personnel may have some effect on the communities along the Colorado River since these recreation-oriented communities are geared to seasonal fluctuations in population. Year-round construction personnel coupled with the seasonal tourism may lead to sporadic overcrowding of the existing facilities.

Interference with the normal flow of street and highway travel will be noticeable at shipping points and at transmission line highway crossings. Parker, Arizona, and Needles, California, will be railroad receiving points for much of the equipment associated with the construction with a resultant increase in heavy truck traffic on State Highway 95 between Parker or Needles and the construction areas. No highway travel disruption is foreseen as road guard structures are erected as the line is constructed across the roads. Between Davis Dam and Parker Dam, there will be six highway crossings: at the intersection of State Highways 95 and 68 just south of Davis Dam; a crossing of Interstate 40 about 6 miles east of Topock; State Highway 95, 10 miles north of Lake Havasu City, and 10 miles south of Lake Havasu City; and two more crossings of State Highway 95, one 14 miles and one 16 miles south of Lake Havasu City. The line will also parallel the highway for about 2 miles at a location about 15 miles south of Lake Havasu City and construction work will be visible to the highway traveler. Where the line crosses Lake Havasu near Parker Dam, there should be only limited disruption of boating and other recreational activities during construction.

Temporary visual impacts associated with the construction will result from the movement of machinery and equipment on the access roads. Increases in airborne particulate matter associated with the activity will be visible particularly from highway crossings and where the line parallels highways. Normal Reclamation construction procedures as discussed in Chapter IV will minimize this impact.

The interval of construction activity will range from 1 day to 2 weeks on a nonuniformally scheduled basis. The increase in the noise level from construction activity will have different effects on those individuals residing in the Lake Havasu Travel Trailer Village, based upon their individual tolerences to noise. This development is being constructed adjacent to the transmission line right-of-way, as shown on Figure 21.

b. Parker Dam Switchyard to Havasu Pumping Plant - 230-kV Line

Along the south shore of the Bill Williams arm of Lake Havasu, construction work will be visible to the traveler driving west toward

Parker on State Highway 95, as well as those boating in the vicinity. At this location near the Havasu Pumping Plant, for a distance of approximately 1/2 mile, the line will be an underground cable. This type installation will require a trench and a leveled clearing to accommodate the equipment necessary for the transition from the overhead to underground conductor.

c. Parker Dam Switchyard to Liberty Substation via Harcuvar Substation - 230-kV Line [3]

Subsequent construction phases of the transmission line construction scheduled will be influenced in time by national program commitments. The contemplated second phase will include the link between Parker Dam on the Colorado River and the Liberty Substation near Phoenix, Arizona. Through this area a total of approximately 119 miles of 230-kV transmission line will be constructed that will replace an existing transmission line and be adjacent to another existing line. About 75 miles of 115-kV radial feeder lines will be constructed, 19 miles of which will be suspended on towers of the 230-kV line.

The direct impacts from construction of the Liberty-Parker line will be similar to those described for the Davis-Parker area, but of a different intensity. Although this segment of the transmission system involves the greatest amount of construction activity, its topographic location and remoteness from travel routes will allow very little of the construction work to be evident to the public.

The Liberty-Parker line will cross State Highway 95 adjacent to Parker Dam and U.S. Highway 60 between Gladden and Aguila. The Harcuvar Substation to Little Harquahala feeder line will cross U.S. Highway 60 near Harcuvar between Hope and Salome, and Interstate 10, west of the Little Harquahala Mountains and east of the Vicksburg access road. A motorist traveling on I-10 (see Figure 31) will be able to observe construction activity along the west slope of the Harquahala Mountains. None of the other major highway crossings will provide a view of the construction except for the actual crossing activity and tower erection closest to the highway. Major highways will be used for transporting equipment and machinery. The impact of additional trucks to these highways will be negligible inasmuch as the roadways are in constant use as east-west links between Phoenix and the major cities of California.

Unlike the communities along the Colorado River where population fluctuation is a way of life, the communities along the Liberty-Parker line will experience an impact from the influx of construction personnel for the transmission facilities as well as the Granite Reef Aqueduct.

Construction of the Parker to Liberty section of the system will take about 4 years, and the communities of Parker, Hope, Bouse, Vicksburg, Buckeye, Wenden, Aguila, and Salome may experience a need for increased services. Recreational and educational facilities providing for housing, utility service of water, power, telephone, sanitation, and waste disposal, as well as food and clothing suppliers and auto service stations will receive the greatest impact from the temporary population increase. Mobile home parks will be a likely choice for living quarters. The reduction in economic activity subsequent to construction will influence these communities but, because the Granite Reef Aqueduct construction will span approximately 10 years, the appearance and disappearance of transmission line construction crews will, overall, have little effect (refer to Final Environmental Statement, Granite Reef Aqueduct, FES 74-5).

The 230-kV line will replace the existing Parker-Phoenix No. 1 161-kV line that passes through a mobile home residential area in Arizona just below Parker Dam on the Colorado River. At the present time these residences are the only ones adjacent to the right-of-way along the Liberty-Parker line. Wood poles that now carry the existing line will be replaced with fewer structures of steel. Approximately 400 less structures will be required.

For a distance of 2 miles from the south side of the Roosevelt Irrigation Canal northeast of Buckeye, Arizona, to the Liberty Substation, construction at each tower site will result in a minimal interference of normal farming practices. Although construction work will be contained within right-of-way limits, it will have a permanent impact on approximately a total of 1/4 acre of farmland at the structure sites. Acreage within the right-of-way will continue to be used for farming subsequent to construction.

d. McCullough-Mead-Davis 230-kV Transmission Line

The McCullough-Mead-Davis Dam segment of the transmission line system will take about 2 years to construct and will probably be the last section of the system to be constructed.

The new line will cross U.S. Highway 95 south of the intersection of U.S. Highway 93 and will be parallel to existing transmission lines. Adjacent to other lines, crossings will also be made over State Highway 60 near Nelson; State Highway 68 east of Searchlight; and parallel to and across State Highway 77 west of Bullhead City, Arizona. The impacts of visual esthetics and noise will be slight at highway crossings because of the short duration of activity at each of the locations.

Although the last portion of the Mead-Davis No. 2 line is routed through the southern tip of the Lake Mead National Recreation Area for about 2 miles, little or no impact will be felt by those engaged in recreational activity in the area. The closest patrolled and recognized camping area is 1/2 mile north of the Colorado River crossing of the line to Davis Dam. The temporary safety and restrictive measures for the protection of the public during the construction period may inconvenience some who are accustomed to the complete freedom of use of the access roads to these recreational areas.

e. Summary [1-3, 47-50, 124, 125]

Generally, the construction of the transmission line system for the Granite Reef Aqueduct may create local esthetic impact, and

Regional and local economic impacts. Impacts which may be considered adverse by some may be considered problematical or beneficial by others. Safety of the public is always a consideration when construction involving men and equipment is conducted in populated areas. Residents of the Lake Havasu Travel Trailer Village and the mobile homes at Parker Dam will be most affected by this influence. The occasional use of explosives in excavation will result in inconveniences to nearby residents and delays to the highway user. The contractor will be required to provide adequate protection to persons and property.

Some interruption of recreation will exist for short time periods. Increased employment and economic activity will be more apparent along the Colorado River and in the Salome area. Nearly 2,000,000 man-hours of direct employment will be required for the construction of the transmission line system for the Granite Reef Aqueduct. Secondary employment impacts will involve those associated with the manufacture and construction of the equipment and machinery to be installed, and other employment associated with service industries for the construction force.

2. Impacts on the Environment

The influence of the construction of the transmission system has been previously discussed as it relates directly to man. The natural environment will also be affected by the construction. This part of the environment includes vegetation and wildlife as well as land, air and water.

a. As it Relates to Land, Air and Water

(1) Land - The construction of a transmission line produces a thin linear structural impact. The effect produced by construction upon the immediate area of activity is discussed below. Construction will generally be contained within an approximate 75 to 150-foot right-of-way width for 333.6 miles. Nineteen miles of the 333.6-mile right-of-way length will be occupied by the east end of the 230-kV Parker to Liberty line as well as the 115-kV distribution line to the Hassayampa Pumping Plant for a total of 352.6 circuit-miles of overall system length. Ownership of this right-of-way is as follows:

Federal land	233.6 miles
National recreation area	2.0 miles
State-owned land	60.9 miles 1/
Privately owned land	33.1 miles
Federal owned/State administered	4.0 miles
Total	333.6 miles

The construction of access roads generally has a greater impact than the construction of the transmission line system. Approximately 70 miles of new access roads will be required with the use of approximately 265 miles of existing roads. Figure 40 shows an existing

1/ Approximately 21.8 miles of this land is owned by the U.S. Government in Eldorado Valley, Nevada, but held in reserve for the State of Nevada under the provisions of P.L. 85-339, as amended.

line with attendant access road. Roads may leave the transmission line right-of-way and in rough terrain be located in relation to the topography. Easement rights or fee simple right-of-way for such roads will be required. New roads constructed in the mountainous areas will create additional scars on the landscape. The new roads may be more susceptible to erosion and because of compaction from traffic may be slow to revegetate. Natural washes will be used as much as practicable for access to tower sites, but where roads cross the washes, fill or ramps may be required to bridge the streambed. Culverts will be installed where needed.

Approximately 10 acres of desertland will be required for construction of the Harcuvar Substation and about 3.5 acres for the 1-mile-long attendant access road. Here, the leveling will be a balancing of cut and fill, but the clearing will create a scar on the generally undeveloped area. The area is presently crossed only with jeep trails and access roads to range areas. The location and vegetation are shown on accompanying Figure 12.

Approximately 0.5 acre of land will be permanently cleared of vegetation near the Havasu Pumping Plant to accommodate a cable spreading yard for the Parker-Havasu 230-kV radial transmission line.

Concrete footings for powerline structures require excavation and backfilling. In locations where the material excavated for the footing is not of sufficient quality to be used for backfill, select backfill will be obtained to make up this deficiency from small borrow areas located on the transmission line right-of-way and may leave small scars to the landscape. Excavated waste material will be mounded against the tower footings or spread evenly around the tower site.

The contracts will allow the contractor to mix concrete for tower footings although in all probability he will contract for its delivery from local ready-mix companies. Approved sources of aggregates for this use, however, are located in the Osborne Wash, Cunningham Wash, and Agua Fria River areas. Excavation for aggregates, though under controlled conditions, leaves a residual pit area that can be only partially restored.

Staging or equipment storage areas and locations for concrete batch plants will be located along the right-of-way. These sites, about 16 miles apart, will be occupied for varying lengths of time. Activity will shift from one to the other as construction progresses. This will be the location for receiving trucked-in material of some structure assembly and concrete mixing. To reduce the adverse impact of scarring to the land, effects of oil and fuel spillage, and the littering of construction material and packaging associated with the use of the area by the crews, the contractor will be required to restore these areas to as near a natural condition as practicable.

(2) Air - Air pollution from dust, smoke and odors associated with the operation of the construction equipment will exist in the area

of activity. Workmen commuting between worksite and residence on unsurfaced access or county roads will add to the dust load because of the increased traffic volume. Heavy equipment-laden trucks delivering materials to the staging area will also contribute to this pollution. The construction of new roads will be primarily limited to those serving the radial lines emanating from Harcuvar Substation and in a more limited manner, near the Hassayampa River area. These new roads will also contribute to the dust problem. The exhaust from diesel-powered engines used in construction equipment contributes to air pollution. Though strictly limited by health and safety requirements, diesel exhaust will exist but will be localized in areas generally remote from population densities. Natural air movement will help to further dissipate the concentrations.

(3) Water - Water that the contractor will require for construction purposes is expected to be transported to the worksites by truck. Greater quantities will be required for dust control than for concrete mixing or other construction work. Erosion sometimes results on slopes and fills from overwatering roadways although contractors strive to avoid this problem because of the inconveniences and increased direct costs it creates for them.

With the exception of the crossings of the Colorado River at Davis and Parker Dams there are no perennial streams on the transmission line alinement. The washes carry area runoff only during and after storms.

b. As it Relates to Vegetation and Wildlife

During the construction period, local disturbance of vegetation and wildlife is anticipated, particularly at the temporary staging and equipment storage sites.

(1) Vegetation - Vegetative clearing at each tower site and for each spur road leading from the access road to the tower site will be required. Tower site clearing may not be necessary except for the foundation footings that will result in a permanent loss of vegetation. Clearing of the spur roads will create a temporary loss of vegetative covering. The desert vegetation is sparse except adjacent to the ephemeral stream channels. Tower sites will be located far enough away to avoid flood hazard and not cause damage to wash bottom vegetation.

Clearing will be accomplished where material will be received by truck, stored and assembled, and where assembly crews will park private vehicles rather than at the construction sites and roads. The compaction of the topsoil by men and machinery may necessitate that the area be scarified to accelerate regrowth.

The Harcuvar Substation, as well as the attendant 1-mile-long access road, will require complete and permanent clearing.

The impact on the vegetal communities can only be estimated prior to construction. The quantification of the impact can be based on field data of specie density, frequency and crown cover, or an estimation by electrical construction people with experience on the Mohave and Sonoran Deserts. The estimation procedure is probably as accurate as field data due to the diversity of vegetation communities and unforeseen construction activities.

The amount of vegetation effected by construction is estimated at 15 percent of new land to be subjugated, and 20 percent on right-of-way that already exists, or about 870 acres of the total rights-of-way for the transmission system. Part of this loss will be temporary due to the crossing of machinery over plants which may only damage them. The regrowth of these plants may resume almost immediately after the crossing of the equipment. The seeds in the soil of the annual herbs and grasses will not be disturbed and, given the proper amount of rainfall, will germinate and grow with little or no change to the operations which have occurred.

The permanent loss of vegetation is due to road, footing, and permanent facility construction. This loss will be most noticeable. The loss of topsoil in the road area will, through the loss of herb and grass seeds, reduce the chance of revegetation in these areas and will add additional years to the time the revegetation will require under normal conditions.

The alinement is principally a creosote bush/bur-sage community as described in detail in Section II.D. This community will have the largest impact but the plants will be able to withstand damage and recover better than the other communities. This community will represent 60 percent or 522 acres of permanent vegetation loss.

The second largest vegetation community to suffer a permanent loss are the tree communities which are located throughout the alinement. The tree communities of paloverde, smoke, and mesquite are generally located near ephemeral washes and these will suffer from equipment travel and construction. Only the smaller trees would be able to rejuvenate themselves with little or no damage after equipment passage. These communities would represent approximately 25 percent of the permanent vegetation loss or 218 acres.

The smallest vegetation communities which represent 15 percent or 130 acres of the total permanent vegetation loss are the cacti, yucca, agave, and ocotillo. These communities are the most susceptible to damage and generally the most difficult to reestablish. Some of this group, such as the prickly pear and cholla, can most likely withstand some disturbance but the larger ones, such as saguaro and barrel cactus, cannot withstand any damage and take many years to reseed and grow. Many plants of this group are protected in Arizona and notification of the Arizona Agricultural and Horticultural Commission will be necessary to facilitate their removal before clearing operations begin. Generally, these plants will be lost to the transmission system alinement and will be extremely slow to vegetate within the disturbed area. Transplanting vegetation on the alinement without an irrigation system would not be successful under normal desert conditions.

Since the permanent access roads will not be used on a regularly scheduled basis subsequent to construction, natural regrowth in the roadways will be permitted to take place. The areas will not be scarified, however.

Natural revegetation could conceivably take years but improvements in machinery and construction techniques have reduced the required amount of vegetation removal. The vegetation surrounding the Southern California Edison Company's 500-kV transmission line towers erected about 5 years ago shown by Figure 18, is less apparent than that disturbed in the proximity of the 25-year-old line as shown in Figure 17.

(2) Wildlife - As the construction proceeds, any habitat destruction will affect wildlife. Many species of the larger terrestrial fauna will abandon an area where humans are present, particularly at staging and storage areas. When human activity is concentrated for long periods of time at one location, it is possible that behavioral patterns of animals oriented or accustomed to a local area will be altered.

There would be some invertebrates such as scorpions, ants and spiders that would be destroyed in clearing operations and by heavy equipment transporting materials. Invertebrates such as moths, butterflies, wasps, bees, gnats and flies may be destroyed by collision with moving equipment and cars going to and returning from the worksites.

There should be no impact on fish populations as the result of construction activities.

Some amphibians and reptiles will be relocated or lost. However, this impact will not be significant to the total population of the area.

Construction activity will have little influence upon the habits of the desert mule deer and bighorn sheep and other mammals along the alinement. Bighorn sheep populations have been identified in the Buckskin Mountains, the Harquahala Mountains and the Eagle Tail Mountains in Arizona and in the Newberry and Eldorado Mountains in Nevada. A typical sheep habitat is shown on Figure 23. Deer are typically sparse in numbers and scattered in the open desert environment but are found in greater numbers in the riparian growth area adjacent to washes. The impact on construction of the transmission system upon mammals is expected to be minimal because of the short duration of activity in any location. It will cause the relocation or loss of some small mammals.

The temporary disturbance of desert bird species, such as the cactus wren, gilded flicker, and Gila woodpecker, will be negligible and limited to the staging and storage areas. The noise, dust, and increased human presence related to construction of the 1/2-mile underground 230-kV line north of Parker Dam might cause a minor disturbance if construction is done during the mating and nesting season of the great blue heron colony on Heron Island. In the spring of the year, approximately 15 pairs of great blue heron nest on Heron Island located about 0.25 mile offshore and approximately 0.5 mile from the work area.

There should be no impact on threatened species due to construction activities. The only exception to this would be the remote possibility that the Gila monster (SU) might be killed by heavy equipment during the construction period.

The impacts of the transmission line construction on the wildlife of the area are difficult to quantify due to a lack of definitive studies of the generally sparsely populated desert habitats. An ongoing study of these impacts is being carried out by biologists at Northern Arizona University for the Arizona Public Service Company (APS) on a 500-kV transmission line of the Navajo Project Southern Transmission System. One of their study sites is located in the typical saguaro-paloverde Sonoran Desert with the majority of the ground cover consisting of bur-sage, creosote bush and annual herbs. The study area consists of three 50- by 150-foot plots directly on the disturbed area, and a duplicate or control set of plots 200 to 400 feet off the disturbed area but on similar terrain with similar vegetation. This vegetative community is similar to that which will be traversed by the eastern half of the proposed Granite Reef Aqueduct

Transmission System. It is likely that the impacts on wildlife will also be similar. It must be noted that the conclusions reported are tentative and are contained only in progress reports submitted to APS. Also, no known studies of a similar nature have been accomplished in a Mohave Desert setting, and the conclusions drawn may not be applicable to the western half of the Granite Reef Aqueduct Transmission Line.

The APS study indicates that an almost total annihilation of arthropod (insect) communities occurs on access roads due to loss of vegetation. However, there was no evidence of an invasion of exotic arthropods or major changes in the overall distribution of native taxa.

Data collected for the APS study show a variable impact on adjacent bird populations. After construction there were increases in three species. House finches increased by 374 percent, mockingbirds 100 percent, and western meadowlarks 74 percent. Six species decreased significantly. These species were the black-throated sparrow (50 percent), Brewer's sparrow (68 percent), cactus wren (24 percent), curve-billed thrasher (39 percent), mourning dove (57 percent), and verdin (24 percent). A total of 23 percent of all of the bird species that occurred on the site were affected in some way by the disturbance.

The work concerning impacts on mammals was confined to rodent populations. The biologists collected seven species of rodents. In order of their abundance, they were the Merriam kangaroo rat, Bailey pocket mouse, whitethroat woodrat, deer mouse, cactus mouse, southern grasshopper mouse, Arizona pocket mouse, and the cliff chipmunk. The studies by Northern Arizona University are being continued in order to obtain a better data base for reliable quantification of the impacts of a transmission line that traverses a desert ecosystem. However, some tentative conclusions were made from the data available which are considered to be pertinent to the construction of the Granite Reef Aqueduct Transmission Line. These tentative conclusions are as follows: (1) overall density and diversity of rodents will not be significantly affected, however, the density of individual species changes, (2) access roads and survey strips appeared to have less impact on rodent populations than larger, broader disturbances such as the clearing of tower sites, and (3) adult-juvenile ratios and reproductive activity may be affected adversely.

c. As it Relates to History and Archeology 77-80, 108, 115, 131, 138, 141

The construction of the transmission line system for the Granite Reef Aqueduct will not have a significant impact upon the historical and archeological resources. A detailed survey for resources along the alinement initially proposed has been completed. Reports on the initial detailed survey by the Department of Anthropology of Arizona State University and the Nevada Archeology Survey of the University of Nevada indicate 6 historic and 27 prehistoric sites were located. Eighteen sites were reported in Arizona and 15 sites in Nevada that were not previously reported in the Granite Reef Aqueduct, Final Environmental Statement FES 74-5. None of the sites are considered by the investigating archeologist to be of national register quality and no further survey has been recommended as these sites will not be affected.

d. Summary

In summary, the impacts to man's surroundings will exist during the 10-year construction period. Some wildlife will be influenced adversely, especially where activity is concentrated which may temporarily disturb their migration patterns and breeding habits. Without protective considerations, the colony of the great blue heron might be affected. About 870 acres of Mohave and Sonoran Desert vegetation along the entire length of the alinement will be disturbed by the construction of 70 miles of new access roads, and tower siting and staging areas. About 0.5 acres of total vegetation will be permanently removed at the tower footings and 14.0 acres at the Harcuvar Substation, its access road and the cable spreading yard at the Havasu Pumping Plant. The effects of the construction on the transmission line are primarily of a temporary nature. Mitigation measures to avoid or reduce the intensity of the adverse impacts will be discussed in Chapter IV.

C. Direct Impacts Related to Operation and Maintenance of the Transmission Line System

Those impacts on man and the environment associated with the operation and maintenance are more permanent than those from construction. Some impacts may lessen and others may increase in intensity, but the esthetic impact will last through the life of the project.

The most obvious adverse impact on man associated with a transmission line installation is esthetic in nature. The permanence of the feature occupying air space appears out of place. This type of esthetic impact will be reduced insofar as possible by constructing the line parallel to the existing lines removed from areas heavily populated and within an area already impacted by existing transmission lines.

Open space as a natural resource is increasing in value and importance and is therefore of major consideration in the planning for the use of the land for transmission line systems. The esthetic considerations of a powerline are not easily identified or quantified. The areas of greatest impact, however, are more readily discernible and measures are incorporated into the plan to minimize the esthetic disturbance of the present land values. Although there is no general agreement as to what type of powerline structure has a pleasing appearance, it has been shown that lattice-type structures are less of an intrusion on the desert landscape, particularly after aging has reduced the reflective quality of the metallic members. In most instances, the access roads for the transmission line systems have more of a visual impact than the line itself.

The esthetic considerations of use of open space and visual impact are being minimized by constructing the line parallel to existing lines and removed from areas heavily populated to within an area already impacted by transmission lines.

As shown in Figures 16, 17, and 18, the construction of the transmission line segment between McCullough Switching Station and Davis Switchyard will have no appreciable increase in visual impacts or reduction in present land use or value because the area is occupied by other systems. The area of greatest visual impact from this segment of the line will be at the river crossing at Davis Dam.

The esthetic effects on the segment of the transmission line system between Davis Dam and Parker Dam are more apparent than the other portions of the system, because the area is more heavily populated and used by river recreationists. In order to reduce the residential land use and visual impacts to the residents of Lake Havasu City, the bypass in Figure 4 assumes a new route which will require a new access road. The new route will result in a recreational land use impact on the mountainous area to the east of the residential area which is at the present time unaffected by any transmission line. The bypass will also add one more highway crossing to Route 95 south of the Lake Havasu City area.

Because of the contrast of the new 230-kV line running parallel to an old wood-pole 161-kV line between Parker and Liberty, the visual impacts will be especially apparent. However, the remoteness of the area provides few opportunities for the contrast to be viewed, except at the road crossings.

1. Impacts on Man

a. Access Roads

An impact will be the 70 miles of new roads built for construction and maintenance access. Even though these roads will not be maintained, as patrol of lines will be accomplished by helicopter, their existence and prior use by the construction crews will open areas of desert for range management and for those seeking desert-oriented travel and recreation.

b. Electrical Interference

At highway crossings, a motorist may experience low-level audible as well as electrical interference with radio reception. This annoyance is generally limited to the immediate area surrounding the conductors and is the result of corona energy loss. Residents of the Lake Havasu Travel Trailer Village adjacent to State Highway 95 near Parker or the residents of Parker Dam should experience no increase in such interference on radio or television over what they now have with existing lines.

c. Maintenance

The monthly fly-by of the helicopter on maintenance inspection patrol can be a moment of adverse distraction. In terms of existing routes of travel and cultural developments, this type of impact will probably be limited to those residing near the Colorado River between Lake Havasu City and Parker. The inspection is performed during daylight hours when the increase in noise level is not as apparent.

d. Farming

The location of approximately 10 towers between the Roosevelt Irrigation Canal and the Liberty Substation near Goodyear, Arizona will result in a permanent impact on 0.25 acre of cultivated land. Some additional crop loss might be experienced should access through cropped fields to the towers be required by maintenance crews to repair major damage.

Aviation obstruction markers will not be installed on the conductor and overhead ground wires which may cause a hazard to crop-duster flying over the fields through which the line passes.

e. Economic

A commitment of $45,975,000 for construction of the transmission system will be an impact for the 50-year payout period to the benefiting communities. The expenditure will not result in an appreciable increase in operational or maintenance employment or population since the transmission line system will be integrated and will upgrade existing facilities utilizing, to a large extent, presently staffed operating and maintenance crews.

f. Source of Energy 11-13, 23-25, 29

The Navajo Generating Station will be the source of the electrical energy transmitted to the central Arizona service area. The transmission lines will carry the energy to operate the water pumping plants of the Granite Reef Aqueduct system and be a tie-in with other features of the CAP and other systems. An average quantity of 1,100,000 acre-feet of water annually will be diverted by the aqueduct to the central Arizona area to decrease the overdraft on ground-water supplies. Pumping of 1,100,000 acre-feet of water will require consumption of 1,675 GWH of electricity annually. At the Navajo Generating Station this will require consumption of 775,000 tons of coal per year.

By linking the McCullough Switching Station and the Westwing Substation through the Liberty and Mead Substations and the Davis and Parker Switchyards, power from the Navajo Generating Station can be made available for commercial consumer use when the pumps are operating at less than full capacity.

The reliability of the Parker-Davis system will be improved. The addition of a 230-kV transmission line parallel to the existing 230-kV line between Davis and Parker provides backup reliability to the system. Reduction in outages and local community energy problems will be ameliorated by the increased reliability. Future improvements to distribution systems serving communities along the Colorado River will be possible by integrating the Granite Reef Aqueduct transmission line system with existing systems.

The 230-kV line between Parker and Liberty will replace a 40-year-old 161-kV line. Not only will system reliability be improved, but the replacement of the wood-pole structures with steel towers will reduce maintenance costs.

2. Impacts on the Environment

a. Land [114, 119, 133, 137]

Over most of the transmission line length the existence of the system may limit but not alter the present use of the land within the right-of-way. In desert areas, the use of the land may be increased as a result of the installation and new roads. Towers will remove from 20 to 400 square feet of land per tower from agricultural use near the Liberty Substation depending on the cropping pattern and harvesting practice of the individual farmer. Farming will continue, however, within the right-of-way area between and adjacent to the towers. Where the line is located near Searchlight, Nevada, some mineral mining is conducted. No mines exist within the present proposed right-of-way, but the presence of the transmission line may limit the area for future prospecting. Underground mining will be vertically unrestricted except in close proximity to the individual towers. The mine access roads may be slightly altered due to structure locations. The Harcuvar Substation removes approximately 10 acres of desertland from other use, and the roads associated with the installation and those serving the pumping plant radial transmission lines will open this desert area to increased recreational use. Where the transmission line crosses rangeland, no restriction on the use of this land for range management will be imposed.

The monetary value of land can be affected by being adjacent to or within sight of transmission lines, based on the contemplated land use. However, due to the nature of present land use of the area and the transmission line for the Granite Reef Aqueduct being generally parallel to or a replacement of existing lines, there should be little additional impact in this respect. The establishment of a utility and roadway corridor can dictate future land use planning because of the transmission line route. Telephone, gas and public powerlines, as well as Bureau of Land Management and minor State and county road alinements can be located on the right-of-way.

When considered on a long-term basis, construction and operation of the transmission system will have a lasting effect on land use planning within the three states traversed by the line. The following discussion outlines the impacts expected on land use planning in the states affected.

(1) <u>Arizona</u> - Bureau of Land Management planning should not be significantly impacted by construction of the proposed transmission system in Arizona since the line would use or closely parallel existing transmission

line routes for most of its course through the state. The alinement of the 230-kV backbone line will bypass Lake Havasu City which is approximately 15 miles long and there is a 6-mile-long departure from the Parker-Phoenix alinement to connect to the Liberty Substation. The Bureau of Land Management and Reclamation are also coordinating the alinement south of Lake Havasu City to avoid adverse impacts on the proposed Aubrey Hills scenic area of the Havasu Planning Unit. In addition, approximately 16 miles of the 115-kV line to the Bouse Hills Pumping Plant, 27 miles of the Little Harquahala Pumping Plant line and 6 miles of the Hassayampa Pumping Plant transmission line do not parallel existing systems. Coordination with State planning agencies and other Federal and local entities with planning functions will insure that these exceptions to existing routes and the feeder lines to the pumping plants will have minimum impact on land use planning.

(2) California - The construction of the 1.2 miles of the Davis-Parker 230-kV transmission line segment from the Lake Havasu crossing to the Parker Switchyard, as shown on Figure 59, will not adversely affect land planning in the area. This land is presently under the jurisdiction of the Bureau of Land Management, but has been permanently withdrawn for Reclamation purposes as part of the security area for Parker Dam. Reclamation will make a filing with the Bureau of Land Management under provisions of the Act of December 5, 1924, that will reflect the intention of constructing the proposed line.

(3) Nevada - Since the Granite Reef Aqueduct transmission system generally parallels other existing lines, it is not expected to adversely affect any resource development plans for the area. However, Reclamation is coordinating closely with the Division of Colorado River Resources, State of Nevada, to insure that construction of the system transmission lines will not have an adverse impact on their development plans for Eldorado Valley which have been described previously in Section II.J.3.f.

(4) Federal Recreation Lands - The proposed transmission line between Mead Substation and Davis Switchyard crosses about 2 miles of the southern tip of the Lake Mead National Recreation Area administered by the National Park Service.

In selecting a route of the Mead-Davis No. 2 230-kV line, an alinement was used that would require the least amount of Recreation Area lands and still be economically feasible. Paralleling the existing Mead-Davis No. 1 230-kV line was avoided so that only 2 miles of right-of-way through the Recreation Area would be necessary.

The National Park Service has proposed certain sections of the Recreation Area as wilderness areas and has issued a draft environmental statement, DES 74-3, outlining the impacts of its proposal. This environmental statement recognizes the construction of the new Mead-Davis No. 2 230-kV line.

b. Air

The air will not be appreciably affected by the transmission line except that the towers and conductors will occupy air space. This occupancy is a hazard to aircraft illegally flying below FAA allowable altitudes or crop dusters working in agricultural locations.

Ozone generation from transmission lines has been the subject of extensive study in recent years. The results of these studies indicate that only insignificant amounts of ozone are generated.

Ozone (O_3), in conjunction with carbon dioxide (CO_2) and suspended particles is one of the natural pollutants of air. The global background atmospheric concentration of ozone at sea level is between 0.01 ppm (parts per million) and 0.03 ppm, and although ozone has a pungent odor at these levels of concentration it is generally not detected by human senses. However, the additions of only small quantities to this background, resulting in a concentration of 0.05 ppm, can be detected by the human sense of smell and, as such, is a useful signal of its presence.

The two most common ozone-producing phenomena, detectable by the average person, are lightning and electrical sparks. They are short in duration and are not a cause for concern.

Ozone can be produced in the vicinity of extra high voltage (EHV) and ultra high voltage (UHV) transmission lines by corona discharge, a phenomenon of high voltage electric transmission lines. Existing studies on three-phase 765-kV and single-phase 1,100-kV transmission lines were unable to detect traces of ozone above background concentrations either under the line or at reasonable distances from the line. The corona loss of a 230-kV line is substantially lower than for the 765-kV and 1,100-kV lines and will therefore generate far less ozone. Since no detectable ozone attributable to corona discharge was measured from the higher voltage lines, it is unlikely that a 230-kV transmission line will produce measurable quantities.

c. Erosion

The emergency services of maintenance crews for the transmission line will most likely be required during and immediately after severe storms. Washes that are usually dry will, during storm periods, carry the storm runoff. Drainage patterns of some washes may be locally affected by maintenance activities with crews passing through them. Local erosion will be negligible.

d. Vegetation

The permanent removal of 14.0 acres of vegetation at the Harcuvar Substation site, service road and Havasu Pumping Plant, and an accumulated total of approximately 0.5 acre at tower sites, as well as the temporary changing growth patterns on construction and maintenance roadways, will affect the vegetation in these immediate locations. No significant impact on vegetation, however, will result from the operation of the transmission line system as it is not expected that maintenance clearing will be required and ground crews will only be used in emergency situations.

e. Wildlife

There will be no direct impacts on fish and invertebrates as a result of operation and maintenance activities. The clearing of vegetation will affect the wildlife in the area to the extent that 14 acres of vegetation-type habitat area are permanently removed. The existence and operation of transmission lines should cause no changes in the migration patterns and other activities of mammals or amphibians and reptiles in the area. The line is, to a large extent, not an uncommon or out-of-place object to the desert animal. In the open range, the line and tower will not be detrimental to livestock.

The operation and maintenance of the transmission line will have no direct adverse impact on the birds of the area. Conductor spacing on the 230-kV system precludes any danger from electrocution for the largest of birds. Occasional nesting in the towers by raptors has been reported with no need indicated to remove the birds. Reported raptor electrocutions have been on lines of the lower distribution voltage range typical of systems with wood-pole construction in rural areas.

Adverse impacts on threatened species as a result of operation and maintenance activities are foreseen as insignificant.

f. Summary

The operation and maintenance of the transmission line system for the Granite Reef Aqueduct will have various direct impacts on man and his environment. The most significant of these impacts is related to the purpose for which the system is constructed - to effect water transport with the power transmitted from the generating station delivery points for use on the Granite Reef Aqueduct and other features of the CAP. Impacts associated with the 334-mile right-of-way include the visual esthetics, limited disturbance of farming operations and land use commitment as well as the commitment of funding. Approximately 4,200 acres of new right-of-way will be required for the transmission lines and the Harcuvar Substation. Of this area, 14 acres will be permanently altered and void of vegetation. The concrete footings for all towers will occupy an aggregate of approximately one-half acre; the Harcuvar Substation about 10 acres, and the substation access road that is 1 mile long, approximately 3.5 acres. The 70 miles of new access roads will alter growth but will not remove all vegetation from 200 acres.

D. Secondary Impacts of Construction and Operation of the Transmission Line System[1-3, 29]

The secondary impacts associated with the transmission line system include many of the direct impacts related to the operation of the

Navajo Powerplant and the Granite Reef Aqueduct. The system will transport energy produced by the Navajo Generating Station for use by the Granite Reef Aqueduct. Such impacts as the use of coal as a source of energy, increased employment for the operation of the generating station, the mining and transporting of coal, and for providing community service requirements are all secondary impacts in relation to the transmission line system. The impacts of the Navajo Generating Station are discussed in the Navajo Project final environmental statement, FES 72-1. A direct impact on environment as a result of the Granite Reef Aqueduct, but a secondary impact because of the transmission line system, is the delivery of water to supplement groundwater supplies in the areas of benefit. These impacts are discussed in the Granite Reef Aqueduct final environmental statement, FES 74-5.

The consumption of natural resources for the production of tower components and conductor material as well as the mining and factory employment related to this work are secondary effects due to the transmission line and affect economic resources in other locations.

The acknowledgement that archeological resources are located near the facilities may result in vandalism by some individuals who may utilize the access roads. This is considered a secondary impact.

Ship, rail and truck transportation facilities will be impacted by delivery dates and production schedules. It is estimated that 8,000 tons of metal will be used in tower and other structural construction and

4,000 tons in the manufacture of conductors. There may be 800 wood poles used on the distribution lines to the pumping plants.

Fuel and lubricants to operate the machinery must be allocated for the construction and to some extent the operation of the line. Special oils for use in transformers must come from various refineries throughout the country.

In a sense, each major construction project is a laboratory for the research and testing of new materials and the introduction of improved construction methods and operating procedures. Research and study of this nature is for the purpose of increasing beneficial and decreasing adverse effects or impacts. Many of the changes that result from this innovative investigation are secondary impacts to the environment as a result of the project. If adopted on a larger scale, these changes can create resultant impacts on another area of the community. An example of this relationship of secondary to direct impact is the study of steel-pole use on the 115-kV radial distribution lines from the substations at Liberty and Harcuvar. Engineering studies are exploring the potential of replacing some or all of the wood poles in this design with steel. Although the relative impact to the present environment resulting from the changes in material is insignificant, the study is to determine the degree or reduction of ground crew maintenance patrol, to reduce replacement costs and to reduce the visual effects from weathering. While the secondary impact on the wood-pole industry is minor because of this project, the ultimate large-scale adoption would affect the industry to a considerable degree and would replace the use of a renewable natural resource (timber) with a nonrenewable but recyclable resource (metal).

Summary

Secondary impacts are generally related to the consumption of resources and the manufacturing of material utilized in the construction and operation of the transmission line. Secondary impacts which can also be considered are those that have a delayed action impact on future projects because of innovations and design changes leading to improvements of methods and greater effectiveness of systems.

E. Unquantified Impacts

Some aspects of the construction of the Granite Reef Aqeuduct portion of the transmission system remain unquantifiable or unmeasurable at this time. Some require additional study and some will become more meaningful as time elapses. This section attempts to recognize that such aspects of the project exist so that methods and procedures can be developed to identify, study and assess them. Others that may become evident in later stages of development will receive similar consideration. The actual influence of the transmission system on these aspects are unquantifiable at this time. Examples of some aspects that will be continuing in nature are presented below.

1. Population Growth Impact [86, 140, 142]

a. Growth in Arizona is projected to be 50 percent in 10 years between 1970 and 1980. Population centers of Phoenix and Tucson will be affected the most by this growth.

b. Electrical system reliability improvement will make this growth easier to cope with.

2. Economic Influence of Construction Crews

a. Chapter I details the length of time for construction of each segment and number of men employed.

b. Though the type of construction associated with transmission line work creates a nomadic type work force, crews will reside in communities that provide the best living conditions. They will in all probability live along the Colorado River and commute many miles rather than live in remote desert communities. Most of the crew personnel will be from cities (especially Phoenix) so when work is within reasonable commuting distance, they will live at home.

c. The number of personnel hired from local communities and how crews will affect small communities is unquantified.

d. The affect crews will have on recreation-oriented communities by living there is unquantified.

3. Residences near the Colorado River

To what degree construction will affect residents now building homesites adjacent to right-of-way near the Colorado River is unknown.

4. Land Use Pattern

The exact range of impacts resulting from temporarily increased population in small communities and resultant changes in land-use is unknown, except in general terms as discussed previously.

5. Revegetation

The access roads used for construction will be allowed to revegetate. How long this will take is unknown as it is largely predicated on climatic conditions. Continuing use by recreationists will tend to retard vegetative regrowth.

6. Wildlife

The range and magnitude of effects that force working on the transmission system will have on the wildlife populations is unknown.

As a result of industrial and municipal growth in the Southwest, power requirements for Arizona, southern Nevada, and southern California are projected to increase. As a region, the area is expected to increase its power demand 40 fold between 1965 and 2020. Chapter IX outlines some of the proposals by utilities in the area to meet this forecasted demand.

With each project there will be transmission facilities that will be required to deliver the generated energy to the service area. These new lines will incur similar impacts on the environment of the Southwest as described in this environmental statement. As the routings for these future transmission facilities have not yet been determined, and will only be made after extensive route analysis studies, the cumulative and secondary impacts that the Granite Reef Aqueduct transmission system will have on the environment with regard to its relationship to these projected lines remains unquantifiable.

CHAPTER IV

MITIGATION AND ENHANCEMENT MEASURES

IV. MITIGATION AND ENHANCEMENT MEASURES

A. Introduction [27, 28, 106, 128, 129]

The impacts relating to the construction and operation of the Granite Reef Aqueduct power transmission system have been discussed in Chapter III. Many of these impacts are characteristic of transmission lines in general while others are applicable to this project in particular. In order to reduce the intensity or eliminate some of the adverse impacts, changes or mitigation measures are applied. An example of the use of a mitigation measure could be the choice of using low profile structures in the design of substations that, while costing more, reduce the visual impact of the facility.

In order to fulfill the objective of transmitting power, the system must operate efficiently, reliably, and as unobstrusively as possible. In addition, it must be installed and maintained with a minimum of disturbance to the environment.

The stages of development of a power transmission line system include coordination and planning, design, construction and operation. Guidelines are used in each of these stages of development to achieve compatibility of system and consideration of man and his environment. Mitigation guidelines for the development of the Granite Reef Aqueduct power transmission system are: (1) Reclamation Instructions Series 350, for the preservation and enhancement of the environment; (2) Environmental Guidebook for

Construction published by the Bureau of Reclamation; (3) Reclamation Instructions for design and construction; (4) Environmental Guidelines published by the Western Systems Coordinating Council, and (5) Environmental Criteria for Electric Transmission Systems by the U.S. Departments of the Interior and Agriculture.

No attempt is being made to monitor the effects this transmission line will have on wildlife of the area. As these new facilities parallel existing lines for 264 miles with only 70 miles of line being constructed through presently undeveloped areas, they will have little or no effect on present wildlife habitat requirements or migration patterns. The transmission line will pass near some monitoring plots that are being set up for monitoring effects of the Granite Reef Aqueduct. These test plots are described in the Granite Reef Aqueduct final environmental statement, FES 74-5. Studies of these areas will give an indication of the influence of the transmission line on the area.

B. Standard Guidelines, Mitigation Measures

As a result of planning and following appropriate environmental guidelines, the route for the Granite Reef Aqueduct transmission line system will have a minimum conflict with present land use. In the agricultural area near the Liberty Substation (Figure 13), the present activity will not be disturbed except in the area of the towers following construction completion. The route has been planned to avoid steep slopes, to avoid any paralleling of highways as much as is practicable and also to utilize existing rights-of-way where possible. In addition, concentrations of population have been avoided where possible.

1. <u>Reclamation Contract and Supervision Procedures</u>

Protection of the environment to minimize the potential adverse effects of construction activities is the responsibility of each Reclamation employee--from the surveyor, geologist, and inspector in the field, to the Construction Engineer, Projects Manager, and Regional Director. The policy of the Bureau of Reclamation for the preservation and enhancement of environmental quality is explained in Part 376 of the Reclamation Instructions, Series 350.

Early in 1973, an "Environmental Guidebook for Construction" was published by the Bureau of Reclamation and has been distributed to all field offices. The book has since been revised in 1974 and is again being made available to field offices. This guidebook discusses Bureau of Reclamation policy regarding certain factors that are more specifically stated in the construction specifications. For example, most Reclamation construction specifications contain certain standard paragraphs requiring contractors to perform operations with minimum impact on the environment. These paragraphs deal with dust abatement, air and water pollution, noise control, cleanliness of work area, and installation of sanitary facilities to name a few.

The environmental specialists of the Regional and Project Offices will assist the Project Construction Engineer in providing orientation training sessions to construction and inspection forces to heighten their awareness of and sensitivity to environmental factors, and in keeping with Reclamation policy for those areas identified in the environmental impact statement and pertinent specifications requirements.

During and upon completion of each contract, personnel of the staff make periodic and final inspections and prepare reports on environmental aspects, impacts, results, and recommendations for future and further consideration.

2. Access Roads

Construction of new access roads that would leave permanent damage to an area will be avoided if possible. Proper drainage control will be provided for any roads that are required and areas that are damaged will be restored. Roads not required for maintenance access will be scarified to encourage regrowth. Slope and soil management will be a guide in the location of roads including those that are not on the alinement.

Specifications provisions will control the construction activities which could cause adverse impacts to the drainage pattern of the area or to wash channels. Restrictions will control unnatural turbidity and any pollutant discharges in areas where water might become contaminated.

3. Borrow Areas

Although it is not expected that extensive borrow areas will be required, such areas will be graded and shaped to blend with the adjacent terrain and made to appear similar in nature to the surrounding landforms.

4. Air Pollution Control

Inherent with thunderstorms, windstorms, construction, travel, and other activity in this desert region is an ever-present dust problem. Construction activities in general raise the particulate dust levels at and adjacent to the construction site during the construction period. General construction specifications will require that the contractor provide efficient measures to reduce the dust originating from construction operations. Compliance with standard Reclamation rules and guidelines for construction practices, which includes dust abatement, will reduce the amount of dust resulting from construction to a point where it will not have a significant impact greater than ambient levels in the project area.

In accordance with specifications provisions and applicable local State and Federal laws, air pollution from any construction activities will be minimized. The measures include those that regulate dust abatement, noise, burning, and vehicle and heavy construction equipment emission controls.

5. Safety Measures

Highways and roads subject to interference by the construction work will be kept open, or suitable detours provided and maintained for the public. Barricades, signs and signals and any other necessary precautions for the protection and safety of the public will be provided. Public access to the work areas will not be permitted, and subsequent to construction, security fencing will enclose the substations.

6. Wildlife Protection

The selection of towers and the spacing of conductors are such that they provide no danger of electrocution to raptors. Construction activities within one location will be of such short duration that there should be no permanent effect on the living patterns of wildlife in the area. Compared to present recreational use of the desert area surrounding the Harcuvar Substation site, the weekly inspection by a maintenance crew will have little effect on wildlife.

Scheduling construction in the vicinity of the Havasu Pumping Plant for periods during the nonnesting season of the great blue heron colony on Heron Island has been demonstrated by the construction of the Havasu Intake Channel to eliminate adverse effects upon the colony.

7. Esthetics

Topographic and vegetative screening will be used to the extent possible to blend the transmission line to the landscape (Figure 51). No permanent clearing will be done except for tower footings, the Harcuvar Substation, and its attendant access road. Temporary clearing for staging and assembly areas, as well as for new access roads to the transmission line, will be done in a manner to permit regrowth. Staging and equipment assembly areas will be screened from public view where possible by landforms and restricted to areas requiring a minimum of leveling.

Galvanized lattice-steel structures will be used on the entire 230-kV line. Consideration is being given to using towers constructed of similar materials on the 115-kV radial transmission lines. After it has been weathered and because of the open construction, this type of structure blends with the landscape. Wood-pole structures that may be used on the 115-kV lines will be colored to minimize visual impacts, and treated for protection against decay to reduce maintenance requirements.

Construction sites, storage and assembly work areas will be maintained in an orderly manner. Temporary protective fences will most likely be of chain-link material and will be used to enclose these areas.

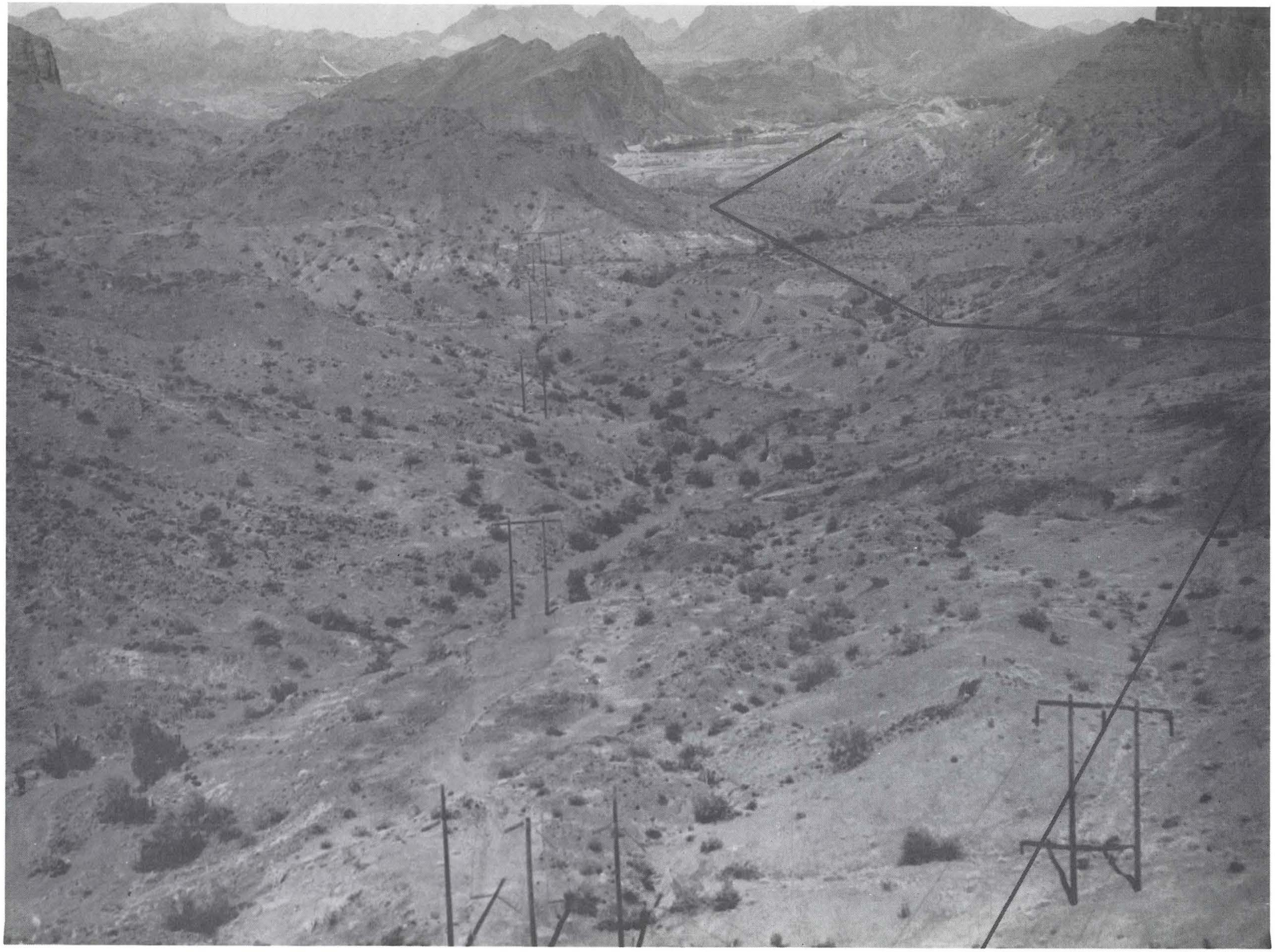


Figure 51
Topographic Screening--Liberty-Parker 230-kV Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01155NA

Only around the installations of switchyards, substations and similar complexes will permanent security fencing be constructed. The transmission line right-of-way will not be fenced.

C. Special Considerations for Mitigation

As previously discussed, many of the mitigation measures adopted are sound methods of environmental protection and have become standard procedure in the development program of transmission line systems. Circumstances that may cause a system to be unique may also create impacts of a special nature. Means of mitigation appropriate to each situation or circumstance are selected or developed. Generally, this type of action occurs in the planning and designing stage and very often involves the investigation, development and selection of alternatives.

1. Routing [132, 139]

In order to reduce the visual impact of a transmission line in a desert setting, mitigation considerations are an important part of planning and design of the route. The proposed route has been selected for the transmission line system for the Granite Reef Aqueduct in coordination with the existing transmission line route. For about 264 miles of the total approximate length of 334 miles, the transmission line will parallel existing lines, creating little additional esthetic impact (Figure 46).

A mitigation advantage was gained by deviating from the parallel concept at Lake Havasu City (Figure 52 shows the existing corridor through the area). A 19-mile bypass is routed behind a low frontal range of hills between the community and the Chemehuevi Mountains so that the line is virtually hidden from the view of the residents. Although the additional visual impact would have been slight, since an existing line now runs through the city, the most apparent effect of the bypass will be that it will not further reduce the subdivided area for community development. Also, disturbances adherent to construction activities through populated areas will be avoided.

North of Lake Havasu City, the line is being routed adjacent to the site for the proposed Citizens Utilities Company Substation. By permitting a tie to the new 230-kV Granite Reef Aqueduct transmission system, the capability of uprating the existing community power distribution system may be provided in this area of programed growth.

Environmental quality protection will be required by the landscape provision in the construction specifications. Contractors will be required to exercise care in preserving the natural landscape in the vicinity of the work, and to conduct operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings. Except where clearing is required for permanent structures and for approved construction roads, borrow areas and excavation operations, all trees, native shrubbery, and vegetation will be preserved and protected from damage caused by contractor construction operations and equipment.

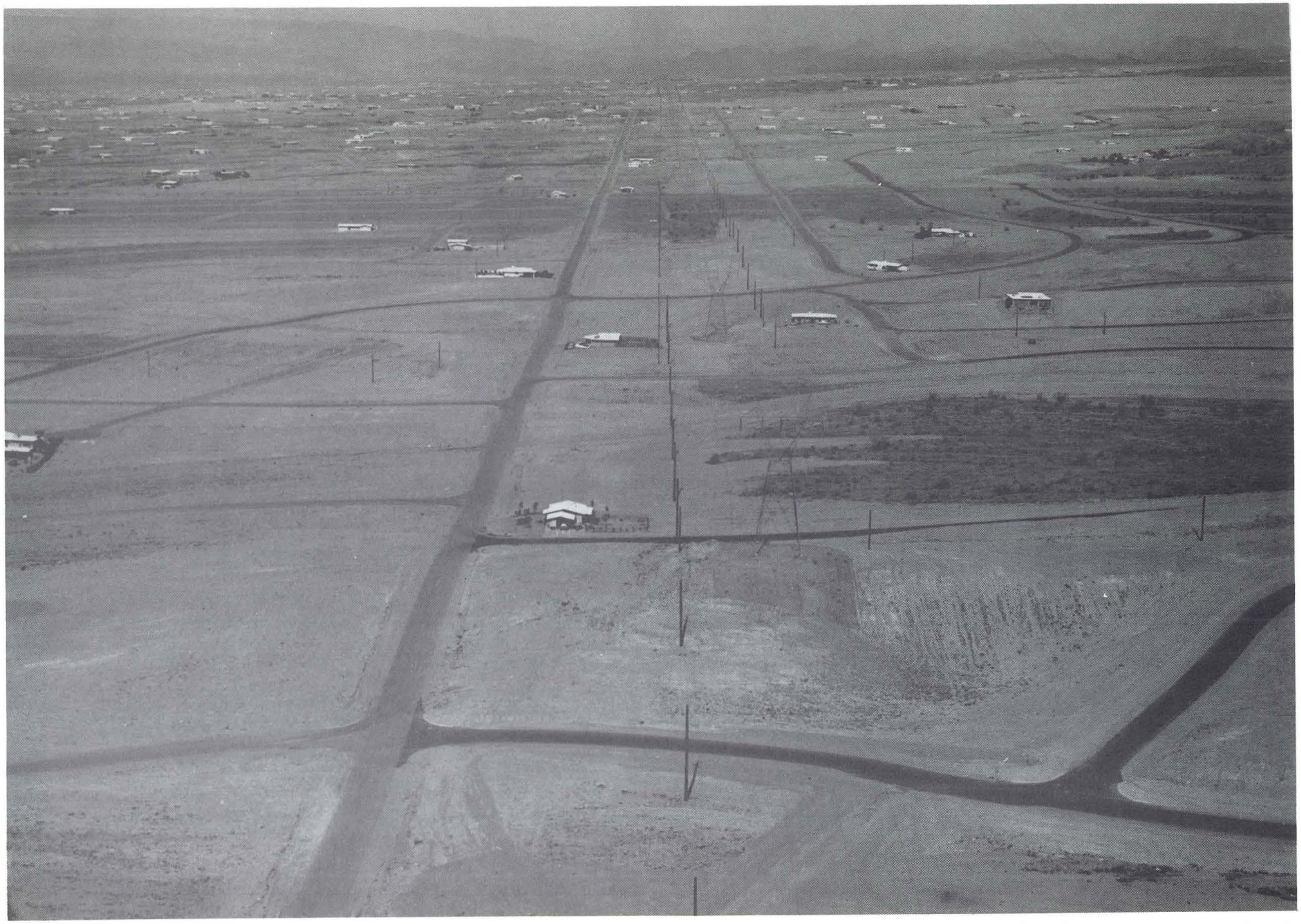


Figure 52
Lake Havasu City, Arizona--View north showing the existing Davis-Parker No. 1 and local distribution system--New alinement will bypass this community to avoid adverse environmental impacts--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01219NA

The construction will necessitate the removal from cleared areas of plants protected under the Arizona Native Plant Act (Arizona Revised Statutes, Sec. 3-901, et. seq. - 1972 Supp.). Some species of the Amaryllideceae (amaryllis) and Cactaceae (cactus) families, Fouquieria (ocotillo) genera, Dalea spinosa (smoke tree), and Holacantha emoryi (crucifixion thorn) are the protected plants expected to be found within this area.

The plant species which are protected and do not lend themselves to transplanting or are not desired for landscaping purposes will be destroyed. These plants would be those propagated with bulbs and cacti such as cholla which are not desired for transplanting.

The States of Nevada and California are presently studying laws based on the Arizona law and upon passage similar arrangements can probably be made with agencies in these states.

Existing crews already used for the maintenance inspection of the existing Reclamation lines will be used for patrolling the Granite Reef Aqueduct powerline, resulting in little total increase in existing maintenance costs.

2. Design

For a distance of six-tenths of a mile adjacent to the Havasu Pumping Plant on Lake Havasu, design will incorporate the use of an

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Existing crews already used for the maintenance inspection of the existing Reclamation lines will be used for patrolling the Granite Reef Aqueduct powerline, resulting in little total increase in existing maintenance costs.

2. Design

For a distance of six-tenths of a mile adjacent to the Havasu Pumping Plant on Lake Havasu, design will incorporate the use of an underground cable to bring power to the pumps. In this way the esthetic visual impact of towers and conductors on the motorists driving on Highway 95 as well as the boaters on Lake Havasu will be avoided.

Present design studies include the use of wood or steel poles on the 115-kV radial distribution lines from the substations to the Bouse Hills, Little Harquahala and Hassayampa Pumping Plants. The choice of steel instead of wood poles would lessen the visual effects (as shown on Figure 53), particularly after aging and weathering and, in addition, would reduce the maintenance costs. Since wood poles are subject to rot and require frequent ground inspection, steel towers that permit the use of helicopter inspection patrol reduce the requirement for access roads for maintenance. More extensive vegetation regrowth in the roadways is possible.

Two 161-kV transmission lines now cross the desert between Parker and Phoenix, Arizona. By designing the Granite Reef Aqueduct power transmission line system to be integrated with the existing system, the 230-kV line will replace and uprate one of the 161-kV lines. The new system will not only minimize the visual and esthetic impacts, but will increase power transmission reliability to the communities served by the system. The uprated system will also make available for consumer use power generated by the Navajo Generating Station when the pumps on the Granite Reef Aqueduct are operated at less than full capacity.

While it is difficult to have a substation harmonize with surroundings in a desert setting, every effort is being made to reduce

Figure 53
Whipple Mountains at Lake Crossing, California--Contrast of wood poles and steel towers with the surroundings--Davis-Parker 230-kV No. 2 Line--Transmission System, Granite Reef Aqueduct, Central Arizona Project--Photo No. P344-300-01231NA

the harshness at the Harcuvar Substation site. The design will be of the low-profile concept and the siting is located to use landforms for screening, as can be visualized from Figures 12 and 12A. Special emphasis will be placed on grading and the treatment of slopes to prevent erosion and changes in drainage patterns in the area.

The additions that are made to the Liberty, Mead, McCullough, Parker and Davis Substations and Switchyards will be designed to be compatible with those already in use. This will eliminate a style contrast that often occurs when additions to structures are made.

3. Construction

During field surveys or while excavation operations or other construction activity are being carried out, prehistoric burial sites, foundations, historic and archeological relics and other distinctive features may be uncovered that were not found during the detailed archeological survey. It will be required that the contractor take extreme care to promptly avoid unnecessary destruction of any artifacts and features and delay operations in the area until necessary clearance has been obtained. Under the intent of the National Historic Preservation Act, the State Historic Preservation Officer will be notified when such items are discovered in order that they may be properly evaluated. The Arizona Archeological Center of the National Park Service has provided assistance in identifying the archeological resources along the transmission line alinement. The Center will continue to provide assistance during the construction of the facility.

Explosives may be used for the excavation of the 230-kV underground cable trench or for tower foundations on the radial distribution line between Parker Dam and the Havasu Pumping Plant. This area is adjacent to mobile home parking areas, Arizona State Highway 95 and Heron Island which supports a rookery for the great blue heron. In addition to the standard provisions for the protection of persons and property, careful planning and controls will be exercised to minimize disturbance of the residents of the mobile home park and disruption of nesting activities of the great blue heron during the month of May. As necessary, blasting will be controlled to coincide with periods of least activity of the heron colony. Much more extensive blasting at the pumping plant site has already been experienced without observable adverse effects on wildlife.

Careful planning and designing of the power transmission system have contributed to the overall minimum adverse impact and reduction of extensive or extraordinary mitigation measures. There are no permanent residences on the planned right-of-way for the transmission line that require relocation.

A thorough knowledge of and adherence to Bureau of Reclamation standards for construction will reduce or eliminate the intensity of most of the adverse impacts experienced from construction activity.

CHAPTER V

UNAVOIDABLE ADVERSE IMPACTS

V. UNAVOIDABLE ADVERSE IMPACTS

It is apparent in the discussion in Chapter III, that there will be some undesirable effects from the transmission line system that cannot be avoided. Most of these impacts will be reduced in intensity by mitigation procedures outlined in Chapter IV.

The most obvious unavoidable impact is the contrast between manmade structures and the natural desert setting. This contrast is shown by the photograph on Figure 30. The visual effect will be most noticeable where the 115-kV radial feeder lines to the pumping plants will not parallel existing lines. During construction, there will be temporary visual impacts associated with the work near recreation and populated areas.

During seasons of high humidity, the interference to radio reception from corona energy in the immediate vicinity of the transmission line is unavoidable.

The temporary loss of vegetation from tower site preparation and storage and assembly areas is unavoidable, as well as the permanent loss of approximately 14 acres at tower foundations and by the clearing for the Harcuvar Substation and its attendant access road.

During construction, some crop loss will result within the area between the Liberty Substation and the Roosevelt Irrigation Canal because of tower sites. The amount of crops lost in unquantifiable as it will depend on the type of crops being grown at the time.

The right-of-way will occupy and restrict the future land use on approximately 4,200 acres. It will restrain the developer from constructing homesites on 24 acres of the Lake Havasu Travel Trailer Village that occupies approximately 640 acres between Lake Havasu City and Parker, Arizona. The photograph, Figure 21, taken in October 1973 while the development was being constructed, demonstrates the relationship the existing highway and development will have with the new transmission line.

Construction activity will have a temporary impact on wildlife. There will be a reduction in the Mohave and Sonoran Deserts habitat at the staging and equipment storage areas located at approximately 16-mile intervals, as well as tower sites. Affected areas will be allowed to return to natural conditions following the construction period. It is recognized that certain types of habitat, particularly involving large brush and cacti, will take several years to revegetate. The original biota associated with this type of habitat may be lost, however, after regrowth, surrounding populations will expand and utilize these areas.

Some noise, dust, odors and smoke attendant to construction activity and the relevant movement of traffic on desert roads will be unavoidable.

The transport of heavy machines and equipment by truck, as well as the use of necessary safety precautions will cause occasional delays to the highway traveler.

New roads may open some desert areas for vandalism as well as for recreation. Birds perching on towers may become targets for individuals whose behavior reflects a lack of respect for the law.

CHAPTER VI

THE RELEATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The construction and operation of the Granite Reef Aqueduct Transmission Line System will result in both short- and long-term uses of the environment. For purposes of this environmental statement, environmental gains and losses which will not be experienced beyond the construction period will be included in the definition of short-term uses. Gains and losses whose influence will be felt beyond the project construction period are considered long-term consequences of the project.

Short-term environmental losses most easily identifiable are those associated with the actual construction of the transmission line itself. Thus, construction activities will require additional access routes to the transmission line corridor and land use in the corridor itself. Wildlife will be displaced by such activity and in limited areas agricultural activities will be occasionally disrupted. Some dust and noise will be associated with the construction activities as well. Long-term gains are those primarily associated with the existence and operation of the CAP as a whole. The transmission system will provide power to the CAP pumps enabling the project to carry water from the Colorado River to central Arizona. In addition to this, construction of the transmission line will allow the replacement of the existing Parker-Phoenix 161-kV line, will strengthen the interconnection between the Parker and Davis generating units, and will thereby increase the reliability of the local Bureau of

Reclamation transmission network. Over the long term, the existing transmission line would have to be replaced by a transmission line very similar to the one proposed as part of the CAP. Because of this, it is not likely that the long-term use of the right-of-way for the transmission line would be any different in the future than it is today or that the future development of central and eastern Arizona would result in this right-of-way being used for any different purpose. The use of existing alinement for the new transmission line is also a long-term gain in the sense that new corridors are largely unnecessary.

The primary short-term gain is the infusion of some $22 million into the area for labor on the project. This economic impact will largely be felt in existing metropolitan areas such as Las Vegas, Nevada and Phoenix, Arizona, but will probably have some effect on developing areas along the Colorado River. Long-term losses directly associated with the construction of the transmission line should be minimal. Wildlife will be able to return to uninhabited areas. Maintenance work should not be of such frequency as to permanently displace wildlife species reentering the area and human access to the area will not be materially increased because of the use of so much of the existing right-of-way. Esthetic losses will be kept to a minimum for this same reason. Likewise, land use and land-use planning options will be minimally restricted. Population and growth influences will also be small or perhaps negligible, due to the fact that the transmission line will not offer a new source of power to the area traversed but will have the power it carries committed to planned uses except in certain temporary situations. Power produced by the

Navajo Generating Station for pumping, but not required during times of operating the aqueduct system at less than full load, will be added to the area power pool. The transmission system will have the capacity to deliver this power although it is anticipated that such delivery would be to existing load centers. The amount of energy available to other users from Reclamation's entitlement to Navajo Project power will vary from year to year depending on the water supply available to the CAP. Based on a long-term average where 1.1 million acre-feet of water are supplied to CAP an estimated 1,804 GWH of energy will be available for sale to other utilities. It is not anticipated that new load centers would develop because of the intermittent and unscheduled nature of this excess supply.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Some of the adverse impacts discussed in Chapter V are the result of or include a commitment of economic and natural resources. The extent to which it curtails the use of a resource for any other potential use is considered an irreversible or irretrievable commitment. For resources such as land surface, the commitment is an extension or reaffirmation of its present use.

Air space approximately 100 feet above ground elevation over the transmission line and the land area occupied by the tower footings and substation will be used throughout the life of the project. During the project life, restrictions will limit the type of land use within the right-of-way; however, most of the lines parallel existing lines where these restrictions presently exist.

Irretrievable will be vegetative loss at each tower site (20 square feet occupied by the four footings) and the clearing for the Harcuvar Substation (10 acres), its access road (1/2 acre), and cable spreading yard (1/2 acre).

Also committed will be 2,000,000 man-hours of employment and $45,975,000 in public and repayment funds.

Aggregates and cement that will become a part of the structures are not retrievable. In addition, 8,000 tons of steel for towers and 4,000 tons of aluminum for conductors are committed. The metals can be recycled at the end of their useful life. As a link between supply and demand, the system is committed to carry 24.3 percent of the net output of the Navajo Generating Station. This generating capacity was specifically constructed for the CAP aqueduct systems and would not otherwise be available in the power market area or for interim use when the pumps are operating at less than full capacity.

The estimated power requirement for operating pumping facilities for the Granite Reef Aqueduct is 1,675 GWH per year, based on a load requirement of 411 MW. Power for the facilities will be generated at the Navajo Generating Station which uses coal as its principal fuel. An average of 2,100 tons of coal per day will be required to service the facilities of the Granite Reef Aqueduct.

CHAPTER VIII

ALTERNATIVES TO THE PROPOSED ACTION

VIII. ALTERNATIVES TO THE PROPOSED ACTION

A. Introduction [1-3, 29]

This chapter will concern itself with other systems which were conceptually designed using various alternative transmission arrangements. In addition, this chapter will discuss alternative line routings of the proposed system and alternatives in the design of components of the proposed system. Alternate power sources, delivery points, and pumping plant loads are not considered in this report because they have been covered in the following environmental statements which have been previously filed with CEQ:

	Title	No.	Date Filed
1.	Navajo Project	FES 72-1	February 4, 1972
2.	Central Arizona Project	FES 72-35	September 26, 1972
3.	Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel	FES 73-2	January 15, 1973
4.	Granite Reef Aqueduct	FES 74-5	January 22, 1974

Although some of the alternatives discussed in this chapter seem desirable and feasible at the present time, it must be remembered that the entire transmission system will not be completed nor carry the CAP pumping power until approximately 1985 or later. Load growth, power system load flows, and system changes cannot be accurately predicted that far in the future. Therefore, the recommended proposed system will have to stand by itself in its ability to handle the CAP pumping load without depending on another utility's transmission system to handle part or all of the load. Those alternate plans which contain wheeling agreements or ties through other utilities and appear to be feasible at the present time will continue to be studied as each phase of the transmission system is constructed and may or may not be used depending on future changes to the existing power systems.

Consideration was given to uprating to a higher voltage the existing Parker-Davis Project's 230-kV transmission line from Mead Substation to the Parker Dam Substation. However, the existing lines were designed and constructed to utilize only one conductor per phase. Bundling the conductor would require rebuilding of the lines, including replacement of all towers with heavier construction and some respanning. Due to the power loading on these lines, they could not be taken out of service long enough to allow such rebuilding unless an alternate could be provided during the construction period. For this reason uprating and bundling the existing line was considered unfeasible.

Conceptual or theoretical alternatives to the transmission system, such as onsite steam generation, gas turbines, storage batteries or solar power have been generally excluded from consideration and are not considered as viable alternatives since the Bureau of Reclamation presently has a firm source of power from the Navajo Generating Station; alternative sources of power were discussed in the Navajo Project Final Environmental Statement, FES 72-1; and due to adverse environmental impacts, greater economic costs, scarcity of petroleum resources, and other constraints.

B. Transmission System Alternatives

The transmission system outlined in Chapter I was developed to serve the integrated needs of the Central Arizona Project, the Parker-Davis Project, and the Pacific Northwest-Pacific Southwest Intertie Project. Other systems were designed using various alternative transmission arrangements. These alternate plans include: (1) a single purpose system consisting of two parallel 230-kV transmission lines from McCullough Switching Station to the Westwing Substation without interconnecting any existing facilities; (2) tapping the Bureau of Reclamation's Mead-Liberty 345-kV line near Burro Creek and running a transmission line to the Parker area and on to Liberty Substation; and (3) starting a transmission line at the Southern California Edison Company's Mohave Generating Station and running it to Liberty Substation via the Davis and Parker Switchyards.

This section outlines the impacts associated with utilizing different systems to supply power to the Granite Reef Aqueduct pumping plants. Section VIII.C. considers alternate routes for transmission lines within the system described in Chapter I.

Table 7 shows a comparison of the miles of line, Colorado River crossings and numbers of new substations and switchyards for the three transmission systems alternatives.

1. Alternative No. 1

a. Description

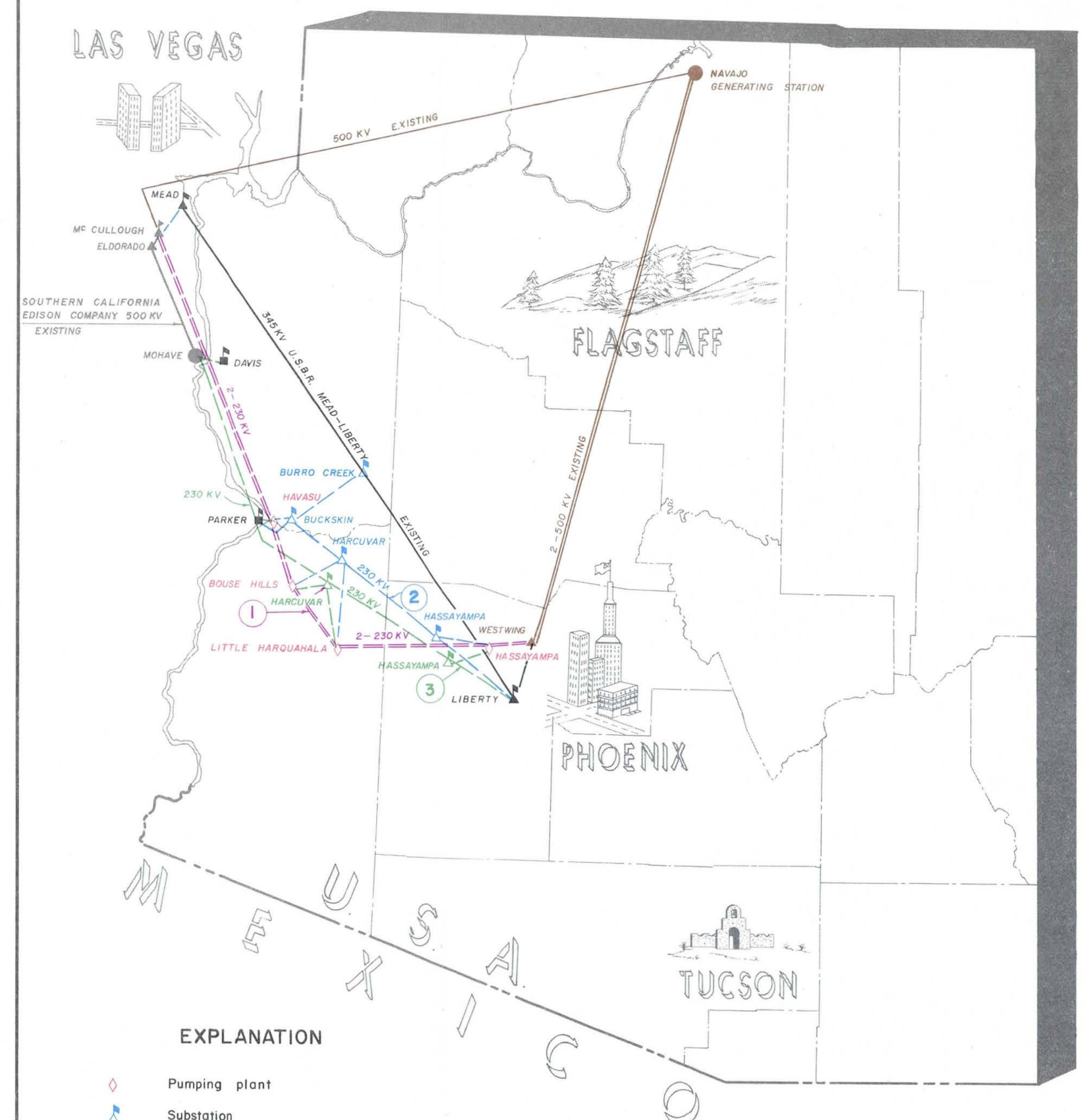
A single-purpose plan to serve CAP only. An independent transmission system could be designed for CAP purposes only as shown in Figure 54 by the alinement labeled No. 1.

This alternative would require two parallel 230-kV transmission lines from the McCullough Switchyard to the Havasu Pumping Plant. The lines would then follow the canal to each of the other pumping plants and would terminate at Westwing Substation. A substation would be required in the immediate vicinity of each pumping plant. No estimate of the amount of new access roads is available. To the extent possible, existing access roads from other lines on the Granite Reef Aqueduct will be used to service the new lines. Adherence to established design criteria to maintain a sound and reliable system would, however, require duplication of almost all facilities because of the two lines required to prevent degradation of the systems of neighboring utilities during contingency situations. This alternate plan would require the construction of 550 miles of transmission line versus 333.6 miles of transmission line described in Chapter I. For these reasons, and also to minimize the

TABLE 7
CENTRAL ARIZONA PROJECT
COMPARISON OF PROPOSED PLAN AND TRANSMISSION SYSTEM ALTERNATIVES

	Parallels Existing Lines (Miles)	Does Not Parallel Existing Lines (Miles)	Total (Miles)	New Substations and Switchyards	Colorado River Crossings
Proposed	264	70	334	1	3
Alternative 1*	210	340	550	4	1
Alternative 2	177	50	227	3	0
Alternative 3	182	70	252	1	3

*Total mileage for two parallel single-circuit transmission lines.



EXPLANATION

- Pumping plant
- Substation
- Hydro power plant and switch yard
- Steam generating plant

ALTERNATE PLANS

Interior – Reclamation, B.C., Nev. 7-74

Figure 54

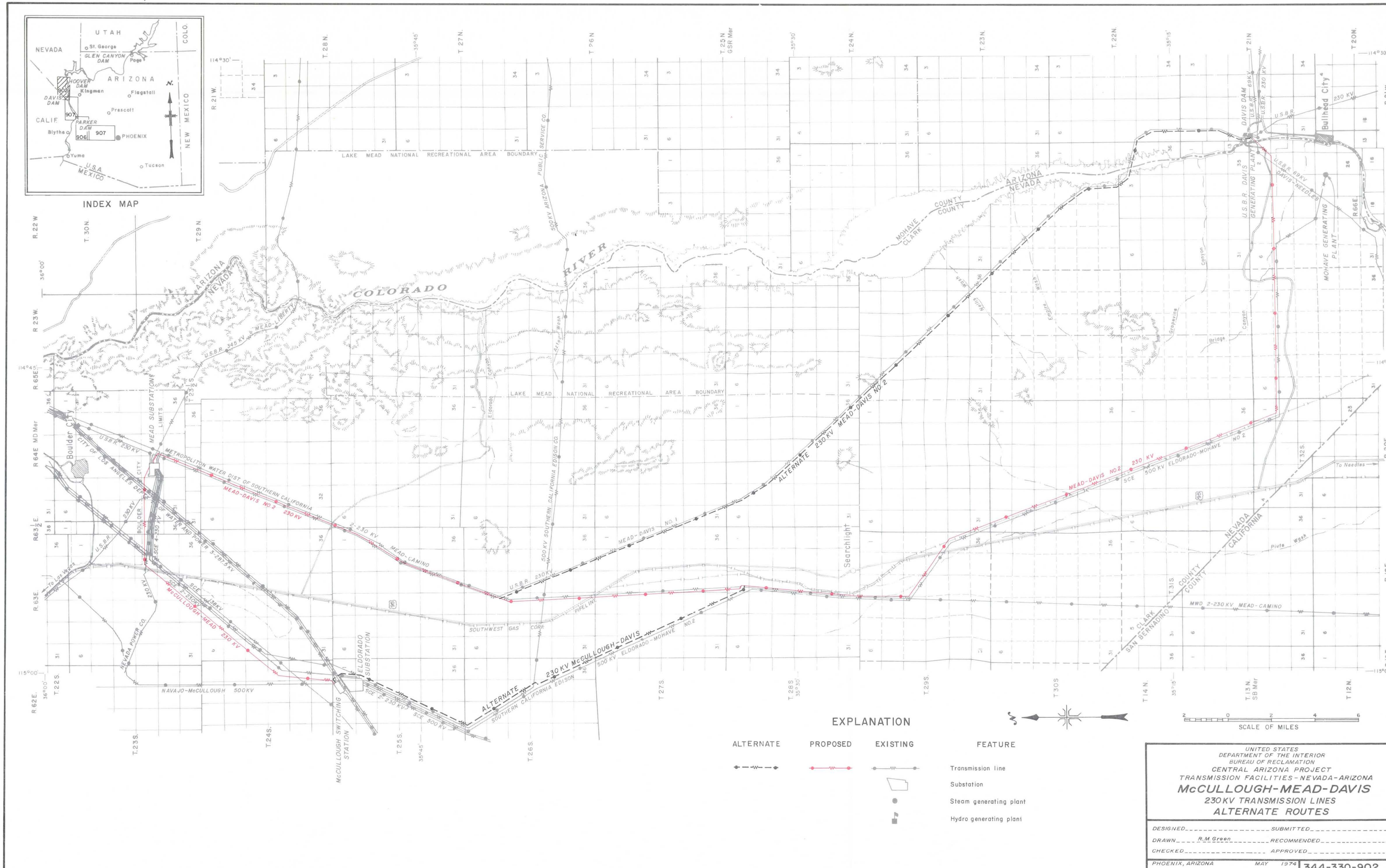
environmental impact of the CAP transmission additions, this alternative was dismissed as infeasible.

b. Description of the Environment

The routing of the single-purpose transmission system would be similar to the plan presented in Chapter I from the McCullough Switching Station to the Parker Substation. The line would travel south from McCullough Switching Station and would not pass through the Mead Substation. McCullough-Davis-Parker line indicated on Figures 55 and 56. The routing from the Parker Substation would parallel and be immediately adjacent to the Granite Reef Aqueduct. A more accurate description of the subdivisions listed below may be obtained in the Granite Reef Aqueduct Final Environmental Statement, No. FES 74-5, dated January 22, 1974; however, it is considered that the descriptions in Chapter II to all intents and purposes are sufficient because of the close proximity to the aqueduct.

(1) Climate and Air Quality

The climate of the area in which the single-purpose transmission system would be constructed is similar to the proposed system described in Section II.B. A summary of the climate described in Section II.B. is furnished for ready reference. The climate is typical of the arid Southwestern United States. It is characterized by long, hot summers; short, mild winters; sparse rainfall; low relative



Interior - Reclamation, B.C., Nev. 7-74

Figure 55

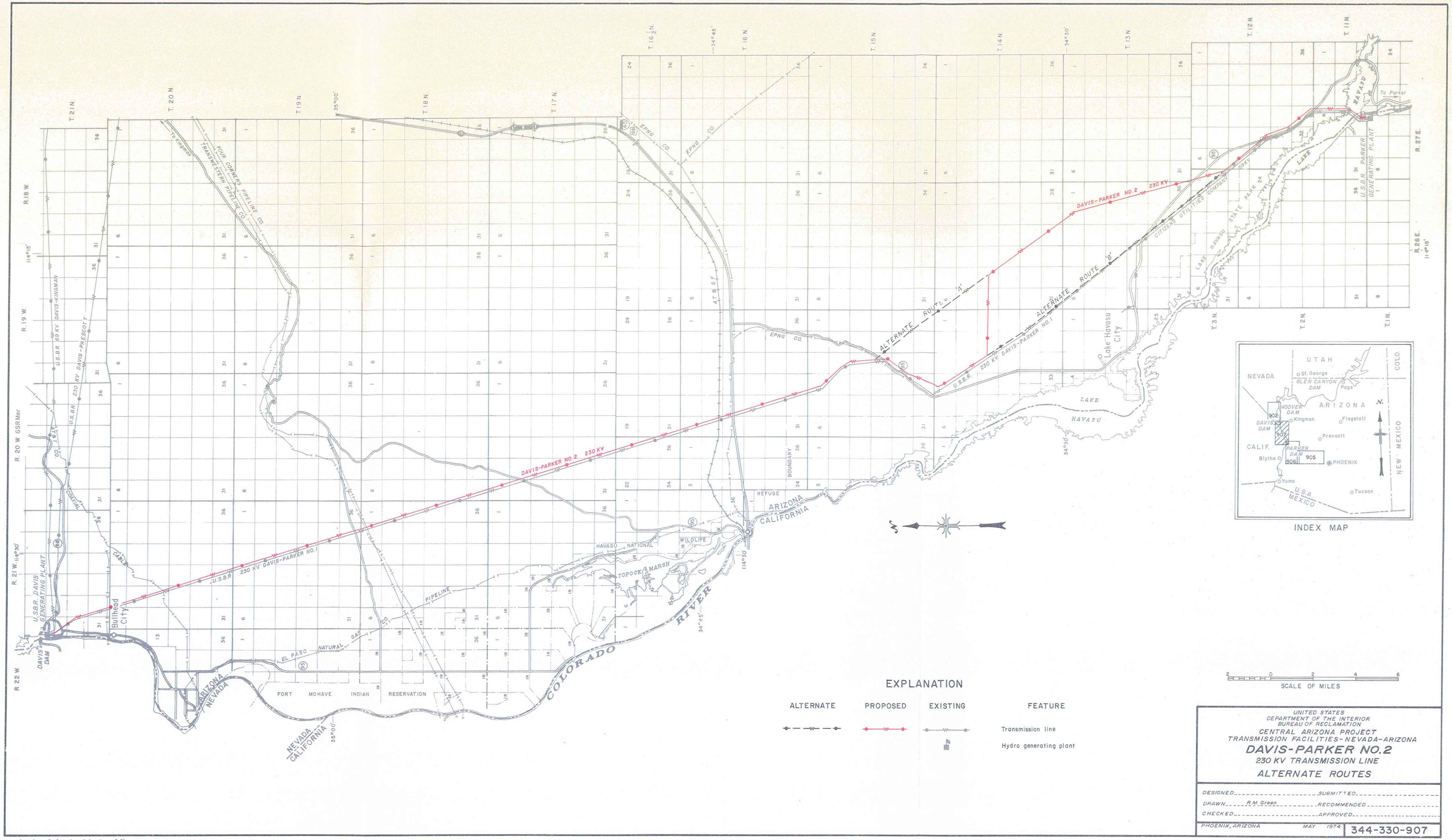


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Figure 56

humidity; and high evaporative rates. The temperature averages about 70°F annually. Temperature extremes of 10°F in the winter and 120°F in the summer have been recorded. Sunshine occurs about 85 percent of the daylight hours. Temperatures along the alinement will vary a few degrees depending on elevations that range from approximately 400 to 4,000 feet.

The mean annual precipitation is approximately 5 inches along the Colorado River and about 10 inches in the higher elevations. Flash flooding is typical at various locations along the line.

Winds of high velocity, dust devils, haboobs, and whirlwinds occur frequently throughout the year and carry considerable sand and dust.

(2) Vegetation

The vegetation of the area in which the single-purpose transmission system would be constructed is similar to the proposed system described in Section II.D. A summary of the vegetation is included here for ready reference.

The transmission system would traverse two distinctly different Southwestern deserts with differing vegetal communities. North of the Bill Williams River the system would cross the southwestern part of the Mohave Desert where the vegetation is predominantly shrubby. South of the Bill Williams River the system would enter the Sonoran Desert where the vegetation is characterized by larger trees and shrubs, due primarily to a larger amount of rainfall.

Typical Mohave Desert vegetation consists mainly of creosote bush/bur-sage, Mohave yuccas, various species of cacti, cat-claw, Joshua trees, ephedra, paloverde trees, mesquite trees, and smoke trees. Some types of grasses and wildflowers may also be found.

Typical Sonoran Desert vegetation consists mainly of paloverde, ironwood, smoke tree, mesquite tree, brittlebush, bur-sage, saguaro cactus, ocotillo cactus, barrel cactus, cholla cactus and scattered grasses and wildflowers. Also found are riparian vegetation such as mesquite trees, tules, cattail, saltcedar and cottonwood trees.

(3) Wildlife

The wildlife of the area in which the three alternative routes of the transmission system would be constructed is similar to that of the proposed system described in Section II.E. For ease of reference a summary of the wildlife is shown below.

(a) Invertebrates

Common invertebrates of the area are scorpions, earwigs, ticks, flies, bees, wasps, termites, ants, butterflies, moths, crickets, beetles, mosquitoes, and spiders. Species common to water habitats may be found in and around the Colorado, Hassayampa, and Bill Williams Rivers, catchments, stock tanks, and ponds.

(b) Fish

Fish species present in the Colorado River include largemouth bass, bluegill, black crappie, channel catfish, striped bass, and rainbow trout. Because no impacts on fish are foreseen, a listing of fish species was not included in the appended material.

(c) Amphibians and Reptiles

Table 1, Appendix C, lists 45 species of amphibians and reptiles that inhabit the area of the proposed transmission system. The most noticeable types of amphibians and reptiles include toads, lizards, and snakes.

(d) Birds

It is assumed that most of the birds listed in Table 2, Appendix C, are present in the areas of the alternatives since the habitat is very similar to that of the proposed transmission system. There are over 270 species that use the various habitat types in varying degrees. The waterfowl and shore birds listed are primarily confined to an area close to the Colorado River.

(e) Mammals

It is assumed that most of the mammals listed in Table 3, Appendix C, are present in the areas of the alternatives since the vegetation and terrain are very similar to that of the proposed transmission system. Wild mammals listed in the Appendix include 16 bats, 21 rodents, 2 rabbits, 9 carnivores, 2 omnivores, and 4 large herbivores.

(f) Threatened Species

There are seven species of wildlife whose ranges are included in the areas in question and who have been given special status in the Fish and Wildlife Service's 1973 edition of Threatened Wildlife of the United States. These species are the Gila monster (SU), southern bald eagle (E), prairie falcon (T), peregrine falcon (E), Yuma clapper rail (E), the osprey (SU), and the spotted bat (T).

(4) Archeology [75-80, 115, 131]

The Bureau of Reclamation obtained an archeological inventory of the proposed transmission system route location through the National Park Service. The survey in July 1973 of the Mead-Davis-Parker portion of the transmission system was contracted to the Southern Branch, Nevada Archeological Survey, University of Nevada, Las Vegas, Nevada. An archeological survey was conducted by the Arizona State Museum along the area to be affected by the Granite Reef Aqueduct in

June 1972. The results of this study are described in Section II.I. of the Granite Reef Aqueduct Final Environmental Statement, FES 74-5, Central Arizona Project. This survey would for the most part cover the area to be used by this alternate transmission line but additional study might be required.

(5) Historical [80, 138]

There are no historical sites as listed in the National Register of Historic Places dated April 2, 1974, that would be affected by construction of this transmission system.

(6) Recreation [135, 136]

Recreational use of the desert and urban-desert areas through which the transmission system will cross is mostly limited to horseback riding, off-road vehicle use, rock and gem hunting enthusiasts, and hunting for desert mule deer, varmints, small game and birds. Fishing, boating and water skiing to some extent exists where the transmission line would cross the Colorado River below Davis Dam.

(7) Noise

The most common sources of noise resulting from man's activities in areas where the single-purpose transmission system may be constructed are railroads, traffic over existing highways, airplanes, and off-road vehicles. Corona creates some sound effects that are inherent with overhead transmission of power at high voltages, and this is sometimes noticeable from existing lines in the area. This sound level is affected by weather conditions due to the air density and is more noticeable during periods of high humidity.

c. Environmental Impacts

Since the transmission system proposed in Chapter I contains several of the basic features included in Alternatives 1, 2 and 3, many of the environmental impacts of the alternatives will be the same as those described in Chapter III. Other impacts are distinctly individual by plan and will be discussed as they compare with impacts of the proposed plan, and the specific environments of the alternate contained herein.

This alternate would require the largest number of new transmission lines, structures, and substations and consequently would have the greatest environmental impact. A major new switchyard would be required in the vicinity of each pumping plant to terminate the 230-kV transmission lines. Impacts of each of the transmission lines would be similar to the impacts described in Chapter III, except that their magnitude would be much greater due to the duplication of facilities.

Specific environmental impacts are:

(1) Climate and Air Quality

The climate of the area in which the single-purpose transmission line would be located would not be affected. Air pollution from dust, smoke, and odors associated with the operation of the construction equipment would exist mostly in the area of direct activity. Workmen commuting between the worksite and their residences on unsurfaced access or County roads will add to the dust load because of the increased traffic volume. Heavy equipment-laden trucks delivering materials to the staging area will also contribute to dust pollution. Construction of new access roads and excavation for structure foundations where the surface is disturbed will be one of the contributing factors due to winds, whirlwinds, haboobs and dust devils.

The contractor would be required to sprinkle disturbed areas to prevent excessive dust.

(2) Vegetation

During the construction period, local disturbance of vegetation is anticipated. Vegetative clearings of storage sites, access roads, tower sites, substations, and spur roads will be required.

Tower site clearing may not be necessary except for the foundation footings that will result in a permanent loss of vegetation. If the towers are erected by crane, vegetation would be disturbed by the equipment even though the area would not be cleared. For the most part vegetation is sparse small shrubs; however, larger vegetation exists at the higher altitudes and some larger vegetation such as Joshua trees, ironwood, and paloverde may have to be removed. Precautions to minimize loss of vegetation would be included in construction plans.

Abandoned access roads and staging sites would be rehabilitated after construction so that vegetation would naturally reclaim the areas.

(3) Wildlife

Just as the wildlife that inhabits the area of the alternative systems is similar to that of the proposed system, the impacts on that wildlife are expected to be similar. The expected impacts on wildlife due to the proposed system are discussed in Chapter III.

(4) Archeology

The environmental impacts and the archeology of the single-purpose transmission system would be identical to the impacts of the proposed system described in Chapter III. Onsite archeological surveys along this proposed alinement have not been made. In the event this alternate was selected, an archeological survey would be performed and steps taken during construction to assure that no significant archeological values would be lost. The site would be flagged by an inspector, and proper authorities notified of its existence. Since the surveys and studies on the proposed route did not indicate significant or major values, it is expected that the impacts of the single-purpose transmission system would be the same as those in Chapter III.

(5) Historical [80, 138, 142]

Since there are no historical sites affected by the routing of this line, no adverse impacts are expected.

(6) Recreation

Little change in recreation would be realized as a result of constructing the single-purpose transmission system. Temporary interruptions may be experienced by off-road vehicle users traveling the access roads.

(7) Noise

Construction noise caused by construction equipment would be experienced by man mainly in the Davis Dam, Havasu City, and Havasu Pumping Plant areas. Construction noise would have a temporary impact on the wildlife in the immediate areas of activity.

2. Alternative No. 2

a. Description

In lieu of constructing the Mead-Davis 230-kV No. 2 and Davis-Parker 230-kV No. 2 transmission lines, consideration is being given to tapping the Bureau of Reclamation Mead-Liberty 345-kV transmission line to serve the Granite Reef Aqueduct pumping plants. This line would parallel an existing 69-kV transmission line from a substation in the Parker area called Buckskin Substation to a substation called Burro Creek Substation near Bagdad, Arizona. This proposed alternate is shown as alinement 2 on Figure 54.

This alternative would require a 345-kV or 345/230-kV Burro Creek Substation to be located south of Wikieup, Arizona, and west of Bagdad to take power from the existing 345-kV transmission line. A 45-mile transmission line would tie this substation to the Buckskin Substation. A new access road and right-of-way would be required, or the existing access road used for the 69-kV line would have to be enlarged for construction along the transmission line.

The Parker-Harcuvar-Liberty 230-kV line would still be required to provide service to the pumping plants along the Granite Reef Aqueduct and to back up the 345-kV tap on the Mead-Liberty line. Also, the McCullough-Mead 230-kV line would still be required to deliver power from the McCullough Switching Station to Mead Substation, a terminal for the Mead-Liberty 345-kV line.

The necessary transmission line to tap the Mead-Liberty line would have to traverse extremely rugged country and pass through an area presently occupied by only a small wood-pole line. Use of this system would require reserving 250 MW of capacity in the Mead-Liberty 345-kV line and preempting the use of this capacity by the Pacific Northwest-Pacific Southwest Intertie. In addition, the use of this line would be complicated by the addition of a phase shifter at Liberty Substation which will have to be installed by the Navajo Project participants to eliminate problems of circulating power flow caused by power schedules over the Mead-Liberty 345-kV line.

b. Description of the Environment [102]

This alternate alinement involves a 230-kV or 345-kV line connecting to the 345-kV Mead-Liberty transmission line in the vicinity of Bagdad, Arizona, and routed to Parker Dam, California. The alinement of the Parker-Liberty line is identical to that described in Chapter I and so the description of the environment described here will only concern itself with the Bagdad-Parker segment of the alternate.

(1) Climate and Air Quality

The climate of the area that the transmission line would traverse, from Wikieup, Arizona, south to the Buckskin Substation that would be located near the Havasu Pumping Plant, is typical of the arid Southwestern United States. It is characterized by long, hot summers; mild winters; sparse rainfall; low relative humidity; and high evaporative rates. Temperature extremes of 10°F. in the winter and 120°F. in the summer have been recorded. Sunshine occurs about 85 percent of the daylight hours. Temperatures along the route will vary a few degrees depending on elevation that ranges from approximately 3,000 feet to 600 feet.

The mean annual precipitation is approximately 5 inches along the Colorado River and about 10 inches at the higher elevations. Flash flooding is typical at various locations along the line.

Winds of high velocity, dust devils, haboobs and whirlwinds occur frequently throughout the year and carry considerable sand and dust. There is little dust pollution caused by vehicle travel over the access road as it is seldom used.

(2) Vegetation

The transmission line would traverse lands within the Mohave and Sonoran Deserts since the Bill Williams River is considered to be the transitional zone. Vegetation common to both deserts exists depending upon elevations and other conditions. Small brush and cacti are the common vegetation in the lower elevations near the Havasu

Pumping Plant. Riparian vegetation is also encountered at or near the Bill Williams River.

Typical Mohave Desert vegetation consists mainly of creosote bush/bur-sage, Mohave yuccas, various species of cacti, catclaw, Joshua trees, ephedra, paloverde trees, and smoke trees. Some types of grasses and wildflowers are also present.

Typical Sonoran Desert vegetation consists mainly of paloverde, mesquite, ironwood, smoke tree, brittlebush, bur-sage, and ocotillo, saguaro, barrel, and cholla cacti. Scattered grasses and wildflowers are also present.

(3) Wildlife

The wildlife that inhabits the area to be traversed by Alternative No. 2 is virtually the same as that of Alternative No. 1. It would be redundant to repeat the description given under Alternative No. 1. Lists of amphibians and reptiles, birds, and mammals are given in Appendix C.

(4) Archeology

An archeological survey has not been conducted on the Bagdad-Parker reach. In the event further consideration is given to selection of this system, a survey will be made and clearance obtained prior to construction. At the present time there are no known archeological sites along the route that have been selected. The route selected would be parallel and immediately adjacent to the Parker-Bagdad 69-kV transmission line.

(5) <u>Historical</u> [80, 108, 138, 142]

There are no historical sites, as listed in the National Register of Historic Places dated February 19, 1974, that would be affected by construction of this transmission system.

(6) <u>Recreation</u>

Recreational use of the desert area through which the transmission system will cross is largely limited to horseback riding, off-road vehicle use, rock and gem hunting and hunting for small game and birds. Some big game hunting for desert mule deer, javelina, and bighorn sheep may also be experienced.

(7) <u>Noise</u>

Most of the noise along the proposed route exists on both ends where highways are located and the area is inhabitated by man. Some noise by maintenance crews on the 69-kV transmission line is experienced occasionally. Airplanes also create noise and can be heard throughout the system. Some noise is created by corona from the existing 69-kV transmission line, especially during periods of high humidity.

c. Environmental Impacts

The 45-mile transmission line connecting the Burro Creek Substation with the Buckskin Substation would have a greater degree of esthetic impact than the proposed McCullough-Mead-Davis-Parker route because the line would traverse rugged country and pass through an area presently occupied by only a small wood-pole line. The line routing would pass through about 0.25 mile of the Havasu National Wildlife Refuge in the lower Bill Williams River area paralleling the existing Parker-Bagdad 69-kV transmission line.

Specific environmental impacts are:

(1) Climate and Air Quality

The climate of the area in which this transmission line would be located would not be affected.

Air pollution from dust, smoke, and odors associated with the operation of construction equipment would exist mostly in the areas of direct activity. Dust would be present from disturbed areas caused by winds, dust devils, haboobs, and whirlwinds. Workmen commuting between the worksite and their residences on unsurfaced access or County roads will add to the dust load because of the increased traffic. Heavy-equipment-laden trucks delivering materials to the staging areas would also contribute to dust pollution. Construction of new access roads or enlargement of the existing access road and excavation for structure foundations where the surface has been disturbed would be the major contributing factor.

The contractor would be required to sprinkle disturbed areas during construction to prevent excessive dust.

(2) Vegetation

During the construction period, local disturbance of vegetation, clearing of storage sites, access roads, tower sites, substations, and spur roads will be required. Tower site clearing may not be necessary except for the foundation footings that would result in a permanent loss to vegetation. If the towers are erected by crane, vegetation would be disturbed by the equipment even though the area would not be cleared. For the most part, vegetation is sparse and common to small brush. However, larger vegetation exists at the higher altitudes and some larger vegetation, such as Joshua trees, ironwood, and paloverde, may have to be removed. Precautions to minimize loss of vegetation would be included in construction plans.

Abandoned access roads and staging sites would be rehabilitated after construction so that vegetation would naturally reclaim the areas.

(3) Wildlife

Just as the wildlife that inhabits the area of the alternative systems is similar to that of the proposed system, the impacts on that wildlife are expected to be similar. The expected impacts on wildlife due to the proposed system are discussed in Chapter III.

(4) Archeology

An archeological survey of the proposed alinement of the transmission line would be conducted prior to any construction. Artifacts would be either left in place or removed and placed in designated depositories to assure that no significant values would be lost. It is expected that the archeological impact would be negligible.

(5) Historical [80, 108, 138, 141]

There are no known historical sites affected by the routing of this line.

(6) Recreation

Recreation in the area would probably increase slightly due to better access roads making it easier to travel. The hunting impact would be negligible due to the sparseness of game.

(7) Noise

Noise would be noticeable during construction in the area. Some wildlife would be disturbed along the transmission line. The Yuma clapper rail may be adversely affected in the event the routing of the line is in the immediate vicinity of their habitation.

3. Alternative No. 3

a. Description

In lieu of constructing the Mead-Davis 230-kV No. 2 and the Mead-McCullough transmission lines, consideration is being given to constructing a short tieline, approximately 4 or 5 miles in length, from the Davis Switchyard tying into the Southern California Edison Company's (SCE) Mohave Generating Station Switchyard which is connected to the McCullough Switching Station by means of a 500-kV line from Mohave to Eldorado to McCullough. This alternative would require wheeling of CAP power and energy over the existing SCE Eldorado-Mohave 500-kV line.

The additions from Davis to Parker to Liberty would be the same as in the system proposed in Chapter I and no new access roads would be required. This alternate is shown by alinement 3 on Figure 54.

A short access road approximately 4 or 5 miles in length and a right-of-way would be required from the SCE Mohave Generating Station located in Nevada to the Davis Switchyard located upstream in Arizona. This system is believed to be technically feasible and is still under study at this time.

b. Description of the Environment

For the most part Alternative No. 3 is geared to a wheeling agreement with SCE from the McCullough Switchyard to the Mohave Generating Station over an existing 500-kV transmission line. Accordingly, the environment described below will be for the interconnection between the Mohave Generating Station and the Davis Switchyard as the description of the environment for the rest of the system is described in Chapter II.

(1) Climate and Air Quality

The climate in the area where the short interconnection would be located is hot in the summer and mild in the winter. Extreme temperatures range from 15°F. to 120°F. and the elevation is less than

1,000 feet. It is characterized by long, dry, hot summers with less than 5 inches of rainfall per year.

Winds of high velocity occur frequently throughout the year and carry considerable dust and sand. At the present time, stack emissions from the Mohave Generating Station contribute to the clean air problem which is being experienced in the area; however, this is expected to improve when the SO_2 scrubber system is installed and in operation. Boat and car exhausts also contribute to the problem.

(2) Vegetation

This short reach of transmission line would be constructed through the Mohave Desert. Vegetation in the area where the transmission line would be located is very sparse and consists of small cacti and creosote bush/bur-sage. Immediately adjacent to the Colorado River, mesquite trees, arrowweed, catclaw, saltcedar, and willows are predominant.

(3) Wildlife

The wildlife that inhabits the area to be traversed by Alternative No. 3 is virtually the same as that of Alternative No. 1. It would be redundant to repeat the description given under Alternative

No. 1. Lists of amphibians and reptiles, birds, and mammals are given in Appendix C.

(4) Archeology

An archeological survey for this short reach of transmission line has not been conducted. In the event further consideration is given to selection of this system, a survey would be made and clearance obtained prior to construction. At the present time there are no known archeological sites along the route.

(5) Historical [80]

There are no known historical sites as listed in the National Register of Historic Places dated April 2, 1974, that would be affected by construction of this transmission system.

(6) Recreation

Recreational use of the desert area through which the transmission system will cross is largely limited to horseback riding, off-road vehicle use, rock and gem hunting and hunting. Water skiing and motor boating are found on the Colorado River and Lake Mohave.

(7) Noise

Most of the noise of the proposed route emanates from the existing highway, Colorado River, Mohave Generating Station, Bullhead City, and other areas inhabited by man. Airplanes can be heard throughout the system at various times.

c. Environmental Impact

This alternative plan has the environmental impacts of the selected plan in all areas except in Nevada where a short 230-kV transmission line 4 or 5 miles in length would be constructed from the Mohave Generating Station to the Davis Switchyard in lieu of the McCullough-Mead-Davis 230-kV line.

Specific environmental impacts are:

(1) Climate and Air Quality

The climate of the area in which this 230-kV transmission line would be located would not be affected.

Air pollution from dust, smoke, and odors associated with the operation of construction equipment would exist mostly in the areas of direct activity. Dust would be present from disturbed areas caused by

(7) Noise

Most of the noise of the proposed route emanates from the existing highway, Colorado River, Mohave Generating Station, Bullhead City, and other areas inhabited by man. Airplanes can be heard throughout the system at various times.

c. Environmental Impact

This alternative plan has the environmental impacts of the selected plan in all areas except in Nevada where a short 230-kV transmission line 4 or 5 miles in length would be constructed from the Mohave Generating Station to the Davis Switchyard in lieu of the McCullough-Mead-Davis 230-kV line.

Specific environmental impacts are:

(1) Climate and Air Quality

The climate of the area in which this 230-kV transmission line would be located would not be affected.

Air pollution from dust, smoke, and odors associated with the operation of construction equipment would exist mostly in the areas of direct activity. Dust would be present from disturbed areas caused by winds, dust devils, and whirlwinds. Workmen commuting between the work-site and their residences on unsurfaced access roads would add to the dust load because of the increased traffic volume. Heavy-equipment-laden trucks delivering materials to the staging areas would also contribute to dust pollution. Construction of new access roads and excavation for structure foundation where the surface has been disturbed would be the major contributing factor.

The contractor would be required to sprinkle disturbed areas during construction to prevent excessive dust.

(2) Vegetation

During the construction period, local disturbance of vegetation is anticipated. Vegetation clearing of storage sites, access roads, and spur roads will be required. Tower site clearings may not be necessary except for the foundation footings that would result in a permanent loss to vegetation. If the towers are erected by crane, vegetation would be disturbed by the equipment even though the area would not be cleared.

Precautions to minimize loss of vegetation would be included in construction plans.

No riparian vegetation at the Colorado River crossing would be disturbed.

(3) Wildlife

Just as the wildlife that inhabits the area of the alternative systems is similar to that of the proposed system, the impacts on that wildlife are expected to be similar. The expected impacts on wildlife due to the proposed system are discussed in Chapter III.

(4) Archeology

An archeological survey of the proposed alinement of the transmission line would be conducted prior to any construction. Artifacts would be either left in place or removed and placed in designated depositories to assure that no significant values would be lost. It is expected that the archeological impact would be negligible.

(5) Historical [80]

Since there are no historical sites affected by the routing of this line, no impacts are anticipated.

(6) Recreation

Recreation in the area would probably increase slightly due to another access road that would be used by motorcyclists and other trail travelers. The hunting impact would be negligible due to the sparseness of game.

(7) Noise

Noise would be noticeable during the short period of construction in the area. Some wildlife would be disturbed along the transmission line.

C. Routing and Location Alternatives within the Proposed Plan

1. Transmission Lines

Within the adopted concept of interconnecting with the existing Federal transmission system, there are alternatives of design, most of which result from differences in routing and substation requirements. These alternate routes traverse land similar to the plan presented in Chapter I. Consequently, description of the environment and impacts on the environment are similar to those outlined in Chapters II and III except that the overall magnitude of impacts will vary depending on changes in lengths of transmission lines proposed. The following discussions list the possible alternate routes and any impacts that may be peculiar to them. Table 8 shows a comparison of landownership, by miles, that the various alternate routes will cross.

a. McCullough-Mead 230-kV Transmission Line

An alternative to the construction of a new 230-kV connection between these two points is to make long-term contractual agreements with

TABLE 8
COMPARISON OF LANDOWNERSHIP FOR
ALTERNATE ROUTES OF
TRANSMISSION LINES

Route	Federal	Recreation	State	Private	Total Miles
Liberty-Parker 230-kV Segment					
Proposed	8.75	0	1.75	8.75	19.25
Route A	13.75	0	4.75	2.75	21.25
Route B	13.25	0	0	4.75	18.00
Route C	13.25	0	0	5.50	18.75
Route D	13.25	0	0.75	5.00	19.00
Route E	10.00	0	0.50	7.75	18.25
Harcuvar-Little Harquahala 115-kV					
Proposed	24.60	0	2.20	0	26.80
Alternate	25.0	0	1.00	2.75	28.75
Relocate Harcuvar Substation	30.5	0	5.0	0	35.50
Harcuvar-Bouse Hills 115-kV					
Proposed	16.9	0	4.0	1.70	22.60
Double-circuited to Liberty-Parker 230-kV	22.25	0	3.8	1.70	22.75
Relocate Harcuvar Substation	8.0	0	0	0	8.00
McCullough-Mead 230-kV					
Proposed	4.8	0	10.5	0	15.3
Avoid lands set aside under P.L. 85-339	15.0	0	3.75	0.5	19.25
Mead-Davis 230-kV					
Proposed	54.0	2.0	11.3	1.0	68.30
Parallel existing Mead-Davis No. 1 230-kV	27.7	22.25	10.75	0	60.70
McCullough-Davis 230-kV	50.0	2.0	8.5	1.0	61.50
Davis-Parker 230-kV					
Proposed	46.5	4.0	6.5	14.0	71.0
Alternate "A"	47.0	4.0	3.25	13.25	67.5
Alternate "B"	43.0	4.0	3.00	20.00	70.0
Avoid Aubrey Hills Scenic Area (BLM Proposal)	48.5	3.5	5.00	14.5	71.5

one of the owners and operators of an existing connecting line. The increasing power demand of the Southwest may, however, require and result in the eventual construction of this line. It is readily discerned from the discussion in Chapter III that the construction of the McCullough Mead segment has little if any adverse impact on the area.

As described in Chapter II, the proposed McCullough-Mead line will cross certain land in Eldorado Valley that has been set aside under Public Law 85-339 for use by the State of Nevada subject to submittal of a satisfactory plan of development to the United States Government. It is conceivable then that at some point in the near future, the proposed transmission line would have to be rerouted to accommodate possible development. Hence, consideration is being given to routing the line originally to avoid crossing this set-aside land and thus avoiding possible conflicts in the future.

This route would run north from the McCullough Switching Station paralleling the Navajo-McCullough 500-kV transmission line to the intersection of the proposed Oregon Border-Mead 750-kV d.c. transmission line. From this point it would run east paralleling the route of the proposed Oregon Border-Mead line to the Mead Substation. This route would be more expensive than the proposed plan due to the 6 to 8 miles additional length required.

b. McCullough-Davis 230-kV Transmission Line

A direct route between the McCullough Switching Station and the Davis Switchyard (Figure 55) would eliminate a terminal at the Mead Substation. Though this alternative has the economic advantages of eliminating the cost of additions to Mead Substation, future growth may create a demand for a new line between Mead Substation and Davis Switchyard. In order to uprate the total system, this bypass of Mead Substation is not included in the proposed plan.

This route would eliminate the interconnection to Mead Subtation and would connect the McCullough Switching Station directly to the Davis Switchyard. The line would run south from the McCullough Switching Station parallel to the SCE Mohave-Eldorado 500-kV transmission line for approximately 24 miles where it would intersect the proposed Mead-Davis No. 2 line, see Figure 3, and continue on to Davis Dam. It would be the most economical route overall, but would not provide an interconnection with the Mead Substation which is desirable in the Regional interconnected transmission system.

As stated above, the feasibility of bypassing Mead Substation is still being investigated from a technical point of view. The proposed initial CAP water delivery date of January 1985 provides adequate time to continue investigations concerning the transmission system. System uprating was foreseen during the planning of Mead Substation and it was constructed to provide for expansion and interconnecting facilities.

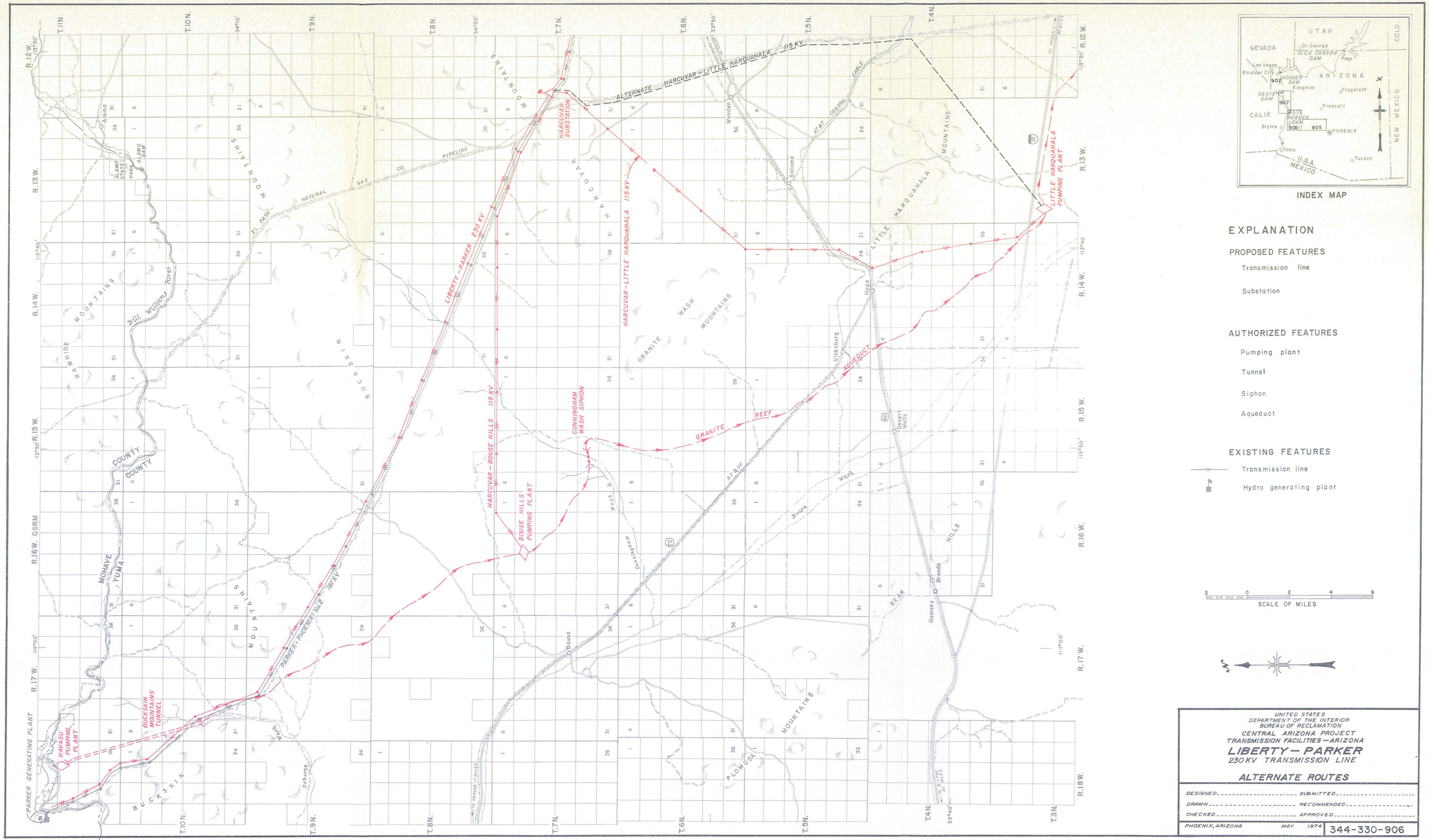
c. Mead-Davis No. 2, 230-kV Transmission Line

An alternative route for a portion of this segment of the system is shown on Figure 55. Access for construction is excellent because the route will parallel an existing 230-kV Bureau of Reclamation line. Due to adverse environmental impacts of crossing 24 miles of the Lake Mead National Recreation Area, the long Lake Mohave water crossing that would be required and the crossing of Katherine Landing, this alternative route is considered undesirable.

Rerouting the Mead-Davis segment to parallel an existing Bureau of Reclamation 230-kV line through the Lake Mead National Recreation Area will result in fewer construction and operating environmental impacts except for the adverse effect at the Lake Mohave and Katherine Landing crossings. The area is remote and the alternative alinement as shown on Figure 55 would have no visual effect.

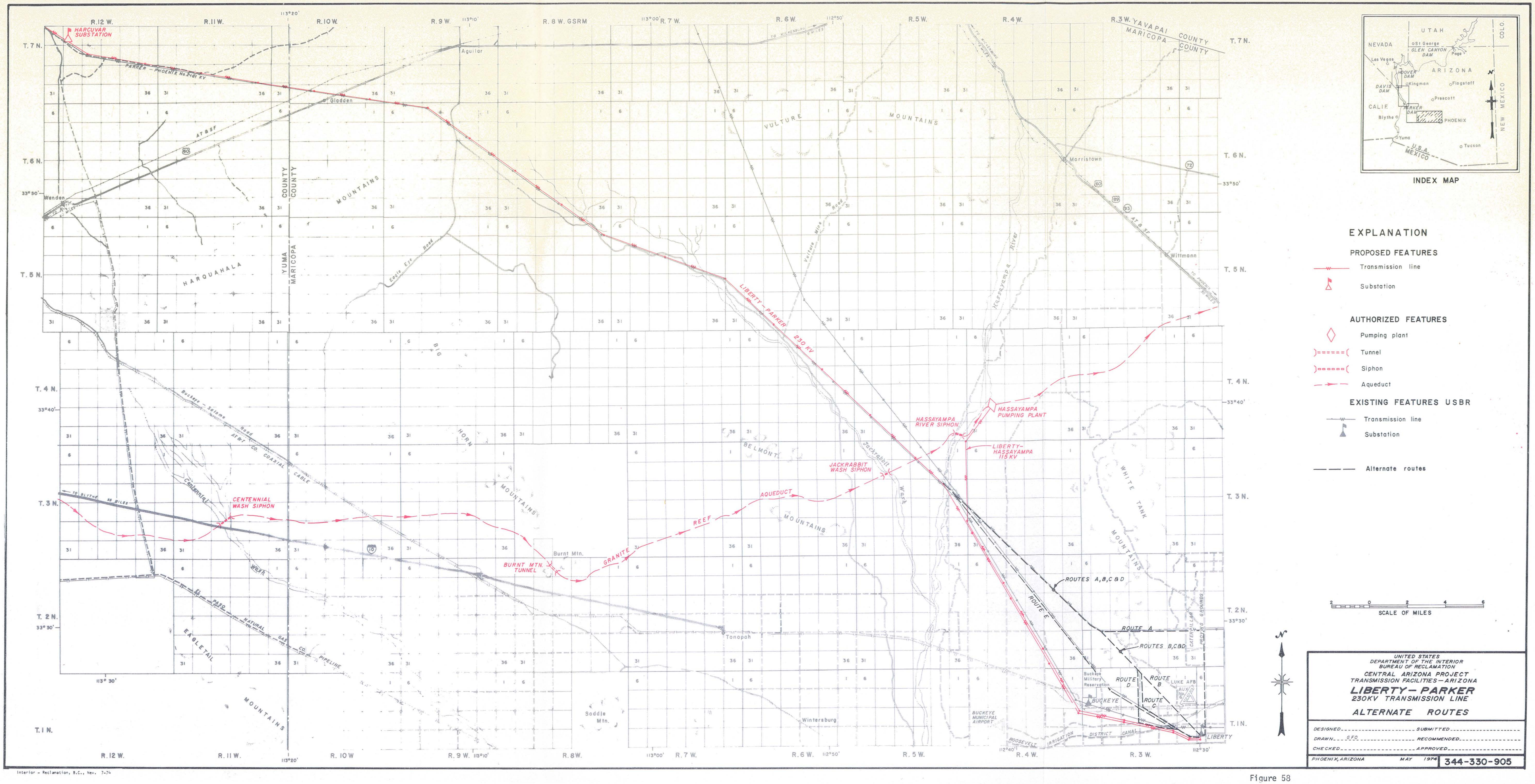
d. Davis-Parker No. 2, 230-kV Transmission Line

This segment of the transmission system between the Davis and Parker Switchyards would parallel an existing 230-kV Bureau of Reclamation line except for the bypass east of the Lake Havasu City area (Figure 56). Alternate "A" was the original proposed route prior to Citizens Utilities Company's proposal to build a substation approximately 5.5 miles north of Lake Havasu City. The proposed line would interconnect with the



Interior - Reclamation, B.C., Nev. 7-74

Figure 57


HARCUVAR SUBSTATION
PARKER - PHOENIX No. 2 161 KV
LIBERTY - PARKER 230 KV
HASSAYAMPA RIVER SIPHON
HASSAYAMPA PUMPING PLANT
LIBERTY-HASSAYAMPA 115 KV
JACKRABBIT WASH SIPHON
CENTENNIAL WASH SIPHON
BURNT MTN. TUNNEL
GRANITE REEF AQUEDUCT
ROUTES A, B, C & D
ROUTE E
ROUTE A
ROUTES B, C & D
ROUTE D
ROUTE B
ROUTE C
Aguilar
Gladden
Wenden
Morristown
Wittmann
Tonopah
Wintersburg
Buckeye
LUKE AFB
LIBERTY
VULTURE MOUNTAINS
HARQUAHALA MOUNTAINS
BIG HORN MOUNTAINS
BELMONT MOUNTAINS
WHITE TANK MOUNTAINS
EAGLETAIL MOUNTAINS
YUMA COUNTY
MARICOPA COUNTY
YAVAPAI COUNTY
INDEX MAP
EXPLANATION
PROPOSED FEATURES
Transmission line
Substation
AUTHORIZED FEATURES
Pumping plant
Tunnel
Siphon
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EXISTING FEATURES USBR
Transmission line
Substation
Alternate routes
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES—ARIZONA
LIBERTY—PARKER
230KV TRANSMISSION LINE
ALTERNATE ROUTES
DESIGNED
SUBMITTED
DRAWN GFO
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA
MAY 1974
344-330-905
Interior - Reclamation, B.C., Nev. 7-74

Figure 58

Citizens Utilities Company's Substation in order to supply the growing needs of the Lake Havasu City area. Therefore, the line was rerouted to provide a shorter interconnection to the substation. Alternate "B" route (Figure 56) would parallel the line through the community either by a separate line or by replacing the existing line with a double-circuit system. Alternate "B" would be considered an undesirable impact by the residents of Lake Havasu City.

The Bureau of Land Management has proposed another alternate route that would keep the line east of State Highway 95 south of Lake Havasu City until it approaches the proposed Colorado River crossing into the Parker Switchyard. This routing would keep the line out of the proposed Aubrey Hills scenic area of the Havasu Planning Unit. This routing would incur considerable additional cost as the terrain to be crossed is much more rugged than the proposed alinement. A new access road for the line would open up a portion of a relatively unspoiled area. Negotiations are continuing with BLM to reach an optimum alinement.

e. Liberty-Parker 230-kV Transmission Line

The portion of the system that links the Parker Switchyard and the Liberty Substation near Phoenix is approximately 121 miles long (Figures 57 and 58). It will replace a line about 137 miles in length that terminates at Phoenix Substation located near 43rd Avenue and Van Buren Street in southwest Phoenix. The new 230-kV transmission line will be constructed on the existing right-of-way until it reaches an area near the Hassayampa River, which is about 18 miles west of the terminal at Liberty Substation. From this point, new routing into Liberty Substation will be required.

Various routings were studied for this 18-mile-long segment. Final route selection was determined by a comparison of impacts of the alternative routings. As shown by Figure 58, Route A will pass too near the Caterpillar Tractor Company Proving Ground and two airplane landing fields; Route B will cross 3.5 miles of irrigated farmland and requires the acquisition of 7.5 miles of new right-of-way where it does not parallel existing lines; Route C will not parallel existing lines for 8 miles, requiring the acquisition of new rights-of-way, and crosses the Sonoran Heights Subdivision and the Phoenix Skyline West Subdivision; and Route D will cross various existing transmission lines requiring the use of single-circuit towers and additional right-of-way for these crossovers. Route E would parallel the existing Mead-Liberty 345-kV line to Liberty Substation. It would also cross the Sonoran Heights Subdivision and the Phoenix Skyline West Subdivision.

f. <u>Liberty-Hassayampa Pumping Plant 115-kV Radial Transmission Line</u>

The proposed method as discussed in Chapter I of providing power to the Hassayampa Pumping Plant will require installation of a

115-kV radial transmission line from Liberty Substation. The location of the pumping plant makes it possible to parallel the 230-kV Parker-Liberty line for the 18-mile distance from Liberty Substation to the Hassayampa River. A separate single-circuit line paralleling the proposed alinement would add reliability to the system but would require additional right-of-way.

g. Harcuvar-Little Harquahala and Bouse Hills Pumping Plants 115-kV Radial Transmission Lines

There are many advantages to constructing a transmission line parallel to existing utility or other transmission line right-of-way, including the availability of existing maintenance roads for construction and use of an area that has an established land use. An alternate to the route as described in Chapter I is 6 miles longer, but is considered because it is parallel to the underground pipeline operated by the El Paso Natural Gas Company. This route runs directly south from the Harcuvar Substation as shown on Figure 57, and while the adverse impact of road construction is minimized, there will be added impacts of crossing areas of irrigated agricultural land near Centennial Wash.

An alternate for the Harcuvar-Bouse Hills 115-kV radial transmission line is to parallel the 230-kV proposed line for 16 miles on double-circuited towers and then run tangent to the Bouse Hills Pumping Plant. This alternate would shorten the amount of new ground crossed and reduce the overall number of towers. The line would be longer and more costly under this alternate.

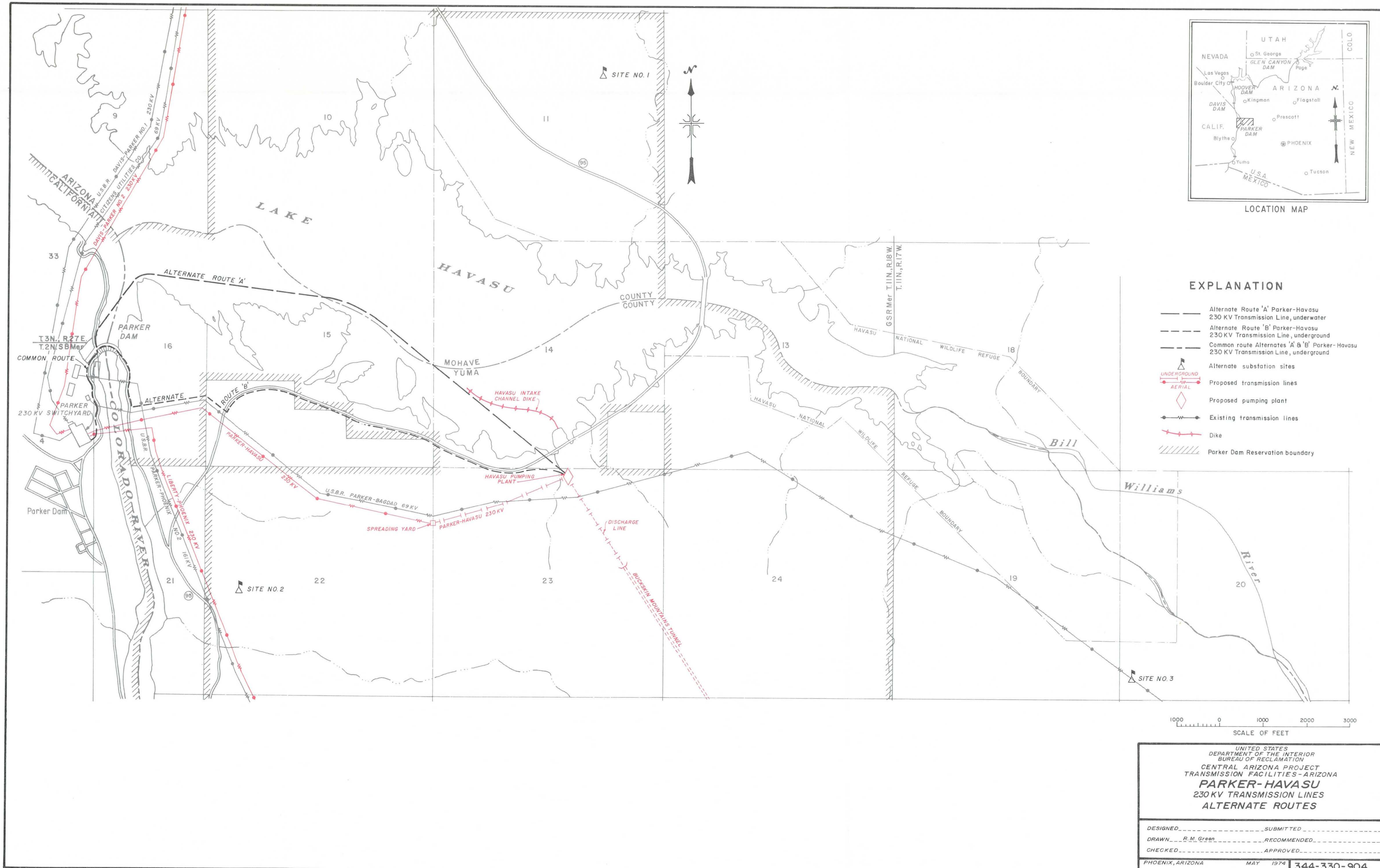
h. Parker-Havasu Pumping Plant Radial Transmission Line

The choice of an underground cable system for six-tenths of a mile on the 230-kV line between Parker Dam Switchyard and Havasu Pumping Plant provides compatibility with the special design of the pumping plant and will eliminate the visual impacts of steel towers. Alternates for the connection (Figure 59) include:

(1) The use of three steel towers for the six-tenths of a mile. The system of towers has proven to be reliable, with maintenance and construction costs more economical than the underground cable installation. The pumping plant is designed to be underground to enhance its appearance and will require structures for the transition from overhead transmission. To reduce the esthetic impacts of overhead suspension from towers in the immediate vicinity of the pumping plant, this alternative was not selected.

(2) Underground cable system for the entire route. The planned route is 2.2 miles in length. Routes that cover the entire distance between the switchyard and the pumping plant with underground cables (Figure 59) would either follow the highway (Route B) or the cables would be submerged below the bottom of Lake Havasu (Route A). The distance by either of these routes is approximately 3 miles.

To provide adequate reliability, two parallel underground lines would be required in an underground system. Oil for coolant would



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
TRANSMISSION FACILITIES - ARIZONA
PARKER-HAVASU
230 KV TRANSMISSION LINES
ALTERNATE ROUTES
DESIGNED
SUBMITTED
DRAWN R. M. Green
RECOMMENDED
CHECKED
APPROVED
PHOENIX, ARIZONA
MAY 1974
344-330-904
EXPLANATION
Alternate Route 'A' Parker-Havasu 230 KV Transmission Line, underwater
Alternate Route 'B' Parker-Havasu 230 KV Transmission Line, underground
Common route Alternates 'A' & 'B' Parker-Havasu 230 KV Transmission Line, underground
Alternate substation sites
UNDERGROUND
AERIAL
Proposed transmission lines
Proposed pumping plant
Existing transmission lines
Dike
Parker Dam Reservation boundary
LOCATION MAP
UTAH
NEVADA
COLO
St. George
GLEN CANYON DAM
Page
Las Vegas
Boulder City
HOOVER DAM
ARIZONA
Kingman
Flagstaff
DAVIS DAM
Prescott
CALIF.
PARKER DAM
Blythe
PHOENIX
NEW MEXICO
Yuma
Tucson
U.S.A.
MEXICO
SCALE OF FEET
1000
0
1000
2000
3000
LAKE
HAVASU
SITE NO. 1
SITE NO. 2
SITE NO. 3
ARIZONA
CALIFORNIA
U.S.B.R. DAVIS-PARKER NO. 1 230 KV
CITIZENS UTILITIES CO. 69 KV
DAVIS-PARKER NO. 2 230 KV
ALTERNATE ROUTE 'A'
ALTERNATE ROUTE 'B'
COMMON ROUTE
T.3N., R.27E.
T.2N. S.B.Mer.
PARKER DAM
PARKER 230 KV SWITCHYARD
COUNTY
COUNTY
MOHAVE
YUMA
HAVASU INTAKE CHANNEL DIKE
HAVASU PUMPING PLANT
DISCHARGE LINE
BUCKSKIN MOUNTAINS TUNNEL
PARKER-HAVASU 230 KV
U.S.B.R. PARKER-BAGDAD 69 KV
SPREADING YARD
U.S.B.R. PARKER-PHOENIX NO. 2 161 KV
LIBERTY-PHOENIX 230 KV
COLORADO RIVER
Parker Dam
HAVASU NATIONAL WILDLIFE REFUGE BOUNDARY
G.S.R.Mer. T.11N., R.18W.
T.11N., R.17W.
Bill Williams River
95
9
10
11
33
16
15
14
13
18
4
21
22
23
24
19
20

Figure 59

be pumped through the conduits in which the cables are installed. The underwater routes open up the possibility of water pollution of Lake Havasu should an oil leak occur. In addition, repair costs for the underwater route would be extremely high.

2. Substations

a. Mead Substation

The proposed transmission system described in Chapter I includes termination facilities at Mead Substation for both the McCullough-Mead and Mead-Davis 230-kV lines. As described above in the alternative routings of transmission lines, it may be desirable to bypass Mead Substation and route the line directly from McCullough Switchyard to Davis. Studies are currently underway to determine the feasibility of eliminating the tie-in to Mead Substation.

b. Buckskin Substation

Consideration was given to constructing Buckskin Substation in the vicinity of the Havasu Pumping Plant in lieu of tying into Parker Switchyard. Several alternative locations were studied for this substation in the Parker area in order to minimize the environmental impact at the Havasu Pumping Plant.

For each location power would be supplied to the pumping plant by means of underground cables from the remote substation location. The sites considered as alternatives for the Buckskin Substation as indicated on Figure 59 are as follows:

(1) Approximately 2 miles north of the Havasu Pumping Plant across the Bill Williams River.

(2) Approximately 1.5 miles southwest of the pumping plant.

(3) Approximately 4 miles east of the pumping plant on the south side of the Bill Williams River.

After review of economic and environmental factors of constructing a separate Buckskin Substation, it was decided to make use of existing facilities at Parker Dam. There is space for 230-kV breaker bays available at Parker for use by CAP.

c. Hassayampa Substation [1, 3]

Original plans for the Granite Reef Aqueduct included a pumping plant at Mile 100.5 called Belmont Mountain Pumping Plant. This pumping plant, along with the Hassayampa Pumping Plant at Mile 112.9, were to have been served out of a new Hassayampa Substation which would be built on the Parker-Liberty 230-kV line approximately 25 miles out from Liberty Substation. After the Belmont Mountain Pumping Plant was eliminated, it was decided the optimum method of serving the Hassayampa Pumping Plant would be through a 115-kV transmission line from Liberty Substation, eliminating the necessity for an additional substation on the Parker-Liberty 230-kV line.

d. Harcuvar Substation

An alternate location for the Harcuvar Substation would be approximately 8.0 miles north of the Bouse Hills Pumping Plant on the alinement of the proposed Liberty-Parker 230-kV line. Radial transmission lines, either single- or double-circuited, would be required to the Bouse Hills and Little Harquahala Pumping Plants. This alternate would shorten the overall length of a 115-kV radial transmission line required for the two plants by 3 miles.

Due to the age and increased maintenance costs of the Parker-Phoenix 161-kV No. 2 line, it will probably be removed. At a future point in time, removal of this line will require a new feeder from the existing Eagle Eye Substation to Harcuvar Substation. Therefore, this location for Harcuvar would require a longer future transmission line, about 20 miles, from Eagle Eye Substation.

D. Alternatives in the Design

1. Transmission Lines [1, 2, 3, 29, 126-128]

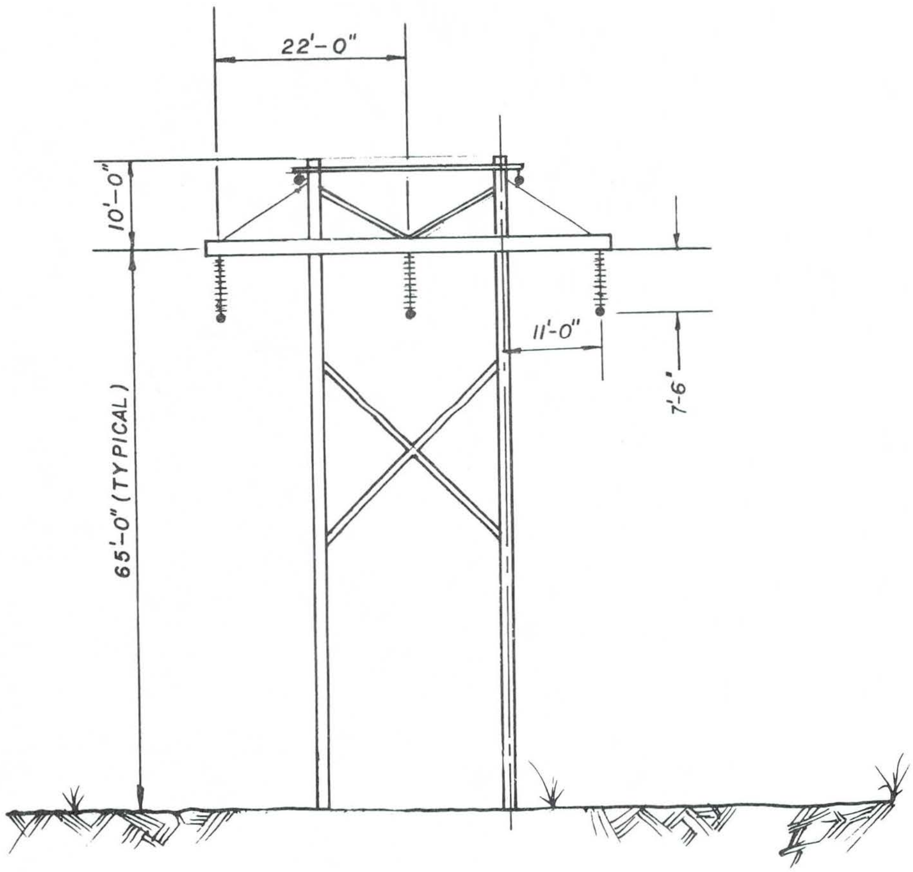
a. Underground Transmission Lines

The cross-country use of underground installation of high voltage transmission lines has not been developed to a practical or economical stage. This has been stated in greater detail in the environmental statements on the Navajo Project, FES 72-1, and the Central Arizona Project, FES 72-35.

b. Structures

Free-standing, lattice-steel towers are the most desirable type of construction for 230-kV lines in rural areas. Their open-lattice construction work makes them less visible at a distance than the solid lines of tubular steel or wood-pole structures. Tubular steel structures (Figures 26, 27 and 32) are more pleasing in urban surroundings because of their simple and narrow configuration.

Wood-pole, H-frame structures of the type shown in Figure 60 are an alternate for lattice steel structures on the 230-kV lines. Wood-pole structures were considered for the Liberty-Parker 230-kV line since it parallels an existing Parker-Phoenix No. 2 161-kV line. However, as



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

230 KV TRANSMISSION LINE
SINGLE CIRCUIT- H- FRAME
WOOD POLE STRUCTURE

DRAWN Bill Logan	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED
PHOENIX, ARIZONA MAY, 1974	344-330-T-296

Figure 60

explained previously, this existing line will, in all probability, be removed in the future. Also, due to the different voltage ratings of the lines, the new structures would be taller and at different span lengths than the existing line.

Lattice-steel guyed-type towers were also considered for the 230-kV lines. Figure 60A depicts two types of guyed towers. Guyed towers were found to be undesirable for the following reasons:

(1) Guyed towers require much more land area than free-standing towers.

(2) Collisions with the nearly invisible guys by animals, humans, and vehicles often occur.

(3) Most of the lines are parallel to existing free-standing lattice-steel type towers.

(4) The Bureau of Reclamation has experienced problems with vandals tampering with guys on one experimental section of guyed towers.

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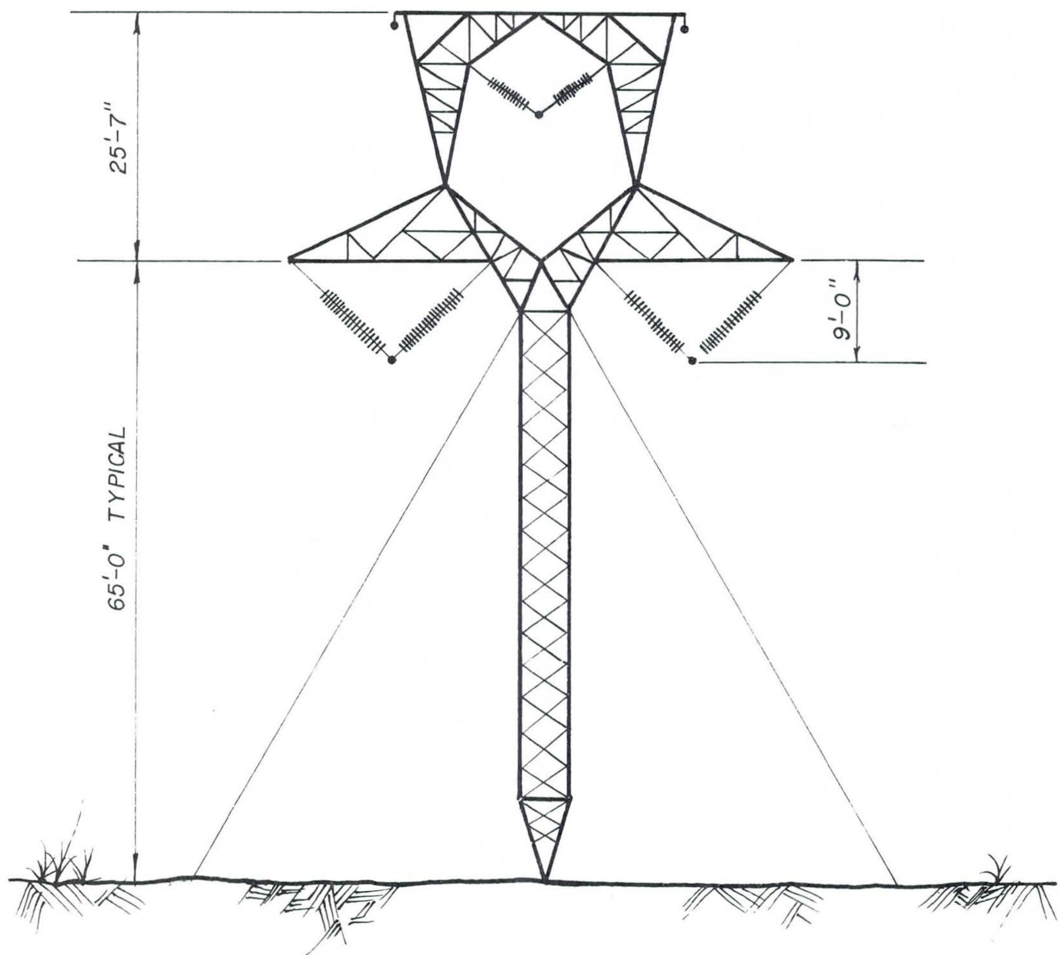
2. Switchyards and Substations

Modern design, square tubular steel structures were considered for additions to the Davis and Parker 230-kV Switchyards. These structures would be incompatible in appearance with the existing lattice-type structures. The replacement of the existing lattice-type structures with tubular structures is not considered to be a realistic and reasonable alternative.



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

230 KV TRANSMISSION LINE
SINGLE CIRCUIT
GUYED STEEL LATTICE STRUCTURE

DRAWN Bill Hogan	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED
PHOENIX, ARIZONA MAY, 1974	344-330-T-295

Figure 60-A

Mead and Liberty Substations and McCullough Switching Station are all of modern design and no alternatives other than to match the existing installations were considered for additions to these facilities.

3. Check Structure Distribution Lines

An alternative to the buried power cables which supply power to each check structure is overhead lines. Conventional wood-pole lines with pole-mounted transformers, fused cutouts, and other equipment may offer some cost savings but were not selected because of their greater esthetic and environmental impacts.

The alternative of no construction of check structure feeders would require an onsite power supply at each site to operate the gates and supervisory control and telemetering equipment. Gas-powered, engine-generator sets are undesirable for all but standby use because continuous operation would produce noise and have a higher operation and maintenance cost and less reliability than an underground or overhead power supply.

Fuel cells or solar energy power supplies would eliminate most of the noise problems but would require a larger, more costly onsite installation and have higher operation and maintenance costs. Also, they are mainly in the experimental stage at this time.

E. The Alternative of No Action

A no-action alternative would be no construction of the 230-kV backbone power transmission system which extends from McCullough Switching Station near Las Vegas, Nevada, to Liberty Substation, near Phoenix, Arizona, or the radial transmission lines to Havasu, Bouse Hills, Little Harquahala, and Hassayampa Pumping Plants. With no alternative replacement feature, this alternative would preclude meeting the objectives of the CAP as set forth by Congress in Public Law 90-537 and outlined in the overall final environmental statement for Central Arizona Project, FES 72-35.

The impacts of no CAP construction are described in previous CAP environmental statements. The impacts caused by construction of the Havasu Intake Channel Dike will remain as they were previously described in the environmental statement, FES 73-2. Construction of the flood detention dikes for Reach 11 of the Granite Reef Aqueduct will continue. The impacts caused by these dikes are described in the Granite Reef Aqueduct environmental statement. The Government would continue to be a participant in the Navajo Project and sell its share of power to other participants. The Parker-Davis Project would continue to maintain the wood pole 161-kv Parker-Phoenix lines. This would entail replacing structures when necessary.

A method of relieving the power supply problems predicted by load flow studies for the area southwest of Phoenix will have to be found. This will probably require the construction of the Davis to Parker No. 2 230-kV line as described in Chapter I.

Any alternate plan to service the electrical requirements of the Granite Reef Aqueduct Pumping Plants with steam or gas turbines or internal combustion engines would require much larger pumping plant sites. A method of fuel delivery, such as railroad, highway, or pipeline, would have to be constructed to each pumping plant from the fuel supply. All of the suitable fuels available except coal are now in short supply in this area.

At this time, no technically feasible method is available of utilizing solar energy or wind power to provide the electrical requirements of the individual pumping plants.

F. The Alternative of Postponing the Action

The transmission system, as discussed in Chapter I, is a portion of one of the major features of the Central Arizona Project. It performs the primary function of delivering power to the pumps on the Granite Reef Aqueduct. By interconnecting with and replacing a portion of the existing Parker-Davis Project transmission system, it also uprates that system.

The schedule for completion of the transmission line system has been made to coincide with and provide feature operation capability upon the completion of the Granite Reef Aqueduct.

Power to the pumping plants depends on replacement of Parker-Phoenix 161-kV transmission line with a 230-kV Parker-Liberty line. In order to provide reliability to the system while this line is being replaced, it is necessary to first install the line between the Davis and Parker Switchyards.

Construction schedule studies to obtain the greatest benefits of value engineering and reducing construction costs have resulted in the present program. Any postponement of the scheduled starts will cause acceleration of the construction schedule which will increase costs since it will be required that completion dates still be met.

CHAPTER IX

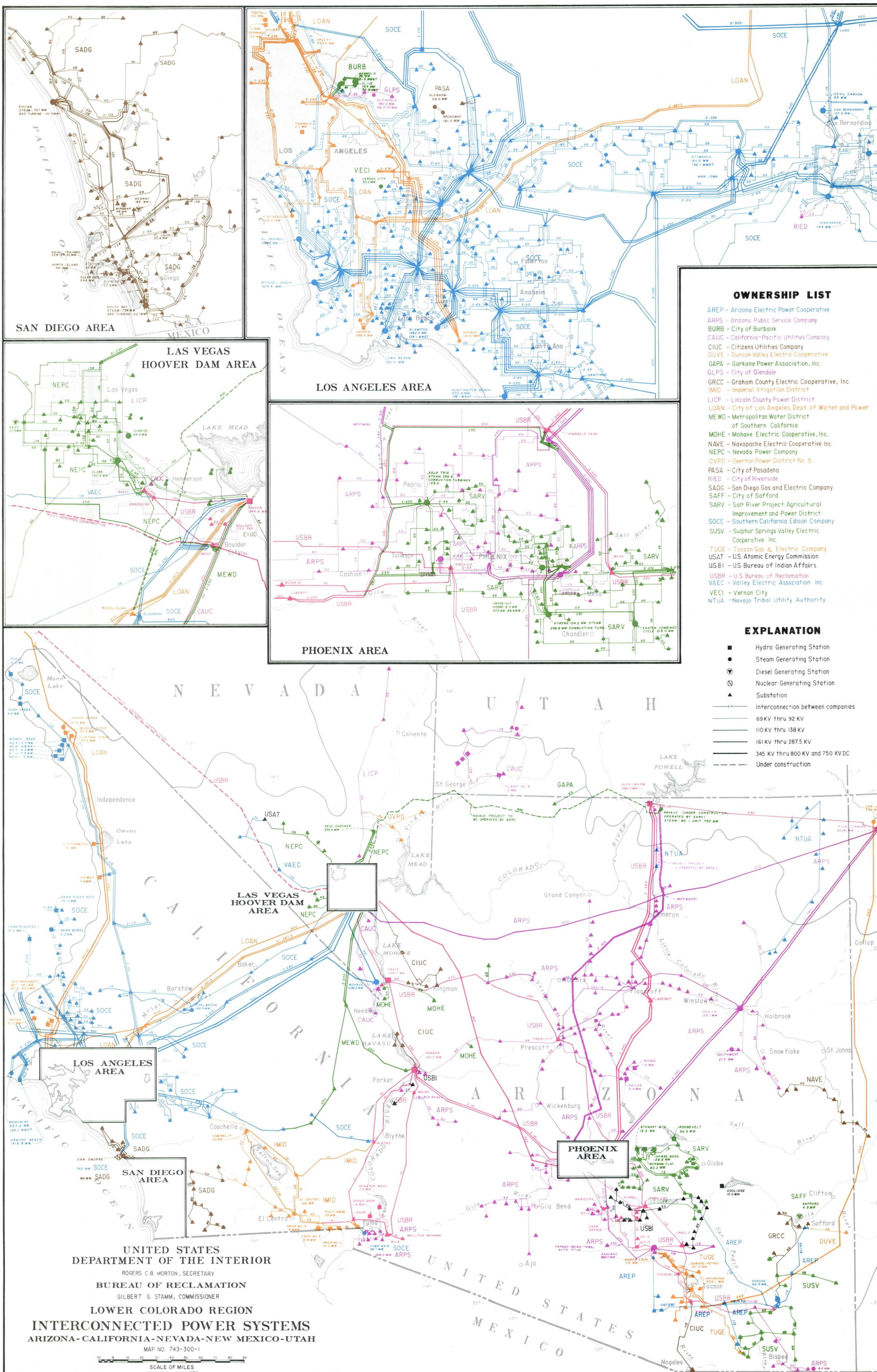
CONSULTATION AND COORDINATION

IX. CONSULTATION AND COORDINATION

A. Consultation and Coordination During Development of the Proposal and During the Preparation of the Draft Environmental Statement

Coordination with local entities, public and private, has been affected during the process of statement preparation and facility planning location and design. A knowledge of the complexity of multiownership power generation, transmission, and supply has been but one element of the coordination and cooperation. Knowledge and familiarity with the planning and goals of future power generation units and existing facilities are part of the background required to develop the plan for the system and alternatives as described.

Map No. 743-300-1 shows the interconnected nature of the system in the Southwest United States that integrates and interconnects hydroelectric and thermal generation units in Arizona, southern California, southern Nevada, Utah, and western New Mexico. The WSCC (Western Systems Coordinating Council) is a formal coordinating organization of which the Bureau of Reclamation is a member. Planning to meet loads during the periods that this transmission system will be under construction and the initial pumping of project water indicate that the following units have reached the stages of extensive detailed environmental studies and preliminary designs:



SAN DIEGO AREA
LOS ANGELES AREA
LAS VEGAS HOOVER DAM AREA
PHOENIX AREA
NEVADA
UTAH
CALIFORNIA
ARIZONA
PACIFIC OCEAN
UNITED STATES
MEXICO
OWNERSHIP LIST
AREP – Arizona Electric Power Cooperative
ARPS – Arizona Public Service Company
BURB – City of Burbank
CAUC – California-Pacific Utilities Company
CIUC – Citizens Utilities Company
DUVE – Duncan Valley Electric Cooperative
GAPA – Garkane Power Association, Inc.
GLPS – City of Glendale
GRCC – Graham County Electric Cooperative, Inc.
IMID – Imperial Irrigation District
LICP – Lincoln County Power District
LOAN – City of Los Angeles, Dept. of Water and Power
MEWD – Metropolitan Water District of Southern California
MOHE – Mohave Electric Cooperative, Inc.
NAVE – Navopache Electric Cooperative Inc.
NEPC – Nevada Power Company
OVPD – Overton Power District No. 5
PASA – City of Pasadena
RIED – City of Riverside
SADG – San Diego Gas and Electric Company
SAFF – City of Safford
SARV – Salt River Project Agricultural Improvement and Power District
SOCE – Southern California Edison Company
SUSV – Sulphur Springs Valley Electric Cooperative Inc.
TUGE – Tucson Gas & Electric Company
USAT – U.S. Atomic Energy Commission
US.BI – U.S. Bureau of Indian Affairs
USBR – U.S. Bureau of Reclamation
VAEC – Valley Electric Association Inc.
VECI – Vernon City
NTUA – Navajo Tribal Utility Authority
EXPLANATION
Hydro Generating Station
Steam Generating Station
Diesel Generating Station
Nuclear Generating Station
Substation
Interconnection between companies
69 KV thru 92 KV
110 KV thru 138 KV
161 KV thru 287.5 KV
345 KV thru 800 KV and 750 KV DC
Under construction
UNITED STATES
DEPARTMENT OF THE INTERIOR
ROGERS C.B. MORTON, SECRETARY
BUREAU OF RECLAMATION
GILBERT G. STAMM, COMMISSIONER
LOWER COLORADO REGION
INTERCONNECTED POWER SYSTEMS
ARIZONA-CALIFORNIA-NEVADA-NEW MEXICO-UTAH
MAP NO. 743-300-1
SCALE OF MILES
REVISED JULY 1974

	Organization	Use	Unit	Capacity	Type	Location
1.	Bureau of Reclamation	Load	Desalting Unit	-	-	Yuma, Arizona
2.	APS Company	Generation	Palo Verde Nuclear Power Project	1,250 MW	Nuclear	Wintersburg, Arizona
3.	APS Company	Generation	Cholla Plant Addition	-	Coal	Joseph City, Arizona
4.	Salt River Project	Generation	Coronado Power Station	1,050 MW	Coal	Near St. John or Snowflake, Arizona
5.	WEST	Generation	Kapairowitz	3,000 MW	Coal	Southern Utah
6.	San Dieto Gas & Elec. Co.	Generation		3,300 MW	Nuclear	Near Blythe, Calif. (Possibly on Colorado River Indian Reservation)
7.	LADWP	Generation	Earp Generating Station	-	Nuclear	Earp, Calif.
8.	Arizona Power Authority	Generation	Montezuma Pumped Storage	1,000 MW	Hydro	Gila River Indian reservation
9.	Arizona Atomic Energy Comm.	Generation	Nuclear Power Desalting Plant	2,000 MW	Nuclear	San Luis, Arizona

The above tabulation indicates the numerous plants of entities that are forthcoming in the relatively near future (5 to 10 years). General and specific discussions with technical, planning, and environmental personnel of the Arizona Public Service Company (APS), Salt River Project (SRP), Bureau of Land Management, Arizona State Land Department, Arizona Atomic Energy Commission, and Citizens Utilities Company, indicate that Reclamation may expect future interconnections with the Liberty, Westwing, Pinnacle Peak, Mesa, Coolidge, and Tucson Substations or switching yards. These interconnections would result from the Palo Verde Nuclear Generating Station (PVNGS), Cholla Powerplant addition, and the Coronado Generating Station. As an example from the Palo Verde Nuclear Generating Station, one connection would be to the Westwing Substation, one to the SRP Kyrene Substation and Powerplant possibly through the Liberty Substation, one line to the APS Saguaro Plant and one to the Tucson Gas and Electric Vail Substation. The Vail Substation is a terminus for the Four Corners-Vail Line, and Saguaro is a terminus for the Cholla (APS) Powerplant addition.

It has been estimated that the electric power requirements in this Region are expected to increase by forty-fold between 1965 and 2020. The listed projects are an indication of the magnitude of the facilities which will be required to serve this upcoming load.

1. <u>State and Local Participation in the Development of the Draft Environmental Statement</u>

Agencies of State and local Governments were notified during the initiation of the environmental statement preparation process through the

OMB A-95 Clearinghouse Notification Procedures. Responses were received from the following agencies, and are shown in Appendix A. Office consultation and coordination were performed with the Evaluation and Planning Branch of the Arizona Game and Fish Department, the Division of Colorado River Resources, State of Nevada, and the Clark County Regional Planning Council.

<u>Arizona</u>

Office of Economic Planning and Development

Arizona Real Estate Department

Arizona Power Authority

Agriculture and Horticulture Department

Department of Economic Security

Arizona Outdoor Recreation Coordinating Commission

State Land Department

Environmental Planning Division, Department of Highways

Department of Anthropology, Arizona State University

State Water Commission

Arizona Bureau of Mines

Arizona Game and Fish Department

Civil Rights Division, Department of Law

District No. 4, Council of Governments, Yuma, Arizona

Arizona Department of Health

Arizona State Parks Department

Department of Public Safety

Arizona Historical Society

Arizona Health Planning Department

Maricopa Association of Governments, Public Works Committee and Planning Committee

City of Scottsdale

City of Mesa, Planning Department

Maricopa County Planning and Zoning Department

City of Phoenix, Planning Department

City of Phoenix, City Manager

City of Glendale

City of Chandler, Public Works Department

Maricopa County Highway Department

Department of Mineral Resources

Indian Affairs Commission

Arizona State Museum

Arid Lands Studies

Arizona Mining Association

California

Office of the Lieutenant Governor

Office of Intergovernmental Management

Southern California Association of Governments

Nevada

State Planning Coordinator

Clark County Regional Planning Council

Colorado River Commission of Nevada (now known as Division of Colorado River Resources)

The State of Arizona has a Powerplant and Transmission Line Siting Committee that is composed of 18 members drawn from the following: State Attorney General, State Land Commissioner, Chairman, Water Quality Control Board; State Health Department; Director, State Air Pollution Control Division, State Health Department; Director, Game and Fish Department; Executive Director, Arizona Water Commission; Office of Economic Planning and Development; Chairman, Corporation Commission; Chairman, University of Arizona Department of Archeology; Director, State Parks Department; Director, Arizona Atomic Energy Commission; two public members, two members from and representing city governments, two members from and representing county governments, and one landscape architect. Most of the membership is notified for coordination of input through their capacity as State or local agency administrators who receive notification through the State Clearinghouse procedure. This committee has no jurisdiction over siting of Federal facilities but has been notified separately for information and coordination purposes.

2. <u>Coordination with Federal Agencies in the Preparation of This Draft Environmental Statement</u>

Federal agencies that have been consulted in the preparation of this environmental statement include the Bureau of Land Management (which has jurisdiction over much of the Federal land that the transmission line will traverse), the National Park Service's Arizona Archeological Center (which coordinated studies for inventorying the archeological resources existing along the alinement) and the Fish and Wildlife Service (for its particular interest in the alinement of Alternate No. 2 along Burro Creek).

3. <u>Involvement of the Central Arizona Project Environmental Advisory Group in the Preparation of this Draft Environmental Statement</u>

The Central Arizona Project Environmental Advisory Group was established by the Commissioner of the Bureau of Reclamation in 1971 for the purpose of affording the general public an opportunity to actively participate with Reclamation in an advisory capacity on environmental planning for the CAP. The advisory group is a seven-member committee listed as follows:

<u>Name</u>	<u>Organization Represented</u>
Mrs. Stephen Detzer	League of Women Voters

Mr. Rich Johnson	Central Arizona Project Association
Mr. Ray Killian	Central Arizona Water Conservation District
Mr. F. J. MacDonald	Advisory Commission on Arizona Environment
Mr. Tom Sullivan	Arizona Wildlife Federation
Mr. William F. Kane, Jr.	Office of Economic Planning and Development
Mr. F. Phillip Sharpe	Bureau of Reclamation

This group has reviewed the advance working draft of the environmental statement.

4. Dissemination of CAP Information Through the News Media

The CAP has received considerable attention from the news media in Arizona through radio and television coverage, newspaper articles, and public presentations. The CAP has been the subject of special programs on Phoenix television stations in August 1972, January 1973, and July 1974. Information on the project was on the front pages of most

Arizona newspapers when on December 15, 1972, the Secretary of the Interior signed the master water repayment contract for the project, and on January 11 and 12, 1973 as an item discussed and commented on during the National Water Commission field hearings in Phoenix. The filings of final environmental statements on the Havasu complex (FES 73-2) and the Granite Reef Aqueduct (FES 74-5) and its attendent public hearing on May 2 and 3, 1973 resulted in further publicity.

B. Coordination and Distribution of the Draft Environmental Statement for Review Purposes

This draft environmental statement is being distributed to the Federal agencies that have expertise or authority in subject areas covered by the statement and to the other Federal offices which provided information for the development of this statement. Additional distribution has been made to State and local agencies and private entities shown on the distribution list at the front of the statement. Additional requests for single copies of the statement will be filled as received after the notice appears in the Federal Register. All written comments on the draft environmental statement received during the review period will be included as an appendix to the final environmental statement. Copies of the statement are available at most public and university libraries in Arizona and southern Nevada.

C. Public Hearing on Draft Environmental Statement

A public hearing on this draft environmental statement will be held in accordance with the notice published in the Federal Register. The public hearing will be formally recorded and a transcript of the proceedings will be available for examination in several offices of the Bureau of Reclamation. The comments of the public that are made at this public hearing will be taken into consideration in the preparation of the final environmental statement for the Granite Reef Aqueduct transmission system.

APPENDIX A

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Phoenix District Office
2929 West Clarendon Avenue
Phoenix, Arizona 85017

IN REPLY REFER TO
PDO
1791/2850

September 10, 1974

Memorandum

To: Projects Manager, Arizona Projects Office, Bureau of Reclamation, 135 North 2nd Avenue, Phoenix, Arizona 85003

From: District Manager, Phoenix

Subject: Proposed Transmission System - Granite Reef Aqueduct - Central Arizona Project

We have again reviewed your sketch maps which show the proposed and alternate routes for the CAP transmission system. The comments contained in our letter to you dated June 26, 1974 still stand except for one change. This change concerns the Parker Dam to Bagdad alternate route. We made an error in our original comment. A 69 KV transmission line does already exist along the Parker Bagdad route and there are no resource conflicts where the route crosses in the Phoenix District. In keeping with the corridor concept, we would be in agreement with an additional transmission line being built along this route if it were selected.

We prefer the Liberty-Parker route. It has been identified via our resource planning process as a transmission line corridor. We understand you propose to replace one of the existing 161 KV lines with a new 230 KV line. We like this concept along this route in the Phoenix District. However, the Yuma District has different recommendations for their administered lands along this route. Their comments are included below.

The Mead Liberty route was also identified as a transmission line corridor in our resource planning system.

Yuma Comments

Parker-Bagdad Alternative - As far as the Yuma District is concerned this route would have the least impact on our resources.

The route would follow an already existing line and would have little visual contact for most people. This route does cross part of a bighorn sheep habitat area identified in the Bill Williams Mountains and a proposed environmental study area in the Bill Williams Canyon. The addition of another line should not impact these resources significantly unless there is considerable ground disturbance coincidental to construction.

Davis-Parker Alternative - Segment (A)1/
From Davis Dam to State Highway 95 south of its intersection with Interstate 40, this route would have little impact on this District except after it crosses Interstate 40. From here to State Highway 95 it crosses bighorn sheep migration routes.

1/ as shown on the attached maps.

Also there would be some visual impact as the line approaches State Highway 95. These impacts are lessened due to the existing lines in that area.

Segment (B)1/ - Alternative 'A' would have more impact from the standpoint of 'new' construction. There are no lines in this area at the present time. The route is in a scenic area for Lake Havasu City. The extent it would be visible is not certain.

After passing Lake Havasu City the line would approach State Highway 95 at a narrow angle through the Standard Wash area. This would greatly increase visual impact. Also there are presently few roads that cross the Standard Wash area. Construction and maintenance roads would open new country to vehicle travel and might have significant impact on wildlife in the area, noteably the Mexican Antelope identified to inhabit the area.

Alternative 'B' through Lake Havasu City would have little impact on public land resources as it would cross private land. There is some question however, as to the advisability of adding an additional line through the city. Then alternative 'B' would have visual impact between State Highway 95 and the Aubrey Hills. This impact would be lessened by the existing line in this area.

Mr. Gary Fry has examined these alternatives on the ground with personnel from our Havasu Resource Area Office. The Havasu Area Manager, Bob Steele, has prepared a report on their findings and will forward a copy to your office.

Parker-Liberty Proposal - This route follows several existing lines through the Buckskin Mountains and across the Cactus Plain. The greatest impact will be in Giers Wash which is presently congested and across the Buckskin

Mountains. However, we would rather go this route than to start a new powerline corridor through virgin country.

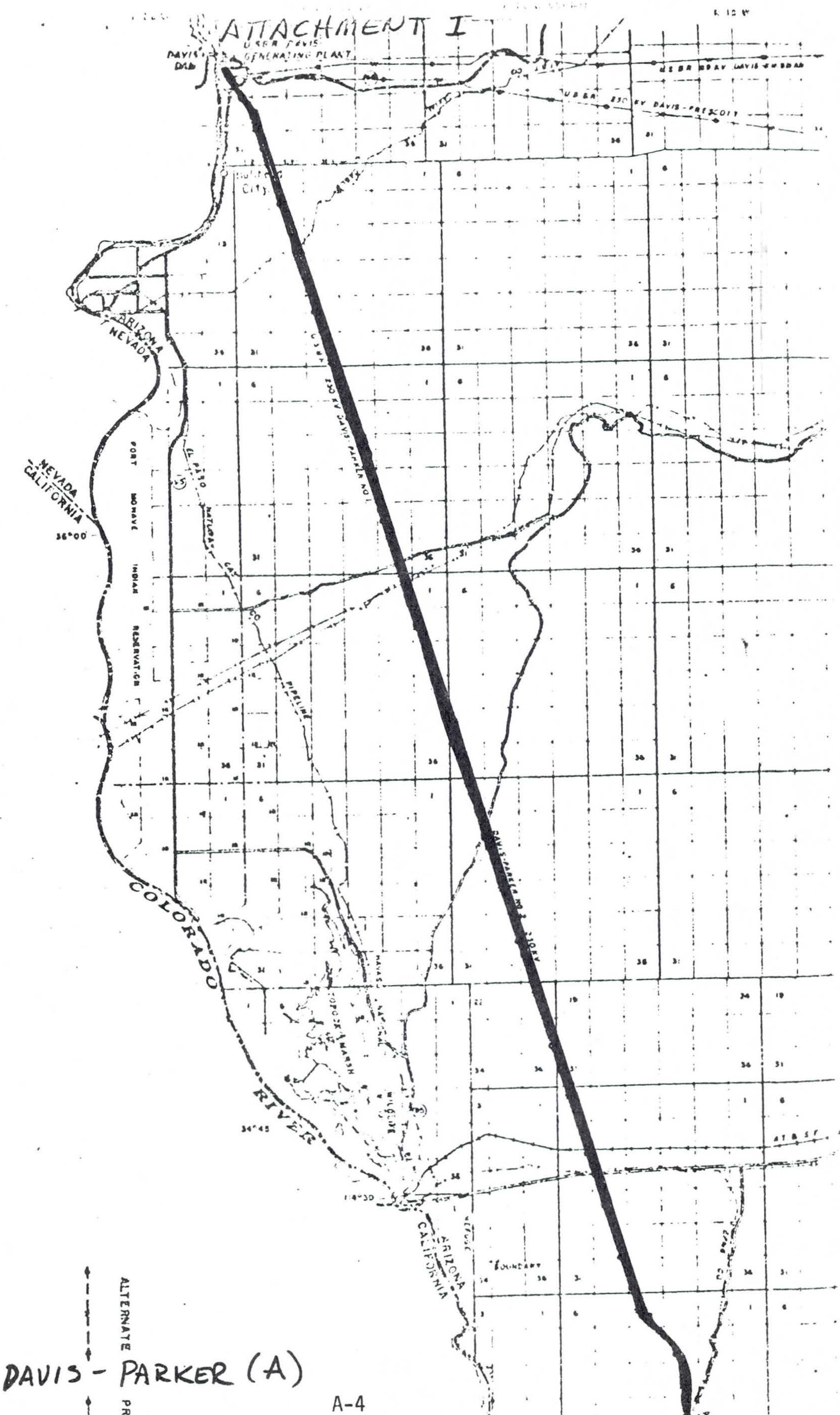
From there east the impact on the existing resources would not be significant.

Harcuvar-Bouse Hills Proposal - This proposal would be new construction through this area and would have an impact from that standpoint. Care should be taken to locate the line where it will be less visible, i.e., not skylined. We recommend that the possibility of going underground with this line be considered.

Enclosures: 3

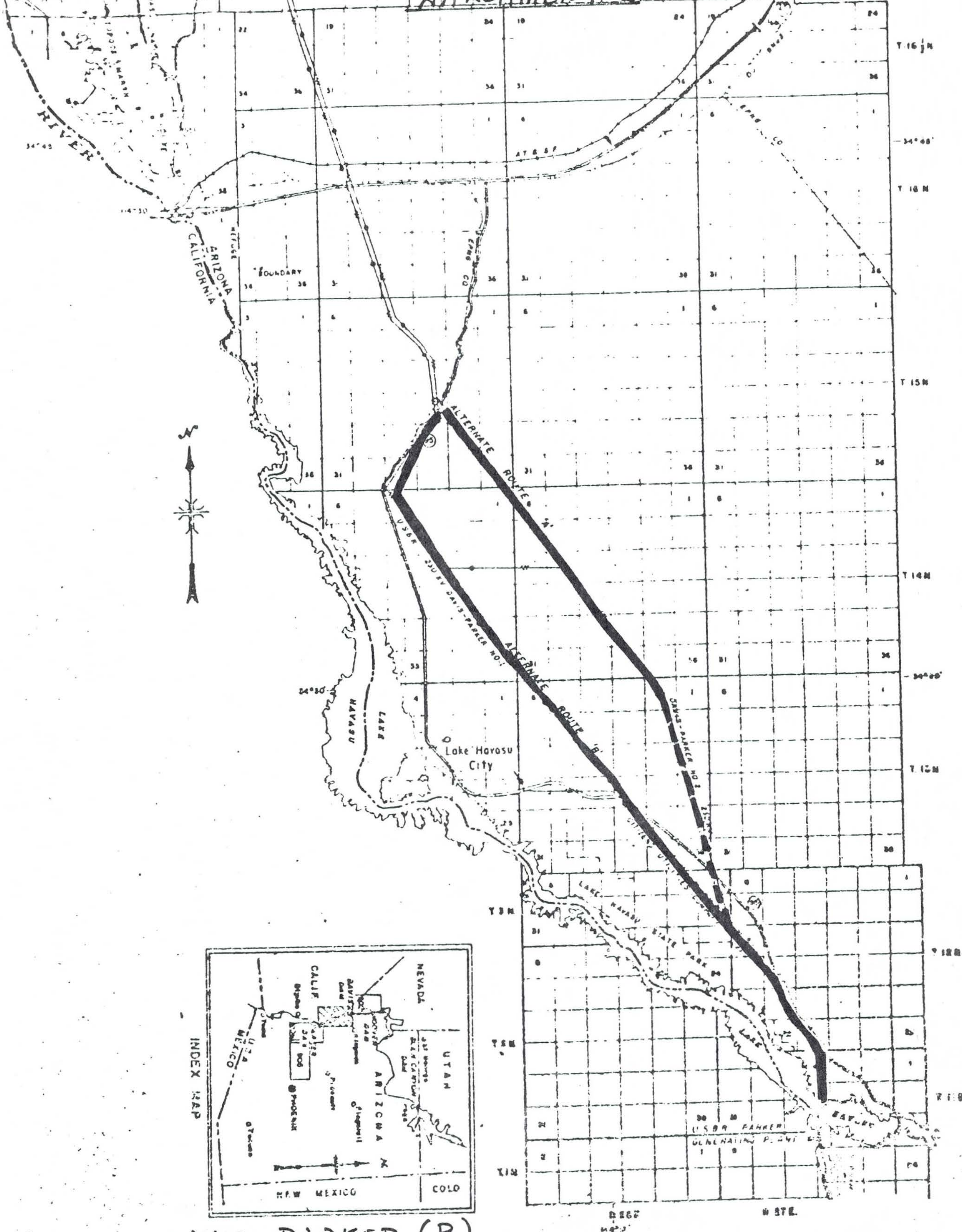
Guy E. Baier
Acting

ATTACHMENT I



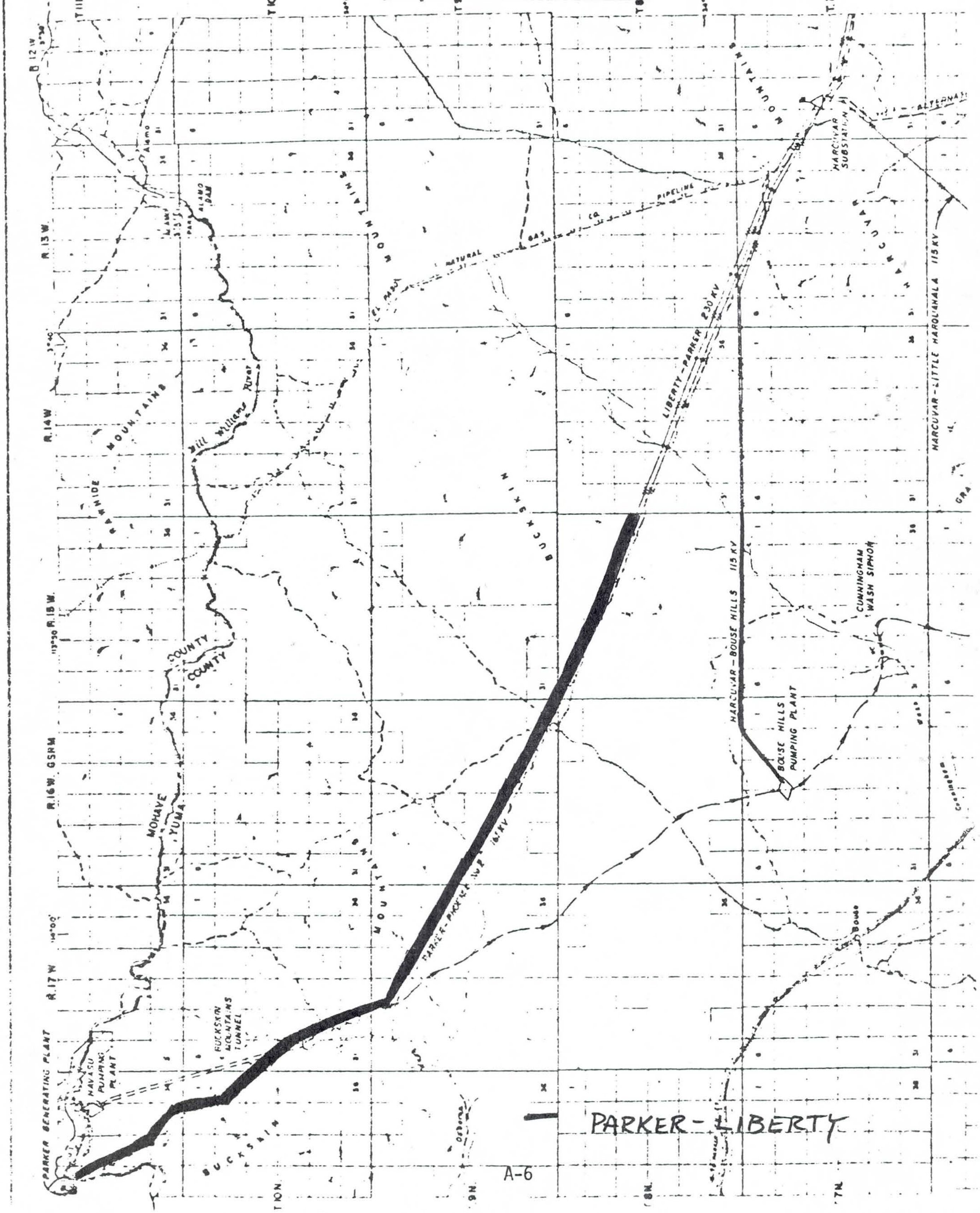
DAVIS - PARKER (A)

ATTACHMENT II



DAVIS - PARKER (B)

ATTACHMENT III



IN REPLY REFER TO

2850
HRA

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
HAVASU RESOURCE AREA
P. O. Box 685
Lake Havasu City, Arizona 86403
August 13, 1974

OFFICIAL FILE COPY

RECEIVED AUG 19 1974

Action:

Action Taken .... (Initials)

Date	Initials	To
8/22	RHC	600
8-20	KCC	650
8-20	[illegible]	656
9-3	FPS	150
8-26	BKR	653
File 8/30	HH	630

Copy Made
to

Mr. E. A. Lundberg
Regional Director
U. S. Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

We wish to express our appreciation for the cooperation extended by your office in coordinating the routing of that portion of the Granite Reef Aquaduct Transmission System which passes through the Havasu Resource Area. As you may be aware, comments on the proposed 230 KV line, as it effects the Yuma District, have been made to our State Office for inclusion in a report that will be forwarded to the Reclamation Projects Office in Phoenix. In response to your request (LC-150, 120.1) for information and suggestions on rerouting, we submit the following for your consideration.

The majority of the proposed routing of the transmission line does not appear to be in serious conflict with known resource values or existing programs in the Havasu Area. However, one portion of the route, that we feel would have a significant scenic impact, is located in Standard Wash, approximately four miles southeast of Lake Havasu City. The proposed route depicts the 230 KV line with accompanying steel frame towers crossing Arizona Highway 95 at a point in the middle of a wide, flat wash. The line continues south, through the middle of the wash, to rejoin the existing 230 KV line in front of the Aubrey Hills. The proposed highway crossing point would mean that the power line would be highly visible on both sides of the highway for a total distance of about 3 miles. The Aubrey Hills, together with their backdrop, the Whipple Mountains, comprise one of the most scenic areas in the Resource Area. The routing of a highly visible power line between the highway and the Aubrey's, combined with the adverse effect of the double lines in front of the hills; suggest that an alternate route be considered.

An alternate route for the Standard Wash-Aubrey Hills area would extend the proposed route approximately 5 miles to the southeast before making the turn to the south to join the existing line. This route would keep the line 2 to 3 miles northeast of the highway, partially or totally screened from view by the ridges in the area. The alternate route would have the proposed line join the existing line east of the highway, thereby eliminating the need for another highway crossing. Adverse effects on the wildlife in the area of the alternate route could be mitigated, if necessary, by closing the powerline service road to public use.

The enclosed map depicts the suggested alternate routing (shown in purple) and our tentative land use designations for the area in question. The area outlined in green has been given an overall classification of "Havasu Recreation Lands," to be managed in accordance with 43 CFR 2070. (In general, any proposed use that would have a significant adverse effect on wildlife and recreation values will be discouraged.) Areas separately identified within the green area are as follows:

<u>Red</u> - Aubrey Hills scenic corridor: Highly significant for its scenic and wildlife qualities. Proposed management in accordance with 43 CFR 6222.

<u>Yellow</u> - Mohave Mountains-Crossman Peak: Management objective is to preserve the open space and scenic backdrop for Lake Havasu City. Uses not compatible with low intensity recreation use, and enhancement of wildlife habitat should be discouraged.

<u>Blue</u> - Bill Williams Mountains: Area encompasses approximately 30,000 acres of relatively undisturbed desert mountain environment. The area, generally inaccessible to motor driven vehicles, supports a variety of wildlife (including several endangered species) and contains high quality scenery. A management plan for the area has not been completed, however protection and enhancement of the areas primitive values may be expected.

We appreciate your cooperation in this matter and if we may be of any further assistance, please do not hesitate to contact us.

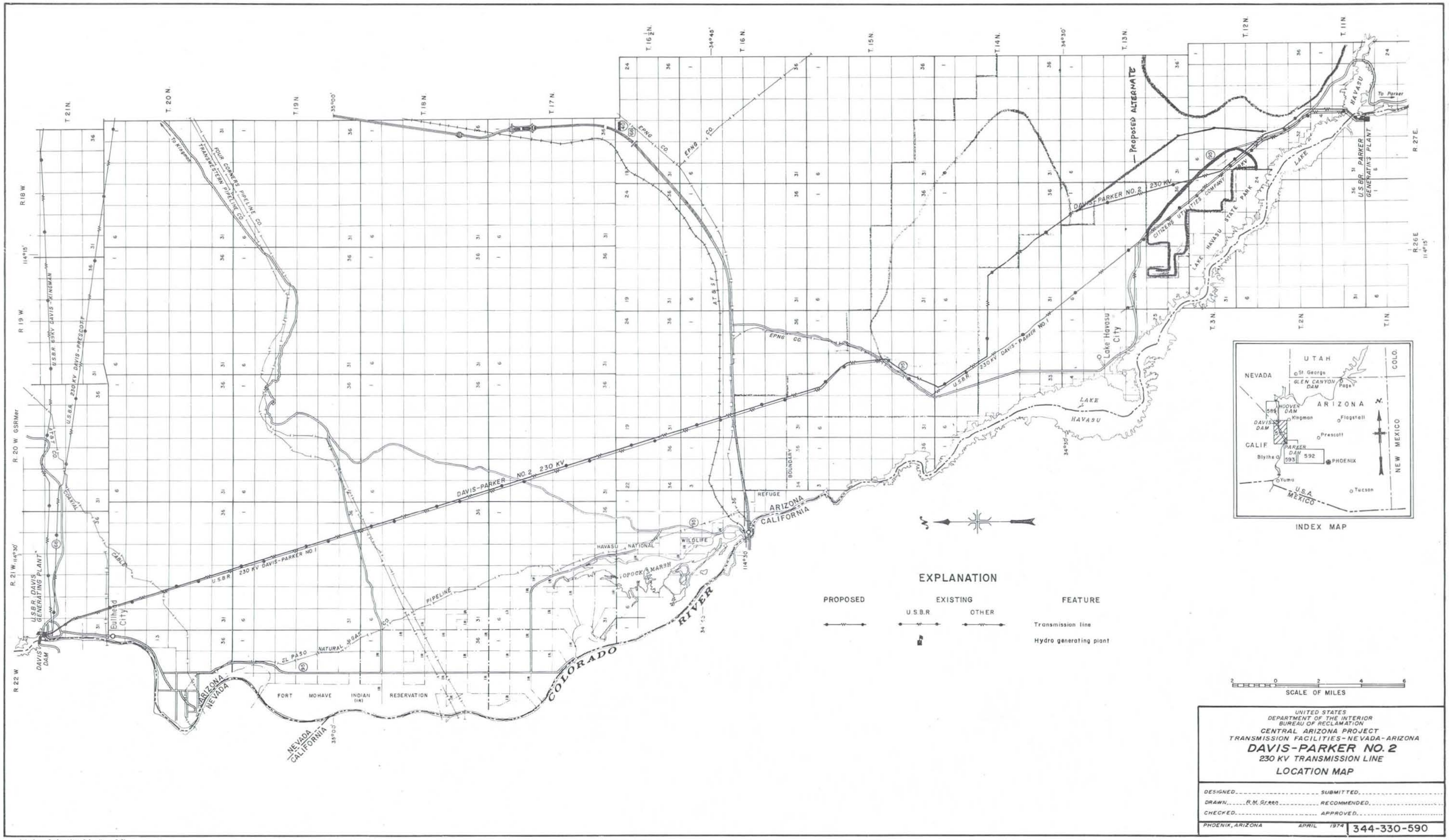
Sincerely,

Robert G. Steele
Area Manager, HRA

Enclosures: 2

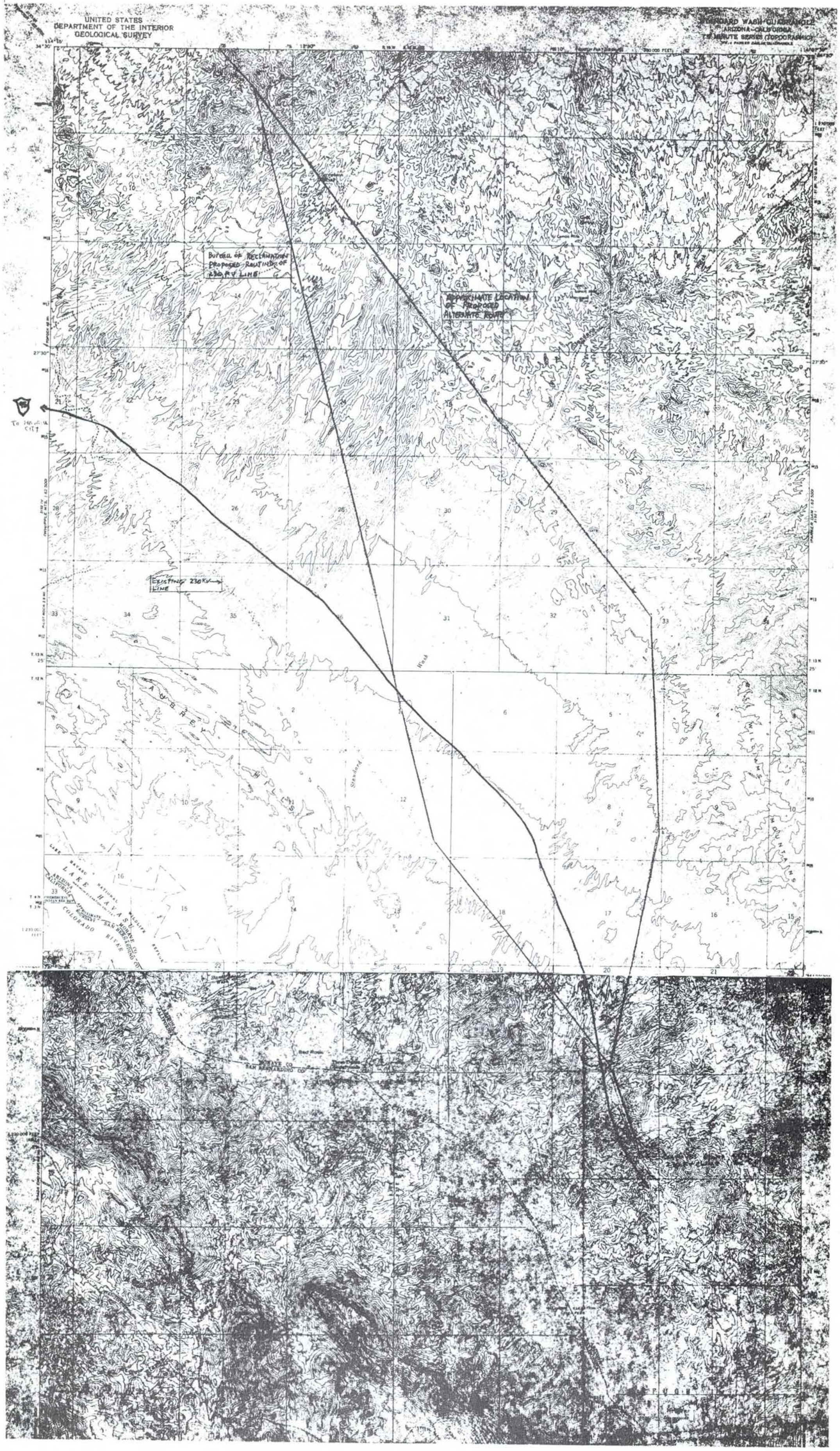
cc: Phoenix BLM Office
Yuma District Office

JUL 3 1 1974



Interior - Reclamation, B.C., Nev. 7-74

Figure 4


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STANDARD WASH QUADRANGLE
ARIZONA–CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
BUREAU OF RECLAMATION PROPOSED ROUTING OF 230 KV LINE
APPROXIMATE LOCATION OF PROPOSED ALTERNATE ROUTE
EXISTING 230 KV LINE
AUBREY HILLS
LAKE HAVASU
COLORADO RIVER
Standard Wash

IN REPLY REFER TO
PDO
1791/2850

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

District Office
2929 West Clarendon
Phoenix, Arizona 85017

June 26, 1974

Memorandum

To: Projects Manager, Arizona Projects Office, Bureau of Reclamation, 135 North 2nd Avenue, Phoenix, Arizona 85003

From: District Manager, Phoenix

Subject: Proposed Transmission System - Granite Reef Aqueduct - Central Arizona Project

We have reviewed your sketch maps which show the proposed and alternative routes for the CAP transmission system.

The proposed Davis Parker line that would cross the Black Mountains Planning Unit follows an existing acceptable transmission line route. This proposed route also occupies a transmission line corridor that was identified in our resource planning process.

Havasu Planning Unit is situated within the boundaries of the BLM Yuma District. The proposed route that crosses the Havasu Planning Unit should be discussed with the Havasu Resource Area Manager, Robert Steele, P. O. Box 685, Lake Havasu City, Arizona, Phone: 855-4512.

On your map, you show an alternate route from Parker Dam to Bagdad, which crosses the Hualapai and Aquarius Planning Units. This alternate route is not as desirable as the proposed Davis Parker route. The alternate route would establish a new transmission line over scenic land which appears unnecessary.

The Mead Liberty proposed route, which follows an existing 161 KV line, is also located in a right-of-way corridor identified via our planning process for the Harquvar and Vulture Planning Units. We are in agreement with this proposed route.

We appreciate the advance notice and opportunity to comment on these proposed routes. They do cross numerous miles of national resource lands that are receiving considerable resource planning effort by us, other government agencies and the public.

Acting

cc:
District Manager, Yuma

ARIZONA
OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

MAILING ADDRESS: 1645 West Jefferson • Room 428 • Phoenix, Arizona 85007

OFFICIAL FILE COPY
ARIZONA PROJECTS OFFICE
RECEIVED AUG 9 1974

Date	Initials	To
8-8		150
8-9		651
8-20		200
8/9		210
8/14		224
8/13		Grant
Inf. copy		

copy to 150 BC

August 6, 1974

Mr. C. A. Pugh, Projects Manager
Bureau of Reclamation
Arizona Projects Office
135 N. Second Avenue
Phoenix, Arizona 85003

Re: Project Title: Transmission System, Granite Reef Aqueduct (CAP)
State Application Identifier: 74-60-0012

Dear Mr. Pugh:

Enclosed is a copy of responses received concerning the above project which was received by us after our letter to you on May 6, 1974.

Sincerely,

Constance LaMonica

Constance LaMonica
Arizona State Clearinghouse

CL:hh

Enc.

1645 West Jefferson, Room 428: Administration (602) 271-5371 • Development (602) 271-5374 • Motion Picture (602) 271-5011 • Tourism (602) 271-5638
1624 West Adams, 3rd Floor: Planning & Clearinghouse (602) 271-5005 • Intergovernmental (602) 271-5939 • Research (602) 271-5001 • Word Center (602) 271-3378

Arizona Water Commission
222 NORTH CENTRAL AVENUE, SUITE 800
Phoenix, Arizona 85004
TELEPHONE (602) 258-7561

MEMORANDUM

TO: Constance LaMonica, Clearinghouse Staff Contact
Office of Economic Planning and Development

FROM: Wesley E. Steiner, Executive Director
Arizona Water Commission

DATE: July 15, 1974

SUBJECT: Transmission System, Granite Reef Aqueduct (CAP)
SAI: 74-60-0012

The Arizona Water Commission staff has reviewed both the original and amended proposals.

There is essentially no change in the design of the proposed system although the amended proposal does contain an expanded project description. The Water Commission continues to support this proposal as amended.

Wesley E. Steiner

Governor
JACK WILLIAMS

Commissioners:
MILTON G. EVANS, Chairman, Flagstaff
ROBERT J. SPILLMAN, Phoenix
WILLIAM H. BEERS, Prescott
CHARLES F. ROBERTS, O.D., Bisbee
FRANK FERGUSON, JR., Yuma

Director
ROBERT A. JANTZEN

Asst. Director, Operations
PHIL M. COSPER

Asst. Director, Services
ROGER J. GRUENEWALD

ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000

July 30, 1974

Mrs. Constance LaMonica
Arizona State Clearinghouse
Office of Economic Planning
and Development
1645 West Jefferson, Room 428
Phoenix, Arizona 85007

Dear Mrs. LaMonica:

We have reviewed the revised proposal concerning the Granite Reef Aqueduct Transmission System (CAP), S.A.I. No.: 74-60-0012, dated June 26, 1974. Our comments on this amended proposal appear below.

The data sent to us, both the descriptive and the graphic portions, are of insufficient quality and quantity to discern the impact of this project. A project of this magnitude should be treated in a manner that would allow it to be presented in a very detailed, precise fashion. We are unable to perform a satisfactory evaluation of this transmission line system using the data given. Hopefully, the Draft Environmental Statement will be complete enough to allow us to determine the true impact of this proposed project.

If the proposed transmission line system follows the existing transmission line down to Parker, then no real loss of wildlife habitat would be incurred to that point. However, the map we received does not give us the opportunity to distinguish exactly what path the proposed transmission line would follow.

As far as we can ascertain from the proposed revision, transmission lines would connect the Harcuvar substation to two pumping plants on the Granite Reef Aqueduct to the south and west. The transmission line running generally west from Harcuvar would have no major wildlife impact, since it would be located primarily in a developed valley area.

The transmission line running south from Harcuvar to the pumping plant near Black Rock Hill, however, would have a major impact on bighorn sheep. This line would cross the Granite Wash and Harquahala Mountains. The disturbance factor during the construction period and the resulting access created by the transmission line maintenance road would undoubtedly force bighorn sheep from these areas. Impacts would also be felt on small game, non-game and other big game species, not to mention vegetative and visual impacts. If there was some way to either re-route the transmission line around the mountainous areas or utilize passes where roads now exist, the total impact on wildlife would be reduced, particularly as far as bighorn sheep are concerned.

We can probably assume that the proposed transmission line system would pass adjacent to the Bighorn Mountains. These mountains presently contain a remnant population of bighorn sheep; the desert floor surrounding the mountains harbors good numbers of desert mule deer and small game species.

It may be impossible at this point in time to generate concern among developers over the wildlife resource. However, the quality of the existing wildlife habitat in any given area is directly affected by the amount of incoming human encroachment. It is often a natural phenomenon of human beings to purposely default the overall evaluation of a situation if something in particular is desired.

We appreciate the opportunity to assess this proposal. Please contact us if we can be of further assistance.

Sincerely,

Robert A. Jantzen, Director

Bruce R. Duke

By: Bruce R. Duke, Specialist
Planning and Evaluation Branch

BRD/ljt

District #4, Council of Governments
377 Main Street, Room 202
Yuma, Arizona 85364
(602) 782-1886

#1301-CAP-GRTL

REGIONAL CLEARINGHOUSE

DISTRICT #4, COUNCIL OF GOVERNMENTS

PROJECT NOTIFICATION AND REVIEW SIGN-OFF

The application for federal financial assistance described below has been reviewed by the District #4, Regional Clearinghouse.

S.A.I. NUMBER 74 60 0012

PROJECT TITLE: Transmission System, Granite Reef Aqueduct (CAP)

OFFICIAL FILE COPY
ARIZONA PROJECTS OFFICE
RECEIVED JUL 17 1974

Date	Initials	To
7/1		100
7/12		105
7/16		150
7-23		200
7/19		210
7/19		Brown
7/22		
Inf. copy		

CCto BC 150

APPLICANT AGENCY: Bureau of Reclamation

FEDERAL PROGRAM TITLE: Federal Reclamation Projects

CATALOG NO.: 15 504

FEDERAL FUNDS REQUESTED: $ 45,975,000

/ / APPLICATION IS SUPPORTED AS WRITTEN

/X/ COMMENTS ATTACHED

DISTRICT #4, COUNCIL OF GOVERNMENTS

BY Robt Kampf

DATE 7-16-74

/X/ COPY TO OEPAD

/X/ COPY TO APPLICANT

PROPOSAL
NOTICE OF INTENT

TO:

☒ AREAWIDE CLEARINGHOUSE
☒ STATE CLEARINGHOUSE

A-95

STATE APPLICATION IDENTIFIER: AZ 74 60 0012 (1-8)
TRANSACTION TYPE: 1 (9)

TARGET DATE FOR FORMAL APPLICATION

10-11 01	PROJECT TITLE (12-71): Transmission System, Granite Reef Aqueduct (CAP)	DATE: MO 0 4 DAY 0 1 YEAR 7 4
02	APPLICANT (12-45): Bureau of Reclamation	DIVISION (46-79): Arizona Projects Office
03	APPLICANT ADDRESS (STREET) (12-45): 135 North Second Avenue	CITY (46-60): Phoenix; COUNTY (61-75): Maricopa; ZIP CODE (76-80): 85003
04	CONTACT PERSON (12-45): C. A. Pugh, Projects Manager	PHONE (49-55): 261-3106

Grant Application ☐ Direct Fed Activity ☒ State Plan ☐ 12-71

PROJECT ABSTRACT (60 characters per line - 6 lines)

05 Transmission System from Mead-McCullough Substations Nevada 12-71
06 to Davis and Parker Switchyards and Liberty Substation, 12-71
07 Maricopa County, Az. and as described in Form DI-711 trans- 12-71
08 mitted this date and previously transmitted Final Environ- 12-71
09 mental Statements FES 72-35, 73-2, and 74-5, Central Arizona 12-71
10 Project. Preparation of detailed ES is starting. 12-71

Is any environmental assessment information required? Yes... No...

If yes, please attach one copy.

IMPORTANT: ATTACH COMPLETE PROJECT DESCRIPTION.

See referenced FESs

PROJECT LOCATION

11	CITY (12-45): Davis Dam to Liberty Substation	COUNTY (46-79): Mohave Yuma and Maricopa

12	FEDERAL FUNDS		NON-FEDERAL FUNDS			TOTAL FUNDS (52-60)
	GRANT (12-19)	OTHER ** (20-27)	STATE (28-35)	LOCAL (36-43)	OTHER § (44-51)	
		45 975 000				45 975 000

13	TYPE OF OTHER FEDERAL FUNDS ** (12-45): Regular budgetary expenditure	TYPE OF OTHER NON-FEDERAL FUNDS § (46-79)
14	FEDERAL PROGRAM TITLE (12-71): Federal Reclamation Projects	FEDERAL CATALOG NUMBER (72-76): 1 5 5 0 4
15	FEDERAL AGENCY NAME (12-45): Dept of the Interior	FEDERAL SUB-AGENCY (46-79): Bureau of Reclamation

Region I
Region IV

Economic Sec
Game & Fish
Real Estate
Civil Rights
Anthropology
State Museum

Bureau of Mines
Az Mining Ass'n
Arid Lands Studies
Highway
Health
Power
Water

Agr Hort
Parks
Land
OEPAD

E. A. Lundberg
AUTHORIZED SIGNATURE
Regional Director

SCH-1 6/73

A-18

COMMENTS: 74 60 0012 (From Review Committee)

We do not support the CAP as planned. If there is enough water in the Colorado River for this project, then we would support an aqueduct system to set up agricultural communities in Butler Valley (Bouse), and similar areas with good land.

We don't need more people and congestion and smog in Phoenix and Tucson - They don't know what to do with the crowds they have.

We need to decentralize population. We need to increase agricultural production, not decrease it.

Therefore, we have to cast a negative vote on the entire CAP Project or any portion thereof.

ARIZONA

OFFICE
OF THE
GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

MAILING ADDRESS: 1645 West Jefferson • Room 428 • Phoenix, Arizona 85007

OFFICIAL FILE COPY
ARIZONA PROJECTS OFFICE
RECEIVED MAY 13 1974

Date	Initials	To
5/17		150
5/28		
5/28		

copy 120.125

May 6, 1974

120.1 CAP

Mr. C. A. Pugh, Projects Manager
Bureau of Reclamation
Arizona Projects Office
135 N. Second Avenue
Phoenix, AZ 85003

Re: Project Title: Transmission System, Granite Reef Aqueduct (CAP)
State Application Identifier: 74-60-0012

Dear Mr. Pugh:

The Arizona State Clearinghouse has received and reviewed your notification of proposed action concerning the above project. The Clearinghouse review has generated several responses, copies of which are attached for your information.

In accordance with current requirements as set forth in the Office of Management and Budget Circular A-95, Revised, this letter will serve as the State Clearinghouse comment on the proposal.

Please include the above State Application Identifier in any future correspondence regarding this proposal. Thank you for providing Arizona with the opportunity to comment upon this proposal.

Sincerely yours,

Constance La Monica

for Dennis A. ~~Davis, Executive~~
Secretary for Federal Programs
DAD:CL:cr

encl:

1645 West Jefferson, Room 428: Administration (602) 271-5371 • Development (602) 271-5374 • Motion Picture (602) 271-5011 • Tourism (602) 271-5638
1624 West Adams, 3rd Floor: Planning & Clearinghouse (602) 271-5005 • Intergovernmental (602) 271-5939 • Research (602) 271-5001 • Word Center (602) 271-3378

ARIZONA OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Office of Economic Planning
and Development, 3rd Floor
1624 West Adams Street
Phoenix, Arizona 85007

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [X] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact ____________________

____
Authorized Review
Agency Signature

ARIZONA OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. J. Fred Talley
Real Estate Department
1645 West Jefferson Street
Phoenix, Arizona 85007

APR 11 1974

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

[x] No comment on the above project.

[ ] Proposal is supported as written.

[ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact F. E. Pettycrew

J. Fred Talley Commissioner
Authorized Review Agency Signature

3-73

SCH-3

ARIZONA OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. Les Ormsby, Admin.
Arizona Power Authority
1810 West Adams Street
Phoenix, Arizona 85005

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact ______________

L Ormsby

Authorized Review Agency Signature

3-73

SCH-3

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. L. D. McCorkindale
Agriculture & Horticulture Dept
414 Capitol Annex West
Phoenix, Arizona 85007

RECEIVED
APR 11 1974
ARIZONA COMMISSION OF AGRICULTURE & HORTICULTURE

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [ ] No comment on the above project.
- [x] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact L. D. McCorkindale

Authorized Review Agency Signature

3-73

SCH-3

APR 11 A.M.

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. John P. Dickinson
Dept. of Economic Security
Post Office Box 6123
Phoenix, Arizona 85005

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact ______

John P. Dickinson
Authorized Review Agency Signature

3-73

SCH-3

√

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. Roland H. Sharer
State Liaison Officer, AORCC
4433 N. 19th Ave., Suite 203
Phoenix, Arizona 85015

RECEIVED
APR 12 1974
O.R.C.C.

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact ____________________

Roland H. Sharer
Authorized Review Agency Signature

3-73 SCH-3

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF

ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. Andrew L. Bettwy
Comm., Department of Land
1624 W. Adams St., 4th Floor
Phoenix, Arizona 85007

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [ ] No comment on the above project.
- [x] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact W. H. Edwards

Authorized Review Agency Signature

3-73 A-27 SCH-3

V

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF

ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. Wm. N. Price, State Hwy. Eng.
Environmental Planning Division
Department of Highways
206 South 17th Avenue
Phoenix, Arizona 85007

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact W. A. Ordway Acting Director

By: [signature]
Authorized Review Agency Signature

RECEIVED
APR 11 1974
ARIZONA HIGHWAY ...

3-73

A-28

SCH-3

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Dr. James Schoenwetter
Department of Anthropology
Arizona State University
Tempe, AZ 85281

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact J Schoenwetter

Authorized Review Agency Signature

ARIZONA
OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

MSA....... PSO.......
GLC....... PLM.......
File.......

TO: Mr. Wesley E. Steiner, Eng.
State Water Commission
222 N. Central Ave., Suite 800
Phoenix, Arizona 85004

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [ ] No comment on the above project.
- [x] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact Bob Farrer

WEH

Authorized Review Agency Signature

RECEIVED
APR 12 1974

ARIZONA OFFICE OF THE GOVERNOR

OFFICE OF ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. William H. Dresher
Dean, College of Mines
Dir., Az. Bureau of Mines
The University of Arizona
Tucson, Arizona 85721

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact ______________________

W H Dresher
Authorized Review Agency Signature

3-73 SCH-3

JACK WILLIAMS

ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000

April 23, 1974

Mrs. Constance La Monica
State Clearinghouse
1624 West Adams, Suite 317
Phoenix, Arizona 85007

Re: Project Title - Transmission System, Granite Reef Aqueduct (CAP)
State Application Identifier - 74-60-0012

Dear Mrs. La Monica:

The Arizona Game and Fish Department has reviewed the notice from the Bureau of Reclamation reference the transmission system, Granite Reef Aqueduct. This Department is vitally interested in the location of transmission lines as they can at times have a direct negative impact upon the fish and wildlife resources of the State.

The Department requests that we be kept informed on the location of the proposed power lines. We would be more than willing to assist in planning to minimize the negative impacts of these transmission lines on the valuable wildlife resources of this State.

Thank you for the opportunity to review and comment on this proposal.

Sincerely,

Robert A. Jantzen, Director

By: John N. Carr, Supervisor
Planning and Evaluation Branch

JNC/cb

ARIZONA
OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

1624 West Adams Street, Suite 317, Phoenix, Arizona 85007 • (602) 271-5005

STATE CLEARINGHOUSE

Date: April 8, 1974

TO: Mr. Ford Smith, Exec. Dir.
Civil Rights Div, Dept of Law
1645 W. Jefferson, Room 140
Phoenix, Arizona 85007

FROM: Clearinghouse Staff Contact: Constance LaMonica

SUBJECT: Project Notification and Review

Applicant: Bureau of Reclamation, Arizona Projects Office

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

State Application Identifier: 74-60-0012

A copy of Notice of Intent Form SCH-1 is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your response below. Also note a staff contact within your agency in case further consultation is required. Please return this completed form within fifteen (15) days of your receipt of this request.

- [ ] No comment on the above project.
- [x] Proposal is supported as written.
- [ ] Comments are attached.

Please contact the Applicant and advise the Clearinghouse should you desire a conference with Applicant, desire further information, or need additional time for review.

Review Agency Staff Contact J. Ford Smith

J. Ford Smith
Authorized Review Agency Signature

Executive Director

3-73

SCH-3

District #4, Council of Governments
377 Main Street, Room 202
Yuma, Arizona 85364
(602) 782-1886

REGIONAL CLEARINGHOUSE

DISTRICT #4, COUNCIL OF GOVERNMENTS

PROJECT NOTIFICATION AND REVIEW SIGN-OFF

The application for federal financial assistance described below has been reviewed by the District #4, Regional Clearinghouse.

S.A.I. NUMBER 74 60 0012

PROJECT TITLE: Transmission System, Granite Reef Aqueduct (CAP)

APPLICANT AGENCY: Bureau of Reclamation

FEDERAL PROGRAM TITLE: Federal Reclamation Projects

CATALOG NO.: 15 504

FEDERAL FUNDS REQUESTED: $45,975,000

[X] APPLICATION IS SUPPORTED AS WRITTEN

[ ] COMMENTS ATTACHED

DISTRICT #4, COUNCIL OF GOVERNMENTS

BY Brian H. Babcais

DATE 4-23-74

[X] COPY TO OEPAD

[ ] COPY TO APPLICANT

DISTRICT #4, COUNCIL OF GOVERNMENTS
377 MAIN STREET, ROOM 202
YUMA, ARIZONA 85364
(602) 782-1886

April 24, 1974

Mrs. Constance La Monica
Arizona State Clearhinghouse
1624 West Adams, Room 317
Phoenix, Arizona 85007

Dear Connie:

Yesterday we sent in the reviews we had received concerning the Bureau of Reclamation Transmission System, Granite Reef Aqueduct (SAI 74-60-0012). At the last minute we received a request for further information concerning this project. We have sent this information to the reviewing agent this day.

Due to the above facts, we would like to emphasis that the review dated 4-23-74 ia not complete and would like to request a ten day extension on this review so that all entities within this region can review this project in light of all the information they required.

If you have any questions please contact me.

Sincerely,

DISTRICT #4, COUNCIL OF GOVERNMENTS

Brian H. Babiars

Brian H. Babiars, Director
Physical & Natural Resources

BHB/gm

Serving: YUMA COUNTY - MOHAVE COUNTY - CITY OF PARKER - CITY OF WELLTON - CITY OF SOMERTON - CITY OF YUMA - CITY OF KINGMAN
COLORADO RIVER INDIAN TRIBE

MARICOPA ASSOCIATION OF GOVERNMENTS

RECEIVED JUL 11 1974

Date	Initials	To
7/15	MAO	600
7/12		650
7/12	BPR	653
7/12		656
7/17		700
7/24	FPS	150

July 9, 1974

SUBJECT: COMMENTS ON PROJECT PROPOSED ACTION

Applicant: Bureau of Reclamation

Project Title: Granite Reef Aqueduct Power Transmission System

MAG/State Application Identifier: -------

The Maricopa Association of Governments' Clearinghouse has received and reviewed your notification of proposed action concerning the above project. In accordance with current requirements as set forth in the Office of Management and Budget Circular A-95, Revised, this letter will serve as the area-wide clearinghouse comment on the proposal.

- [x] No comment on the above project.
- [ ] Proposal is supported as written.
- [ ] The proposal is not supported as written.
- [ ] Comments are attached.

Please include the MAG State application identifier if applicable in any future correspondence regarding this proposal. Thank you for providing MAG with the opportunity to comment on this proposal.

JOHN J. DEBOLSKE, Secretary

By Ken Driggs
G. Kenneth Driggs

A Voluntary Association of Local Governments in Maricopa County

MARICOPA ASSOCIATION OF GOVERNMENTS

May 10, 1974

SUBJECT: Comments on proposed action

APPLICANT: U. S. Burear of Reclamation

PROJECT TITLE: Transmission System, Granite Reef Aqueduct, Central Arizona Project

MAG/STATE APPLICATION IDENTIFIER: 74-80-0009 & 74-60-0012

The Maricopa Association of Governments Clearinghouse has received and reviewed your notification of proposed action concerning the above project. The Clearinghouse review has found no conflict between your proposal and the existing areawide plan.

In accordance with current requirements as set forth in the Office of Management and Budget Circular A-95, Revised, this letter will serve as the areawide Clearinghouse comment on the proposal.

Please include the above MAG/STATE APPLICATION IDENTIFIER in any future correspondence regarding this proposal. Thank you for providing MAG with the opportunity to comment upon this proposal.

Cordially,

JOHN J. DEBOLSKE, Secretary

By Ken Driggs
G. Kenneth Driggs

cc: Dennis Davis - OEPAD

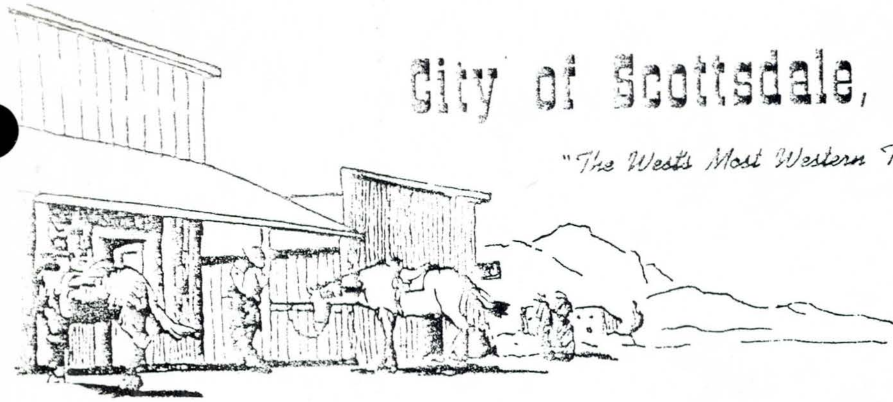
OFFICIAL FILE COPY
ARIZONA PROJECTS OFFICE
RECEIVED MAY 13 1974

Date	Initials	To
5/13		100
5/29		105
5-14		150
5-13		110
5/2		210
8/13		J. G.

Inf. copy

City of Scottsdale, Arizona

"The Wests Most Western Town"



April 19, 1974

Mr. Jesse Castillo
Maricopa Association of Governments
1820 W. Washington
Phoenix, Arizona 85007

Dear Mr. Castillo:

Re: 74-80-0009, Transmission System
Granite Reef Aqeduct CAP

The City of Scottsdale finds no conflict with the above referenced project. There will be no construction or upgrading of the system within the city limits.

Sincerely,

Martha R. Almon

Martha R. Almon
Intergovernmental Relations

MRA:sl

CITY OF MESA
ARIZONA
MUNICIPALLY OWNED UTILITIES • ELECTRICITY • NATURAL GAS • WATER
55 NORTH CENTER STREET • P. O. BOX 1466 • 85201 • 834-2011

April 9, 1974

TO: Jesse Castillo

FROM: Wayne Balmer, City of Mesa Planning Dept.

SUBJECT: 74-80-0009

We have received your letter requesting our comments on the above mentioned project.

We have reviewed the proposal and see no difficulties with the project at the present time.

WB:jlw

MARICOPA COUNTY PLANNING AND ZONING DEPARTMENT

300 County Administration Bldg. 111 S. 3rd Avenue, Phoenix, Arizona 85003

MARICOPA COUNTY ARIZONA

April 16, 1974

Maricopa Association of Governments
1820 West Washington
Phoenix, AZ 85007

ATTENTION: Mr. Jesse Castillo

SUBJECT: Transmission System, Granite Reef Aqueduct, Central Arizona. Application Identifier: 74-80-0009

Dear Mr. Castillo:

This is in reply to the A-95 project notification for MAG/State Application Identifier number 74-80-0009 by the U. S. Bureau of Reclamation.

In reviewing the forwarded information concerning this project, we find that data provided and the scale of the map is insufficient to evaluate this proposal. Therefore, the Maricopa County Planning Department has no comment concerning Application number 74-80-0009.

Sincerely,

Donald W. Hutton
Director

Philip V. Bloom

Philip V. Bloom
Principal Planner
Advance Planning Division

PVB/tln

CITY OF PHOENIX
ARIZONA

PLANNING DEPARTMENT ◦ 801 MUNICIPAL BUILDING ◦ 251 WEST WASHINGTON ◦ PHOENIX, ARIZONA 85003

A-95 Reply Form

To: Maricopa Association of Governments
3800 North Central Avenue
Phoenix, Arizona 85012
ATT: G. Kenneth Driggs

Project Name: TRANSPORTATION SYSTEM, GRANITE REEF AQUEDUCT, CENTRAL ARIZONA PROJECT

MAG Review No.: 74-80-0009

FHA File No.: —

COMMENTS

None

Date 4-10-74

Signature [signature]

City of Glendale

7022 NORTH 58TH DRIVE • P. O. BOX 1556 • GLENDALE, ARIZONA 85311 • (602) 939-9711

April 30, 1974

Mr. Jesse Castillo
A-95 Areawide Clearinghouse
Maricopa Ass'n of Governments
1820 West Washington
Phoenix, Arizona 85007

Dear Mr. Castillo:

This letter is in reference to A-95 Clearinghouse Reviews, Bureau of Reclamation, "Transmission System-Granite Reef Aqueduct (CAP) # 74-60-0012, and Office of Economic Planning and Development, "Comprehensive Planning Assistance Project FY 74-75" #74-10-0062.

The City of Glendale approves of both applications and supports their total funding.

Sincerely yours,

Raymond E. Morse

Raymond E. Morse
Program Development Coordinator

cc: Mr. Martin Vanacour, Ass't City Mgr

MARICOPA ASSOCIATION OF GOVERNMENTS

April 26, 1974

TO: Planning Committee and Public Works Committee

FROM: A - 95 Areawide Clearinghouse
Staff: Jesse Castillo

SUBJECT: PROJECT NOTIFICATION

Applicant: Bureau of Reclamation

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

MAG/State Application Identifier: 74-60-0012

Please include the above MAG/State Application Identifier in any future correspondence regarding this proposal and forward your comments to the Maricopa Association of Governments before May 11, 1974.

Enclosures

CITY
OF
PHOENIX

OFFICE OF THE CITY MANAGER

May 1, 1974

Mr. Jesse Castillo
A - 95 Areawide Clearinghouse Staff
Maricopa Association of Governments
1820 West Washington
Phoenix, Arizona 85007

Subject: Transmission System, Granite Reef Aqueduct (CAP)
MAG/State Application Identifier: 74-60-0012

Dear Mr. Castillo:

In response to your memorandum of April 26, to the Planning Committee and the Public Works Committee, I wish to advise that at the present time I do not see how the Transmission Line can have much affect on Public Works Committee interests except that it will help to get the Granite Reef Aqueduct in operation to furnish the water which we all need. So, as a member of the Public Works Committee, I would expect to endorse it unless something comes to my attention which persuades me otherwise.

I do feel that the Planning Committee would have an interest and, of course, the State power line sighting group would be more involved than anyone else.

Very truly yours,

Fred Glendening by K

FRED GLENDENING
Deputy City Manager

FG:pvk

Attachments
cc: Mr. Attebery
Mr. Beatty

1974

CITY OF MESA

MUNICIPALLY OWNED UTILITIES • ELECTRICITY • NATURAL GAS • WATER

55 NORTH CENTER STREET • P. O. BOX 1466 • 85201 • 834-2011

ARIZONA

April 30, 1974

TO: Jesse Castillo
Maricopa Association of Governments

FROM: Wayne Balmer, Planner I
City of Mesa Planning Department

SUBJECT: MAG/State Application Identifier 74-60-0012

We have received your letter requesting comments on the above mentioned project.

We have reviewed this project and have no comments at this time.

WB:jlw

RECEIVED

MARICOPA ASSOCIATION OF GOVERNMENTS

April 26, 1974

TO: Planning Committee and Public Works Committee

FROM: A - 95 Areawide Clearinghouse
Staff: Jesse Castillo

SUBJECT: PROJECT NOTIFICATION

Applicant: Bureau of Reclamation

Project Title: Transmission System, Granite Reef Aqueduct (CAP)

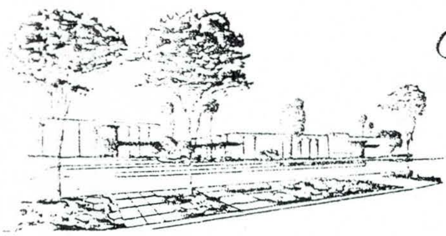
MAG/State Application Identifier: 74-60-0012

Please include the above MAG/State Application Identifier in any future correspondence regarding this proposal and forward your comments to the Maricopa Association of Governments before May 11, 1974.

Enclosures

RECOMMEND APPROVAL

[illegible]



Municipal Building

City of Chandler

PUBLIC WORKS DEPARTMENT

P.O. Box 248
200 E. Commonwealth Avenue
Chandler, Arizona 85224

April 30, 1974

Maricopa Association of Governments
1820 West Washington
Phoenix, Arizona

RE: ARIZONA STATE CLEARINGHOUSE (A-95)
IDENTIFIER: 74-60-0012
ATTN: MRS. CONSTANCE LA MONICA

Gentlemen:

The City of Chandler offers no objection to the "Notice of Intent" covering "Transmission System, Granite Reef Aqueduct".

Sincerely,

Bruce B. Knutson

Bruce B. Knutson
Director of Public Works

BBK/cle

MARICOPA COUNTY PLANNING AND ZONING DEPARTMENT

300 County Administration Bldg   111 S. 3rd Avenue, Phoenix, Arizona 85003

MARICOPA COUNTY ARIZONA

May 1, 1974

MAY 3 1974

Maricopa County Association fo Governments
1820 West Washington Street
Phoenix, AZ 85007

Attention: Mr. Jesse Castillo

Subject: Transmission System, Granite Reef Aqueduct (C.A.P.)
MAG/State Application Identifier: 74-60-0012

Dear Mr. Castillo:

This is in reply to the A-95 project notification for MAG/State Application Identifer #74-60-0012 by the U. S. Bureau of Reclamation.

In reviewing the forwarded information concerning this project we find that the data provided and the scale of the map are both insufficient to evaluate this proposal. Therefore, the Maricopa County Planning Department has no comment concerning Application #74-60-0012.

In the event that the U. S. Bureau of Reclamation should choose to submit further information of a more detailed nature we would be happy to comment further.

Donald W. Hutton
Director

David Miller

David Miller
Planner
Advance Planning Division

sfh

MARICOPA COUNTY HIGHWAY DEPARTMENT

3325 WEST DURANGO STREET • PHOENIX, ARIZONA 85009

MARICOPA COUNTY ARIZONA

May 1, 1974

MAY 8 1974

Maricopa Association of Government
1820 West Washington
Phoenix, Arizona 85007

Gentlemen

Re: A-95 CLEARINGHOUSE #74-60-0012

Maricopa County Highway Department has no reason to oppose the Bureau of Reclamation request for Federal Funds for Granite Reef Aqueduct Transmission System.

Very truly yours,

F. H. Lathrop

F. H. Lathrop, P.E.
Acting County Engineer

FHL:of

MIKE O'CALLAGHAN
GOVERNOR

COLORADO RIVER COMMISSION
OF NEVADA

P.O. Box 1748
LAS VEGAS, NEVADA 89101
TELEPHONE 384-5135

June 24, 1974

Mr. E. A. Lundberg
Regional Director
Lower Colorado Regional Office
U. S. Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Attention: Phillip Sharpe

Dear Mr. Lundberg:

Enclosed is a copy of the "Policies for Development of the Eldorado Valley" which had been adopted by the Colorado River Commission of Nevada on December 21, 1971.

This material was requested by Mr. Sharpe at the June 19 meeting at your office regarding the Environmental Statement on proposed Granite Reef Aqueduct power transmission system.

Please contact me if you have further questions.

Sincerely,

Theodore F. Whitmoyer

Theodore F. Whitmoyer
Secretary

Enclosure

ELDORADO VALLEY DEVELOPMENT AREA

POLICY FOR DEVELOPMENT
(Adopted 12-21-71)

The present Policy for Development established by the Eldorado Valley Advisory Group is centered around and based upon an industrial development with the necessary residential and commercial areas to support the industrial activities. The implementation and details of this policy is set forth in the Amendment to the General Plan, Eldorado Valley, Nevada, 1969.

The Colorado River Commission's policy for the acquisition and disposal of land in the Eldorado Valley is as follows:

(1) The Colorado River Commission's policy on Eldorado Valley contemplates the acquisition of the entire withdrawn area, less relinquishments.

(2) The Eldorado Valley should be developed into an industrial area or community and the nucleus of the development would be an industrial complex with the possibility that a major airport system would be integrated into the complex. This complex would provide the economic base for the growth of the residential and commercial areas and other necessary amenities which

would be in accordance with good urban planning principles. The land would be developed (put into use) in an orderly manner and not resold for speculative purposes.

(3) In the disposal of Eldorado Valley, the Commission does not propose to sell the entire valley to any one developer for development purposes. A large enough area to be attractive for development in desert conditions, such as are found in Eldorado Valley, will be offered and the remainder held for sale to other developers at another time. In the release of acreage to a developer the maximum amount of land that would be considered for purchase by one developer would be 25,000 acres with an option for an additional 25,000 acres. The minimum size parcel for release would be one section (640 acres). The sale of land will entail the imposition of conditions on the developer which require the developer to provide the funds through means of his sale contract with which the Commission will pay

the Bureau of Land Management for all lands for which patent has been requested.

(4) The Commission's policy will be to release land in fee to the developer in parcels conditioned upon the developer's payment of a land purchase installment at least equal to the land for which fee is conveyed and conditioned, additionally, on the developer providing or the guarantee of certain defined improvements equal to a certain value to be established prior to fee being conveyed to the developer by the Commission. The number of increments and the size of the payments are subject to negotiation and will be developed taking into consideration the type of development, the schedule of development, and other conditions at the time of sale.

(5) Before any sale is made to a developer the Commission will require the presentation of a preliminary plan and procedure by the developer which is acceptable to the Commission, and before any development work is

permitted the Commission will require approval by the Commission. The Commission will look to the developer to provide all those things necessary to complete the development and disposal of the land, the principal being to get the land on the tax rolls at its highest economic value.

(6) The Commission, among other conditions in any proposed contract with a developer, will require the developer to comply with all State and local laws and regulations pertaining to the development of land and air and water pollution control. Development of the valley would be under the jurisdiction of Clark County or Boulder City. A new governmental entity will not be considered.

(7) The purchase of the entire valley by the Commission from the Bureau of Land Management will be by requesting patent to successive increments of the valley as monies are provided through the contract terms the Commission has with developers. No increment of land will be requested from the Bureau of Land Management for which the Commission does not have monies to pay the Bureau of Land Management's appraised price.

CLARK COUNTY REGIONAL PLANNING COUNCIL
COUNTY COURT HOUSE ANNEX
400 LAS VEGAS BLVD. SOUTH
LAS VEGAS, NEVADA 89101

(702) 386-4011

652-

April 12, 1974

MR. E. A. LUNDBERG
Regional Director
U. S. Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

600-

Dear Sir:

Please be informed that in its meeting of April 9, the Technical Committee of the Clark County Regional Planning Council reviewed the intent of the Bureau of Reclamation to construct and improve the Granite Reef Aqueduct that supplies electrical power to areas in the lower Colorado River Basin. In its review, the Committee members expressed some concern as to how this project might affect the following:

1. Lake Mead Wilderness area.
2. The Las Vegas Wash conservation proposal.
3. The Rainbow Garden area.
4. Are new corridors to be established and if so, where?

The Committee moved to hold any action on this matter until their meeting of May 14 and asked that I contact you with a request that you provide us additional information concerning the project.

Please contact me if you have any questions concerning our request.

Sincerely,

Homer C Chandler

HOMER C. CHANDLER
Executive Director

HCC/cc

County of Clark; Cities of Boulder City Henderson Las Vegas North Las Vegas;
Clark County School District; Las Vegas Valley Water District

APPENDIX B

Appendix B

Advisory Commission on Arizona Environment

List of Participating Agencies and Organizations

ABI Corporation, Scottsdale

Advisory Council on Intergovernmental Relations, Office of the Governor

American Association of University Women

American Society of Landscape Architects, Arizona Chapter

Arizona Academy of Science

Arizona Association of Colored Women's Clubs

Arizona Atomic Energy Commission

American Arbitration Association

Arizona Bureau of Mines, College of Mines, The University of Arizona

Arizona Commission of Agriculture and Horticulture

Arizona Community Planners and Developers Association

Arizona Council of Engineering and Scientific Associations, Tucson Regional Committee

Arizona Department of Education

Arizona Department of Mineral Resources

Arizona Department of Public Safety

Arizona Education Association

Arizona Environmental Education Association

Arizona Federation of Garden Clubs, Inc.

Arizona Federation of Republican Women, Environmental Quality Committee

Arizona Game and Fish Department

Arizona Highway Department

Arizona Hotel and Motel Association

Arizona Mining Association

Arizona Outdoor Recreation Coordinating Commission

Arizona Parks and Recreation Association

Arizona Public Health Association

Arizona Public Service Company

Arizona State Department of Health

Arizona State Land Department

Arizona State Nurses Association

Arizona State Parks Board

Arizona State University

Arizona Water Commission

Arizona Wildlife Federation

Bashas' Markets, Chandler

Bisbee Council on the Arts and Humanities

Boy Scouts of America, Theodore Roosevelt Council

Bozell, Jacobs & Wallrapp, Inc., Phoenix

Chandler Beautification Committee

Coconino Sportsmen

Construction Graphics, Lake Havasu City

Corps of Engineers, U.S. Department of the Army

Department of Civil Engineering, College of Engineering, The University of Arizona

Desert Caballeros Western Museum, Wickenburg

Eller Outdoor Advertising Company of Arizona

Henderson Realty, Tucson

Immigration and Naturalization Service, Nogales

Institute of Electrical and Electronics Engineers, Tucson Section

Department of the Interior

Bureau of Land Management

Bureau of Mines

Bureau of Reclamation

Fish and Wildlife Service, Division of River Basin Studies

National Park Service

Kingman-Mohave County Chamber of Commerce

League of Women Voters

Lowell Observatory, Flagstaff

Maricopa Audubon Society

Maricopa County Parks and Recreation Department

Mayor's Youth Advisory Board, Phoenix

Gordon J. McCulloch & Associates, Consulting Engineers

Men's Garden Club of Tucson

Mountain Bell

National Committee for Support of the Public Schools

National Wildlife Federation

Navajo Communication Board, Window Rock

Phoenix Coca-Cola Bottling Company

Roman Catholic Diocese of Tucson

Salt River Project

SAVE, Inc. (Sportsmen Against Vandalism Everywhere)

School of Forestry, Northern Arizona University

Simon and Jekel, Attorneys at Law

Soil Need, Inc., Globe

Southern Arizona Environmental Council

Southwest Forest Industries

Tonto National Forest, U.S. Department of Agriculture

The Arizona Daily Star

The National Brewing Company

The Navajo Nation, Window Rock

The Arizona Republic

Tucson Consumers Council

Tucson Environmental Committee

Tucson Gas & Electric Company

United States Brewers Association, Inc.

U.S. Public Health Service, Window Rock

Valley Christian Centers, Phoenix

Valley Forward Association, Phoenix

Valley National Bank

Yates Army-Navy Stores, Inc.

Yavapai Group, Grand Canyon Chapter, Sierra Club, Prescott

Yuma County Cotton Wives

APPENDIX C

Table 1 Amphibians and Reptiles in the Vicinity of the Granite Reef Transmission System

		Relative Abundance*			
		Rare	Uncommon	Common	Very Common
Couches Spadefoot	*Scaphiopus couchi*		X		
Colorado River Toad	*Bufo alvarius*			X	
Woodhouse's Toad	*Bufo woodhousei*		X		
Great Plains Toad	*Bufo cognatus*			X	
Bad-spotted Toad	*Bufo punctatus*			X	
Treefrog	*Hyla arenicolor*	X			
Leopard Frog	*Rana pipiens*		X		
Desert Tortoise	*Gopherus agassizi*		X		
Gila Monster	*Heloderma suspectum*		X		
Banded Gecko	*Coleonyx variegatus*				X
Desert Iguana	*Dipsosaurus dorsalis*				X
Collared Lizard	*Crotaphytus collaris*				X
Leopard Lizard	*Gambelia wislizeni*		X		
Chuckwalla	*Sauromalus obesus*			X	
Zebra-tailed Lizard	*Collisaurus draconoides*			X	
Desert Spiny Lizard	*Sceloporus magister*				X
Long-tailed Brush Lizard	*Urosaurus graciosus*				X
Tree Lizard	*Urosaurus ornatus*				X
Side-blotched Lizard	*Uta stansburiana*				X
Desert Horned Lizard	*Phrynosoma platyrhinos*				X
Flat-tailed Horned Lizard	*Phrynosoma m'calli*	X			
Desert Night Lizard	*Xantusia vigilis*		X		
Western Whiptail	*Cnemidophorus tigris*				X
Western Blind Snake	*Leptotyphlops humilis*	X			
Desert Boa	*Lichanura trivirgata*	X			

*"Relative Abundance" means the abundance of the animal in the Granite Reef Transmission System area relative to the abundance of other species in the area.

Table 1 Amphibians and Reptiles in the Vicinity of the Granite Reef Transmission System (cont.)

		Relative Abundance*			
		Rare	Uncommon	Common	Very Common
Checkered Garter Snake	Thamnophis marcianus			X	
Coachwhip; Whipsnake (Red Racer)	Masticophis flagellum			X	
Desert Patch-nosed Snake	Salvadora hexalepis	X			
Ringneck Snake	Diadophis punctatus	X			
Bullsnake; Gopher Snake	Pituophis melanoleucas				X
Glossy Snake	Arizona elegans			X	
Long-nosed Snake	Rhinocheilus lecontei			X	
Common Kingsnake	Lampropeltis getulus			X	
Spotted Leaf-nosed Snake	Phyllorhynchus decurtatus			X	
Western Ground Snake	Sonora semiannulata	X		X	
Western Shovel-nosed Snake	Chionactis occipitalis			X	
Southwestern Lyre Snake	Trimorphodon lyrophanes		X		
Night Snake	Hypsiglena torquata			X	
Arizona Coral Snake	Micruroides euryxanthus		X		
Western Diamondback Rattlesnake	Crotalus atrox		X		
Black-tailed Rattlesnake	Crotalus molossus		X		
Mohave Rattlesnake	Crotalus scutulatus			X	
Speckled Rattlesnake	Crotalus mitchelli			X	
Sidewinder	Crotalus cerastes				X

Note: Information in this table was compiled by the Environmental Staff of the Bureau of Reclamation with editorial cooperation and consultation from members of the academic staff at Arizona State University.

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System

Explanation

1 Common and scientific names were taken from the Check-list of North American Birds and Supplement published by The American Ornithologists' Union.

2 Relative abundance refers to the abundance of a species relative to other similar species (i.e. hawk relative to hawks).

*Indicates nesting
**Introduced species

E-Listed as Endangered in Fish and Wildlife Service's 1973 edition of Threatened Wildlife of the United States.
T-Listed as Threatened.
SU-Listed as Status Undetermined.

KEY TO RELATIVE ABUNDANCE:

S--March - May	a--abundant
S--June - August	c--common
F--September - November	u--uncommon
W--December - February	o--occasional
	r--rare

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
Common Loon	*Gavia immer*	o	r	o	o
Arctic Loon	*Gavia arctica*	accidental			
Horned Grebe	*Podiceps auritus*	accidental			
Eared Grebe	*Podiceps nigricollis*	c	o	c	c
Western Grebe	*Aechmophorus occidentalis*	c	o	c	c
*Pied-billed Grebe	*Podilymbus podiceps*	u	u	c	c
White Pelican	*Pelecanus erythrorhynchos*	c	o	c	u
Brown Pelican	*Pelecanus occidentalis*	accidental			
*Double-crested Cormorant	*Phalacrocorax auritus*	a	c	a	a
*Great Blue Heron	*Andea herodias*	c	c	c	c
*Green Heron	*Butorides virescens*	u	c	u	r
*Common Egret	*Casmerodius albus*	c	c	c	c
*Snowy Egret	*Egretta thula*	c	c	c	c
*Black-crowned Night Heron	*Nycticorah mycticorax*	u	c	c	u
*Least Bittern	*Ixobrychus exilis*	u	c	c	u
American Bittern	*Botaurus lentiginosus*	r		u	u
Wood Ibis	*Mycteria americana*		o	u	
White-faced Ibis	*Plegadis chihi*	o		o	
Whistling Swan	*Olor columbianus*			o	o
Canada Goose	*Branta canadensis*	u		c	c
White-fronted Goose	*Anser albifrons*	r		o	r
Snow Goose	*Chen caerulescens*	o		c	c
Ross' Goose	*Chen rossii*	accidental			
Fulvous Tree Duck	*Dendrocygna* bicolor	accidental			
*Mallard	*Anas platyrhynchos*	u	o	c	c
*Gadwall	*Anas strepera*	u	r	c	c
Pintail	*Anas acuta*	c	o	a	u
Green-winged Teal	*Anas crecca*	o	r	c	a
Blue-winged Teal	*Anas discors*	o	r		

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/]			
		S	S	F	W
Cinnamon Teal	_Anas cyanoptera_	c	o	a	o
European Wigeon	_Anas penelope_	accidental			
American Wigeon	_Anas americana_	u	o	c	c
Shoveler	_Anas clypeata_	o	r	c	c
Wood Duck	_Aix sponsa_			r	r
Redhead	_Aythya americana_	c	o	c	u
Ring-necked Duck	_Aythya collaris_	o		u	u
Canvasback	_Aythya valisineria_	o		u	u
Lesser Scaup	_Aythya affinis_	c	o	c	u
Common Goldeneye	_Bucephala clangula_	o		o	u
Bufflehead	_Bucephala albeola_	c		c	c
Oldsquaw	_Clangula hyemalis_	accidental			
Ruddy Duck	_Oxyura jamaicensis_	c	o	a	u
Hooded Merganser	_Lophodytes cucullatus_				r
Common Merganser	_Mergus merganser_	o	o	o	c
Red-breasted Merganser	_Mergus serrator_	c	r	c	r
Turkey Vulture	_Cathartes aura_	c	c	u	o
Sharp-skinned Hawk	_Accipiter striatus_	u		u	u
*Cooper's Hawk	_Accipiter cooperii_	u	r	c	u
*Red-tailed Hawk	_Buteo jamaicensis_	c	c	c	c
Swainson's Hawk	_Buteo swainsoni_	accidental			
*Zone-tailed Hawk	_Buteo albonotatus_		r	r	
White-tailed Hawk	_Buteo albicaudatus_				r
Rough-legged Hawk	_Buteo lagopus_	accidental			
Ferruginous Hawk	_Buteo regalis_	accidental			
*Harris' Hawk	_Parabuteo unicinctus_	o	o	o	o
Golden Eagle	_Aquila chrysaetos_				u

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
E Bald Eagle	Haliaeetus leucocephalus				r
Marsh Hawk	Circus cyaneus	u		c	c
SU Osprey	Pandion haliaetus	c	r	c	o
T Prairie Falcon	Falco mexicanus	r	r	r	r
E Peregrine Falcon	Falco peregrinus	o	o	o	o
Pigeon Hawk	Falco columbarius			u	o
*Sparrow Hawk	Falco sparverius	c	u	c	c
*Gambel's Quail	Lophortyx gambelii	a	a	a	a
Sandhill Crane	Grus canadensis	o		o	
E*Yuma Clapper Rail	Rallus longirostris yumanensis	c	c		
Virginia Rail	Rallus limicola	r		u	u
Sora	Porzana carolina	c		c	c
*Common Gallinule	Gallinula chloropus	u	u	u	u
*American Coot	Fulica americana	c	c	c	a
Semipalmated Plover	Charadrius semipalmatus	u	o	u	
Snowy Plover	Charadrius alexandrinus	u	c	c	r
*Killdeer	Charadrius vociferus	c	c	c	c
Mountain Plover	Charadrius montanus			r	
Black-bellied Plover	Pluvialis squatarola	o	o	o	
Common Snipe	Capella gallinazo	u		u	u
Long-billed Curlew	Numenius americanus	u	c	u	
Whimbrel	Numenius phaeopus			r	
Spotted Sandpiper	Actitis macularia	c	u	c	u
Solitary Sandpiper	Tringa solitaria	r	u	u	
Willet	Catoptrophorus semipalmatus	u	c		
Greater Yellowlegs	Tringa melanoleucus	u	u	c	o
Lesser Yellowlegs	Tringa flavipes	o	o	o	o

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
Pectoral Sandpiper	Calidris melanotos			o	
Baird's Sandpiper	Calidris bairdii		u	u	
Least Sandpiper	Calidris minutilla	u		c	c
Dunlin	Calidris alpina	r		o	r
Western Sandpiper	Calidris mauri	u	c	c	
Sanderling	Calidris alba	r	r	r	
Long-billed Dowitcher	Limnodromus scolopaceus	u		c	u
Marbled Godwit	Limosa fedoa	o	c	r	
American Avocet	Recurvirostra americana	u	c	c	r
Black-necked Stilt	Himantopus mexicanus	o	c	u	
Red Phalarope	Phalaropus fulicarius			r	
Wilson's Phalarope	Steganopus tricolor	o	u	u	
Northern Phalarope	Lobipes lobatus	r	c	u	
Parasitic Jaeger	Stercorarius parasiticus	accidental			
Herring Gull	Larus argentatus				o
California Gull	Larus californicus	c		u	
Ring-billed Gull	Larus delawarensis	C	U	C	C
Franklin's Gull	Larus pipixcan			r	
Bonaparte's Gull	Larus philadelphia	o		o	r
Sabine's Gull	Xema sabini			r	
Forster's Tern	Sterna forsteri	u	c	u	
Common Tern	Sterna hirundo		u	u	
Caspian Tern	Hydroprogne caspia	o	c	u	
Black Tern	Childonias niger	o	c	u	
*Mourning Dove	Zenaida macroura	c	a	c	u
*White-winged Dove	Zenaida asiatica	u	c	u	
Ground Dove	Columbiana passerina		r	r	

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1]	Scientific Name[1]	Relative Abundance[2] S	S	F	W
Inca Dove	*Scardafella inca*	u	u	u	u
*Yellow-billed Cuckoo	*Coccyzus americanus*		u		
*Roadrunner	*Geococcyx californianus*	c	c	c	c
*Barn Owl	*Tyto alba*	u	u	u	u
*Screech Owl	*Otus asio*	c	c	c	c
*Great Horned Owl	*Bubo virginianus*	c	c	c	c
*Ferruginous Owl	*Glaucidium brasilianum*	u	u	u	u
Elf Owl	*Micrathene whitneyi*	r	r		
Long-eared Owl	*Asio otus*	r			r
Short-eared Owl	*Asio flammeus*	accidental			
*Poor-will	*Phalaenoptilus nuttallii*	c	o	c	
*Lesser Nighthawk	*Chordeiles acutipennis*	c	c	c	
Vaux's Swift	*Chaetura vauxi*	u		o	
*White-throated Swift	*Aeronautes saxatalis*	u	u	o	u
*Black-chinned Hummingbird	*Archilochus alexandri*	u	u		
*Costa's Hummingbird	*Calypte costae*	c			u
Calliope Hummingbird	*Stellula calliope*	u		u	
Rufous Hummingbird	*Selasphorus rufus*		o	o	
Belted Kingfisher	*Megaceryle alcyon*	u		c	c
*Common Flicker	*Colaptes auratus*	u	o	c	c
*Gila Woodpecker	*Centurus uropygialis*	c	c	c	c
Acorn Woodpecker	*Melanerpes formicivorus*	accidental			
Lewis' Woodpecker	*Asyndesmus lewis*			o	o
Yellow-bellied Sapsucker	*Sphyrapicus varius*	o		u	u
Williamson's Sapsucker	*Sphyrapicus thyroideus*	accidental			
*Ladder-backed Woodpecker	*Dendrocopos scalaris*	c	c	c	c
Tropical Kingbird	*Tyrannus melancholicus*	accidental			
*Western Kingbird	*Tyrannus verticalis*	c	c	o	

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
Cassin's Kingbird	Tyrannus vociferans		r		
*Wied's Crested Flycatcher	Myiarchus tyrannulus	o	o		
*Ash-throated Flycatcher	Myiarchus cinerascens	c	c	o	o
Eastern Phoebe	Sayornis phoebe	accidental			
Black Phoebe	Sayornis nigricans	u	c	c	c
Say's Phoebe	Sayornis saya	c	u	c	c
Traill's Flycatcher	Empidonax traillii	a	o	c	
Hammond's Flycatcher	Empidonax hammondii	c		c	
Least Flycatcher	Empidonax minimus	r		r	
Gray Flycatcher	Empidonax wrightii	o		o	o
Western Flycatcher	Empidonax difficilis	c		c	
Western Wood Pewee	Contopus sordidulus	c		c	
Olive-sided Flycatcher	Nuttallornis borealis	o		o	
*Vermilion Flycatcher	Pyrocephalus rubinus	c	c	c	c
Horned Lark	Eremophila alpestris			o	o
Violet-green Swallow	Tachycineta thalassina	c	o	u	o
Tree Swallow	Iridoprocne bicolor	a	u	a	a
Bank Swallow	Riparia riparia	o	o		
*Rough-winged Swallow	Stelgidopteryx ruficollis	c	c	o	o
Barn Swallow	Hirundo rustica	c		c	
*Cliff Swallow	Petrochelidon pyrrhononota	c	c	o	
Purple Martin	Progne subis	r		r	
Steller's Jay	Cyanocitta stelleri	r		r	r
Scrub Jay	Aphelocoma coerulescens	r		o	o
Common Raven	Corvus coras	c	c	c	c
Common Crow	Corvus brachyrhynchos	r		r	u
Pinyon Jay	Gymnorhinus cyanocephalus	accidental			
Mountain Chickadee	Parus gambeli	r		u	r

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
Bridled Titmouse	*Parus wollweberi*	r		u	r
Verdin	*Auriparus flaviceps*	c	c	c	c
Bushtit	*Psaltriparus minimus*	accidental			
White-breasted Nuthatch	*Sitta carolinensis*			r	r
Red-breasted Nuthatch	*Sitta caradensis*			r	
Brown Creeper	*Certhia familiaris*			r	r
House Wren	*Troglodytes aedon*	u		c	c
Bewick's Wren	*Thryomanes bewickii*			o	o
*Cactus Wren	*Campylorhynchus brunneicapillus*	u	u	u	u
*Long-billed Marsh Wren	*Telmatodytes palustris*	u	u	u	u
*Canyon Wren	*Catherpes mexicanus*	u	u	u	u
*Rock Wren	*Salpinctes obsoletus*	u	u	c	c
*Mockingbird	*Mimus polyglottos*	c	c	c	c
Bendere's Thrasher	*Toxostoma bendirei*	o			
*Curve-billed Thrasher	*Toxostoma curvirostre*	c	c	c	c
*Crissal Thrasher	*Toxostoma dorsale*	c	c	c	c
Sage Thrasher	*Oreoscoptes mountanus*	u		u	o
American Robin	*Turdus migratorius*	o		u	u
Hermit Thrush	*Catharus guttata*	u		u	u
Swainson's Thrush	*Catharus ustulata*	o		o	
Western Bluebird	*Sialia mexicana*			u	u
Mountain Bluebird	*Sialia currucoides*			u	u
Townsend's Solitaire	*Myadestes townsendi*	o		o	o
Blue-gray Gnatcatcher	*Polioptila caerulea*	o		o	o
*Black-tailed Gnatcatcher	*Polioptila melanura*	c	c	c	c
Ruby-crowned Kinglet	*Regulus calendula*	c		c	c
Sprague's Pipet	*Anthus sparagueii*	accidental			

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name 1/	Scientific Name 1/	Relative Abundance 2/ S	S	F	W
Cedar Waxwing	*Bombycilla cedrorum*	r		o	
*Phainopepla	*Phainopepla nitens*	c	c	u	c
*Loggerhead Shrike	*Lanius ludovicianus*	c	c	c	c
**Starling	*Sturnus vulgaris*				u
Hutton's Vireo	*Vireo huttoni*	accidental			
Bell's Vireo	*Vireo bellii*	r	r		
Gray Vireo	*Vireo vicinior*	accidental			
Yellow-throated Vireo	*Vireo flavifrons*	accidental			
Solitary Vireo	*Vireo solitarius*	u		u	
Warbling Vireo	*Vireo gilvus*	c	u	c	
Black-and-White Warbler	*Mniotilta varia*			r	r
Blue-winged Warbler	*Vermivora pinus*	accidental			
Orange-crowned Warbler	*Vermivora celata*	c		c	c
Nashville Warbler	*Vermivora ruficapilla*	u		u	
Virginia's Warbler	*Vermivora virginiae*	accidental			
*Lucy's Warbler	*Vermivora luciae*	r	r	r	
Northern Parula	*Parula americana*	r		r	o
Yellow Warbler	*Dendroica petechia*	c	c	c	
Magnolia Warbler	*Dendroica magnolia*	accidental			
Yellow-rumped Warbler	*Dendroica coronata*	c		c	c
Black-throated Gray Warbler	*Dendroica nigrescens*	u		u	
Townsend's Warbler	*Dendroica townsendi*	u		u	
Black-throated Green Warbler	*Dendroica virens*	accidental			
Hermit Warbler	*Dendroica occidentalis*	u		o	
Northern Waterthrush	*Seiurus noveboracensis*	accidental			
MacGillivray's Warbler	*Oporornis tolmiei*	c		c	
*Yellowthroat	*Geothlypis trichas*	c	c	c	u
*Yellow-breasted Chat	*Icteria virens*	c	c	u	

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name 1/	Scientific Name 1/	Relative Abundance 2/ S	S	F	W
Wilson's Warbler	Wilsonia pusilla	c	c	c	
American Redstart	Setophaga ruticilla	r		o	
**House Sparrow	Passer domesticus	u	u	u	u
Bobolink	Dolichonyx oryzivorus	r		r	o
Western Meadowlark	Sturnella neglecta	u		c	c
*Yellow-headed Blackbird	Xanthocephalus xanthocephalus	c	c	c	
*Red-winged Blackbird	Agelaius phoeniceus	o	o		
*Hooded Oriole	Icterus cucullatus	o	o		
Scott's Oriole	Icterus parisorum	accidental			
*Northern Oriole	Icterus galbula	c	c		
Rusty Blackbird	Euphagus carolinus			r	r
Brewer's Blackbird	Euphagus cyancephalus	u		c	c
Great-tailed Grachle	Cassidix mexicanus	u		u	u
*Brown-headed Cowbird	Molothrus ater	c	c		
*Bronzed Cowbird	Tangavius aeneus	u	u	u	u
Western Tanager	Prianga ludoviciana	c		c	
Hepatic Tanager	Piranga flava	r		r	o
*Summer Tanager	Piranga rubra	o	o	o	
*Cardinal	Cardinalis cardinalis	o	o	o	o
Rose-breasted Grosbeak	Pheucticus ludovicianus	u	o	c	
*Black-headed Grosbeak	Pheucticus melanocphalus	u	o	c	
*Blue Grosbeak	Guiraca caerulea	o	c	o	
Lazuli Bunting	Passerina amoena	u		u	
Varied Bunting	Passerina versicolor	accidental			
Dickcissel	Spiza americana	accidental			
Evening Grosbeak	Hesperiphona vespertina	u		u	r
Purple Finch	Carpodacus purpureus			r	

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1/]	Scientific Name[1/]	Relative Abundance[2/] S	S	F	W
*House Finch	Carpodacus mexicanus	c	c	c	c
Pine Siskin	Spinus pinus	o		u	u
American Goldfinch	Spinus tristis	o		o	o
*Lesser Goldfinch	Spinus psaltria	u	u	u	u
Lawrence's Goldfinch	Spinus lawrencei	r			o
Red Crossbill	Loxia curvirostra	r		r	o
Green-tailed Towhee	Chlorura chlorura	u		u	u
Rufous-sided Towhee	Pipilo erythrophthalmus	o		u	o
*Brown Towhee	Pipilo fuscus	c	c	c	c
Abert's Towhee	Pipilo aberti	c	c	c	c
Lark Bunting	Calamospiza melanocorys	accidental			
Savannah Sparrow	Passerculus sandwichensis	u		c	u
Grasshopper Sparrow	Ammodramus savannaram	accidental			
Vesper Sparrow	Poolcetes gramineus	u		u	
Lark Sparrow	Chondestes grammacus	o		o	
*Black-throated Sparrow	Amphispiza bilineata	u	u	u	u
Sage Sparrow	Amphispiza belli			u	u
Dark-eyed Junco	Junco Hyemalis	o		u	u
Gray-headed Junco	Junco caniceps			r	
Chipping Sparrow	Spizella passerina	c	o	c	o
Brewer's Sparrow	Spizella breweri	c		c	o
Black-chinned Sparrow	Spizella atrogularis	accidental			
White-crowned Sparrow	Zonotichia leucophrys	c		c	c
Golden-crowned Sparrow	Zonotrichia atricapilla	o		o	r
White-throated Sparrow	Zonotrichia albicollis	o		o	r
Fox Sparrow	Passerella iliaca	r		r	r
Lincoln's Sparrow	Melospiza lincolnii	c		c	o

Table 2 Birds in the Vicinity of the Granite Reef Aqueduct Transmission System (Cont.)

Common Name[1]	Scientific Name[1]	Relative Abundance[2] S	S	F	W
Swamp Sparrow	*Melospiza georgiana*	accidental			
*Song Sparrow	*Melospiza melodia*	c	c	c	c
Chestnut-collared Longspur	*Calcarius ornatus*			r	

1 Common and scientific names were taken from the Check-list of North American Birds and Supplement published by The American Ornithologists' Union.
2 Relative abundance refers to the abundance of a species relative to other similar species (i.e. hawk relative to hawks).

*Indicates nesting
**Introduced species

E-Listed as Endangered in Fish and Wildlife Service's 1973 edition of Threatened Wildlife of the United States.
T-Listed as Threatened.
SU-Listed as Status Undetermined.

KEY TO RELATIVE ABUNDANCE:

S--March - May
S--June - August
F--September - November
W--December - February

a--abundant
c--common
u--uncommon
o--occasional
r--rare

Table 3 Mammals in the Vicinity of the Granite Reef Aqueduct Transmission System

		Relative Abundance			
		Rare	Uncommon	Common	Very Common
Man	*Homo sapien*				X
Desert Shrew	*Notiosorex crawfordi*			X	
California Leaf-nosed Bat	*Macrotus californicus*			X	
Yuma Myotis	*Myotis yumanensis*			X	
Cave Myotis	*Myotis velifer*				X
California Myotis	*Myotis californicus*			X	
Small-footed Myotis	*Myotis subulatus*		X		
Western Pipistrelle	*Pipistrellus hesperus*			X	
Big Brown Bat	*Eptesicus fuscus*			X	
Red Bat	*Lasiurus borealis*		X		
Hoary Bat	*Lasiurus cinereus*		X		
Lump-nosed Bat	*Plecotus townsendii*	X			
R Spotted Bat	*Euderma maculata*	X			
Pallie Bat	*Antrozous pallidus*			X	
Mexican Free-tailed Bat	*Tadarida brasiliensis*				X
Pocketed Free-tailed Bat	*Tadarida femorosaca*	X			
Big Free-tailed Bat	*Tadarida molossa*	X			
Western Mastiff Bat	*Eumops periotis*	X			
Black-tailed Jack Rabbit	*Lepus californicus*				X
Desert Cottontail	*Sylvilagus audubonii*				X
Rock Squirrel	*Citellus variegatus*			X	
Harris Antelope Squirrel	*Citellus harrisii*			X	
White-tailed Antelope Squirrel	*Citellus leucurus*				X

* Relative abundance means the abundance of the animal in the area the Granite Reef Transmission System will go through relative to other species.

R Listed as rare on the Fish and Wildlife Service's list of Threatened Wildlife of the United States.

Table 3 Mammals in the Vicinity of the Granite Reef Aqueduct Transmission System (cont.)

		Relative Abundance			
		Rare	Uncommon	Common	Very Common
***Horse	Equus			X	
***Burro	Equus asinus			X	
***Cat	Felis domestica			X	
***Cow	Bos sp.			X	
***Dog	Canis familiaris			X	
***Goat	Capra hircus			X	
***Mouse	Mus musculus			X	
***Rat	Rattus norvegicus			X	
***Sheep	Ovis aries			X	
Round-tailed Ground Squirrel	Spermophilus tereticandus			X	
Valley Pocket Gopher	Thomomys bottae			X	
Longtail Pocket Mouse	Perognathus formosus		X		
Little Pocket Mouse	Peronathus longimembris		X		
Arizona Pocket Mouse	Perognathus amplus			X	
Bailey's Pocket Mouse	Perognathus baileyi		X		
Desert Pocket Mouse	Perognathus penicillatus		X		
Rock Pocket Mouse	Perognathus intermedius		X		
Merriam's Kangaroo Rat	Dipodomys merriami			X	
Desert Kangaroo Rat	Dipodomys deserti			X	
Southern Grasshopper Mouse	Onychomys torridus		X		
Western Harvest Mouse	Reithrodontomys megalotis		X		
Canyon Mouse	Peromyscus orinitus		X		
Cactus Mouse	Peromyscus eremicus		X		
Deer Mouse	Peromyscus maniculatus				X
Hispid Cotton Rat	Sigmodon hispidus			X	
White-throated Wood Rat	Neotoma albigula		X		
Desert Wood Rat	Neotoma lepida			X	
Coyote	Canis latrans		X		
Kit Fox	Vulpes macrotis		X		
Gray Fox	Urccyon cinereoargenteus		X		
Ringtail	Bassariscus astutus			X	

***Introduced

Table 3 Mammals in the Vicinity of the Granite Reef Aqueduct Transmission System (cont.)

		Relative Abundance			
		Rare	Uncommon	Common	Very Common
Raccoon	Procyon lotor		X		
***Opossum	Didelphis marsupialis	X			
Badger	Taxidea taxus			X	
Spotted Skunk	Spilogale putorius		X		
Striped Skunk	Mephitis mephitis			X	
Mountain Lion	Felic concolor			X	
Bobcat	Lynx rufus			X	
Javelina	Pecari tajacu		X		
Black-tailed Mule Deer	Odocoileus hemionus			X	
Bighorn	Ovis canadensis		X		
Pronghorn	Antilocarpra americana	X			

***Introduced

Note: Information included in this table was compiled by the Environmental Staff of the Bureau of Reclamation with editorial cooperation and consultation from members of the academic staff at Arizona State University.

Table 4

Trees, Shrubs, and Herbs

in the Vicinity of the Granite Reef Aqueduct Transmission System 1/

(Not including Cacti and Grasses)

Arizona-poppy	*Kallstroemia grandiflora*
Arrow-leaf	*Hofmeisteria pluriseta*
Arrowweed	*Pluchea sericca*
Alfileria, Filaree	*Erodium eicutarium*
Anglepod	*Gonolobus productus*
Allionia, trailing	*Allionia incarnata*
Aster, Mohave	*Aster abatus*
Brickell bush	*Brickellia coulteri*
Broomrape	*Orobanche ludoviciana*
Buffalo-gourd	*Cucurbita foetidissima*
Burrobush, cheeseweed	*Hymenoclea salsola*
Big Saltbush	*Atriplex lentiformis*
Bladder-sage	*Salazaria mexicana*
Bur clover	*Medicago hispida*
Brandegea	*Brandegea Bigelovii*
Burrobrush	*Hymenoclea monogyra*
Bur-sage	*Franseria sp.*
Burrow weed	*Aplopappus tenuiseclus*

1/ This is a listing of the trees, shrubs, and herbs that could be found in the vicinity of the Granite Reef Aqueduct Transmission System. All of these are not expected to be found on the alinement nor is this intended to represent a complete listing of trees, shrubs, and herbs that will be found.

Table 4 (cont.)

Broom baccharis	_Baccharis sarothroides_
Beardtongue, desert	_Penstemon pseudospectabills_
**Bind-weed, field	_Convolvulus arvensis_
Bladderpod	_Lesquerella Gordoni_
Brittle-bush	_Encelia farinosa_
Buffalobur	_Solanum rostratum_
Cottonwood	_Populus Fremontii_
Creosote bush	_Larrea tridentata_
Chinese pusley or quail plant	_Heliotropium curassavicum_
Canaigre	_Rumex hymenosepalus_
Curley leaf dock	_Rumex conglomeratus_
Catclaw-acacia	_Acacia Greggii_
Cream-cups	_Platystemon californicus_
California or Golden poppy	_Eschscholtzia mexicana_
Chuparosa	_Beloperone californica_
Cucumber, wild	_Marab gilensis_
Cocklebur	_Xanthium saccharatum_
Cenizo	_Atriplex canescere_
Chaenactis	_Chaenactis Fremontii_
Coreopsis	_Coreopsis Douglasii_
Coyote-melon	_Cucurbita palmais_

**Introduced species

Crown-beard	*Verbesina encelioides*
*Crucifixion thorn	*Holacantha Emoryi*
Clammyweed	*Polanisia trachysporma*
Clematis, Western Virgin Blower	*Clematis Drummondii*
Crested prickle poppy	*Argemone platyceras*
**Daisy, African	
Desert Baileya, Desert Marigold	*Baileya multiradiata*
Desert Chicory, Goatsbeard	*Rafinesquia neomexicana*
Desert sunflower	*Geraea canescens*
*Desertlily	*Hesperocallis undulata*
*Desert Mariposa	*Calochortus Kennedyi*
Desert tobacco	*Nicotiana trigonophylla*
Devilsclaws, Unicornplant	*Proboscidea parviflora*
Dock	*Rumex hymenosepalus*
Dodder	*Cuscuta indecora*
Desert lavendar	*Hyptis Emoryi*
Dalea	*Dalea Fremontii*
Dandelion, desert	*Malacothryx glabrata*
Datura, sacred	*Datura metcloides*
Desert thornapple	*Datura discolor*
Desert indian wheat	*Plantago Fastigiata*
Deer Vetch	*Lotus sp.*

*Protected plants

**Introduced species

Table 4 (Cont.)

Desert marigold	*Baileya multiradiata*
Desert-mallow	*Sphaeralcea ambigua*
Desert star	*Monoptilon bellioidas*
Desert-willow	*Chilopsis linearis*
Desert saltbush	*Atriplex polycarpa*
Dove weed	*Croton texensic*
Desert hackberry	*Celtis pallida*
Euphorbia	*Euphorbia albomarginata*
Escobita	*Orthocarpus purpurascens*
Evening snow	*Linanthus dichotomus*
Elephant tree	*Bursera microphylla*
Enceliopsis, silverleaf	*Enceliopsis argophylla*
Ephedra, longleaf	*Ephedra trifurca*
Evening-primrose	*Oenothera brevipes* or *trichocalyx*
False mesquite calliandra, fairy duster	*Calliandra eriophylla*
Fiddleneck	*Amsincka intermedia*
Fourwing saltbush	*Atriplex canescens*
Fleabane	*Erigeron divergens*
Goldfields	*Baeria chrysostoma*
Goldpoppy, Mexican	*Eschscholtzia mexicana*

*Protected plants

Table 4 (cont.)

Groundsel	Senecio monoensis
Graythorn	Condalia lycioides
Grease-wood	Sarcobatus vermiculatus
Gilia	Gilia filiformis
Globemallow	Sphueralcea ambiqua
Guajilla	Calliandra eriophylla
Helio-trope, salt	Heliotropium curassavicum
Heron-bill	Erodium cicutarium
Horse-nettle, white	Solanum elaeagnifolium
Horehound	Marrubium vulgare
Indian wheat	Plantaginaceae sp.
Ironwood	Olneya tesota
Indian mallow	Abutilon Pringlei
Janusia	Janusia gracilis
Jimmyweed	Aplopappus heterophyllus
Jojoba, Goatnut	Simmondsia chinensis
*Joshua-tree	Yucca brevifolia
Jimson weed	Datura stramonium
Jackass clover	Wislizenia refracta
Knap-weed	Centaurea melitemsis
Larkspur	Delphinium scaposum
Loco	Astragalus Nuttallianus

*Protected plants

Table 4 (Cont.)

Lambsquarter	Chenopodium album
Lupine	Lupinus sparsiflorus
Mesquite	Prosopis velutina
Milkvetch	Astragalus sp.
Malacothrix	Malacothryx fendleri
Mallow, cheeseweed	Malva parviflora
Mesquite, honey	Prosopis juliflora
Mesquite, screwbean	Prosopis pubescens
Milkweed	Asclepias sp.
Misteltoe, American & Desert	Phoradendron Californicum
Monkey flower	Mimulus Bigelovii
Mexican Goldpoppy	Exchschottzia mexicana
Mormon-tea	Ephedra trifurca
Narrow leaf saltbush	Atriplex linearis
Nama	Nama demissum
*Ocotillo	Fouquieria splendens
Owl-clover	Orthocarpus purpurascens
Penstemon, Beard tongue	Penstemon pseudospectabilis
Phacelia, Scorpion weed	Phacelia crenulata
Phlox	Phlox tenuifolia

*Protected plants

Table 4 (cont.)

Plantain	Plantago purshii
Poinciana, Bird of Paradise	Caesalpinia Gilliesii
Puncturevine, Burnut, Bullhead	Tribulus terrestris
Paintbrush	Castilleja angustifolia
Prostrate pigweed	Amaranthus graecizan
Phlox, Santa Fe	Phlox nana
Pricklepoppy	Argemone platyceras
Paloverde foothill	Cercidium microphyllum
Paloverde blue	Cercidium floridum
Pasture sagebrush	Artemisia frigida
Petunia	Petunia parviflora
Prickle poppy	Argemone intermedia
Pigmy-weed	Tillaea eracta
Pepper grass	Lepidium Thurderi
Pickleweed, Iodine bush	Allenrolfea occidentalis
Primrose	Oenothera sp.
Prickley lettuce	Lactuca Serriola
**Russian thistle	Salsola pestifer
Rattlesnake weed	Euphorbia albomarginata
Reed, common, Carrizo	Phragmites communis
Rock-nettle	Eucnide urens
Rose mallow	Hibiscus denudatus
Sacred datura, Western & Giant Jinison	Datura meteloides

**Introduced species

Table 4 (Cont.)

Sego-lily	_Calochortus nuttallii_
Sand-verbena	_Abronia villosa_
Senna	_Cassia covesii_
Snake-weed	_Gutierrezia lucida_
Sowthistle, prickly	_Sonchus asper_
Spectaclepod	_Dithyrea wislizenii_
Starflower	_Gilia longiflora_
Skunkbush	_Rhus trilobata_
**Saltcedar	_Tamarix pentandra_
Sour clover	_Medicago indicus_
Snapdragon	_Antirrhinum filipes_
Sunflower	_Helianthus annuus_
Snakes-head	_Matacothrix Coulteri_
Star thistle	_Centaurea Calcitrape_
Seepweed	_Dondia toxreyana_
Seepwillow, water motic	_Baccharis glutinosa_
Spiderling	_Boerhaavia_
Spiny aster	_Astor spinosus_
Shrubby buckwheat	_Eriogonum wrightii_
Seepweed	_Suaeda suffrutescens_
Senna	_Cassia bauhinioides_
Sunray	_Enceliopsis argophylla_
*Smoke tree, smoke thorn	_Dalea spinosa_

*Protected plants

**Introduced species

Table 4 (Cont.)

**Tamarisk	Tamarix pentandra
Thistle, New Mexico	Cirsium ucomexicanum
Tobacco, tree	Nicotiana glauca
Triangle bur-sage	Franseria deltoidea
Turpentine bush	Aplopappus laricifolius
Tackstem	Calycoseris wrightii
**Tamarisk	Tamarix aphylla
Telegraph plant, Camphor weed	Heterotheca subaxillaris
Thistle, Mojave	Cirsium neomexicanum
Threadplant	Nemacladus glandul-ferus
Trailing-four-o'clock	Allionia incarnata
White bur-sage	Franseria dumosa
Willow	Salix sp.
White ratany	Krameria grayi
Wolfberry	Lycium macrodon, & Fremontii californicum
*Yucca, soaptree	Yucca elata

*Protected plants

**Introduced species

Table 5

Grasses (Gramineae) in the

Vicinity of the Granite Reef Aqueduct Transmission System

Alkali sacaton	*Sporobolus airoides*
Arizona cottontop	*Trichachne californica*
Arizona panicum	*Panicum arizonicum* or *hirticaule*
Barley grass	*Hordeum brachyantherum*
Blue grama	*Bouteloua gracilis*
Big galleta	*Hilaria rigida*
Bur grass	*Tragus Berteronianus*
**Bermuda grass	*Cynodon dactylon*
Blue grama	*Boutelous gracilis*
Bullgrass	*Muhlenbergia Emersleyi*
Burrograss	*Scleropogon brevifolius*
Bigelow bluegrass	*Poa Bigelovii*
Canarygrass	*Phalaris caroliniana*
Crabgrass	*Digitaria sanguinalis*
Cane beardgrass	*Andropogon barbinodis*
Curly mesquite	*Hilaria Belangeri*
Fluffgrass	*Tridens pulchellus*

* This is a listing of some of the grasses that could be found in the vicinity of the Granite Reef Aqueduct Route. All of these plants are not expected to be found growing on the aqueduct alinement nor is this intended to represent a complete listing of grasses that will be found.

**Introduced species

Foxtail brome	Bromus rubens
Foxtail barley	Hordeum jubatum
Giant Reed	Arundo Donax
Hairy grama	Bouteloua hirsuta
June grass	Koeleria cristata
Johnson grass	Sorghum halepense
Littleseed muhly	Muhlenbergia microsperma
Lovegrass	Eragrostis diffusa
Needle grama	Bouteloua aristidoides
Perennial ryegrass	Lolium perenne
Plains bristlegrass	Setaria macrostachya
Red sprangletop	Leptochloa filiformis
Rabbit-foot grass	Polypogon monspeliensis
Rothrock grama	Bouteloua Rothrockii
Reed	Phragmites communis
Red brome	Bromus rubens
Rescue brome	Bromus catharticus
Schismus	Schismus barbatus and arabicus
Saltgrass	Distichlis stricta
Spider grass	Aristida ternipes

Table 5(cont.)

Spike bent grass	Agrostis exorata
Sixweeks three-awn	Aristida adsensionis
Sixweeks grama	Bouteloua curtipendula
Sixweeks fescue	Festuca octoflora
Slim tridens	Tridens muticus
Sideoats grama	Bouteloua curtipendula
Slender grama	Bouteloua filiformis
Santa Rita three-awn	Artistida glabrata
Texas beargrass	Andropogon cirretus
Tanglehead	Heteropogon contortus
Water grass	Paspalum dilatatum
Wild oats	Avena fatua or barbata

Table 6 Cacti in the Vicinity of the Granite Reef Aqueduct Transmission System

Prickly-Pears

Beaver-tail	*Opuntia basilaris*
Clock-face	*Opuntia chlorotica*
Desert	*Opuntia Engelmannii*
Fragile	*Opuntia fragilis*
Purple	*Opuntia Gosselliana* var. *santa-rita*
Purple-fruited	*Opuntia phaeacantha*

Chollas

Buckhorn	*Opuntia acanthocarpa*
Bush	*Opuntia arbuscula*
Cane	*Opuntia spinosior*
Chain-fruit	*Opuntia fulgida*
Desert Christmas	*Opuntia leptocaulis*
Pencil	*Opuntia ramosissima*
Plateau	*Opuntia whipple*
Silver	*Opuntia echinocarpa*
Stag-horn	*Opuntia versicolor*
Teddy-bear	*Opuntia Bigelovii*

*This is a listing of some of the cacti that could be found in the vicinity of the Granite Reef Aqueduct Transmission System. All of these cacti are not expected to be found on the alinement nor is this intended to represent a complete listing of the cacti to be found.

Table 6 (cont.)

Hedgehogs

Arizona Rainbow	*Echinocereus pectinatus* var. *rigidissimus*
Bonker's	*Echinocereus Bonkerae*
Fendler's	*Echinocereus Fendleri*
Mohave	*Echinocereus mojavensis*
Porcupine	*Echinocereus stramineus*
Robust claret-cup	*Echinocereus gonacanthus*

Barrels (Small, 4-6")

Blue	*Echinocactus horizonthalonius*
Johnson's Pineapple	*Echinomastus Johnsonii*
Chartreuse	*Echinomastus Johnsonii* var. *lutescens*
Pineapple	*Echinomastus acunensis*

Barrels (Large 1-6')

California or Compass	*Ferocactus acanthodes*
Arizona Candy or Fishook	*Ferocactus Wislizeni*
Woolly-headed	*Echinocactus polycephalus*

Cereus

Saguaro-giant	*Carnegiea gigantea*
Night-blooming Cercus	*Peniocercus greggii*

Pincushions

Fishook Pincushion	*Mammillaria microcarpa*
Miller's Pincushion	*Mammillaria milleri*

TABLE 7

INVENTORY OF CULTURAL RESOURCES AFFECTED BY THE GRANITE REEF AQUEDUCT TRANSMISSION SYSTEM

Prehistoric 1/

Site	Remarks
Nevada	
Boulder City 1	Thin lithic scatter, metate fragment, trail related
Boulder City 2	Thin lithic scatter, trail related
Boulder City 3	Related to quarry site Eldorado Mountain No. 1
Eldorado Mountains 1	Quarry site
Metropolitan Water District 1	Widespread lithic scatter 2/
Metropolitan Water District 2	Widespread lithic scatter 2/
Metropolitan Water District 3	Widespread lithic scatter, quarry site 2/
Metropolitan Water District 4	Widespread lithic scatter 2/
Searchlight 1	One lone stone circle, basalt metate
Newberry Mountains 2	Three large rock-lined circular depressions
Davis Dam and Mohave Plant 1	One disturbed rock feature in a sandy area
Arizona	
Bullhead City 1	Chipping station
Bullhead City 2	Chipping station
Oatman 1	Widespread lithic scatter
Oatman 2	Widespread lithic scatter
Oatman 3	Three circular depressions in pavement
Oatman 4	Rock alinement, widespread lithic scatter
Oatman 5	Widespread lithic scatter
Oatman 6	Thin restricted lithic scatter
Oatman 7	Rock alinement, widespread lithic scatter
Oatman 8	Rock alinement, widespread lithic scatter
Oatman 9	Widespread lithic scatter
Basalt Basin 1	Possible rock alinement, widespread lithic scatter
Topock 1	Aboriginal trail, widespread lithic scatter
Sacramento Wash 1	Chipping station
AZ T:10:18	Temporary camp with sherd scatter
AZ S:2:1	Temporary camp with sherd scatter

1/ Sites with ceramics: The entire right-of-way fits this classification.
2/ Sites related by possible cultural affiliation.

TABLE 7 (Continued)

Historic

Site	Remarks
Nevada	
Searchlight Mining District 1	Area of historical mining claims and related activity
Searchlight Mining District 2	Ruins of ore processing mill, associated camps, dumps, and mining claims
Searchlight Mining District 3	Historical foundation and dump on edge of historical railroad bed (Crescent RR)
Newberry Mountains 1	Historical cache in small blowout
Arizona	
Buck Mountains 1	Walled arroyo for placer mining
Buck Mountains 2	Historic foundations, dumps, and shafts

Table 8

ISOLATED ARTIFACTS RECOVERED DURING ARCHEOLOGICAL SURVEY ALONG GRANITE REEF AQUEDUCT TRANSMISSION SYSTEM

No.	Artifact	Reach No.	No.	Artifact	Reach No.
1	Flakes	1	23	Quartz hammerstone	4
2	Rhyolite (?) core tool	1	24	Quartzite cobble (hammerstone(?))	4
3	Silicate blade fragment	2	25	Vesicular basalt metate fragment	4
4	Glass drinking vessel	2	26	Schist (?) pestle (?)	5
5	Unmodified quartz crystal	2	27	Granite mano fragment	5
6	Quartz flake	2	28	Vesicular basalt metate fragment	5
7	Chert core, flake	2	29	Rolled jasper flake (?)	5
8	Chert core	2	30	Quartz flake (?)	5
9	Jasper retouched flake	3	31	Andesite core	5
10	Silicate flake	3	32	Flake (?) (artifact absent)	5
11	Basalt (?) core tool, flake	3	33	Rhyolite (?) flake	5
12	Basalt (?) core	3	34	Rhyolite flake tool	5
13	Chalcedony flake	3	35	Silicate core (?)	5
14	Chalcedony flake	3	36	Chalcedony core (tool (?))	5
15	Granite milling stone fragments	4	37	Chalcedony core tool	6
16	Granite, schist (?) metate fragment	4	38	Rhyolite flake tool	6
17	Jasper flake	4	39	Gila (Wingate (?)) shouldered sherd	6
18	Granite (?) milling stone fragments	4	40	Granite mano, metate	7
19	Granite mano	4	41	Quartz core tool and debitage	7
20	Basalt metate fragment	4	42	Sherd scatter #7	8
21	Silicate flakes, some utilized	4	43	Granite mano fragment, vesicular basalt metate fragment	8
22	Basalt metate fragment	4	44	Sherd scatter #6	8
			45	Sherd scatter #5	9

Table 8

ISOLATED ARTIFACTS RECOVERED DURING ARCHEOLOGICAL SURVEY ALONG GRANITE REEF AQUEDUCT TRANSMISSION SYSTEM (cont.)

No.	Artifact	Reach No.
46	Sherd scatter #3	10
47	Sherd scatter #4	10
48	Lithics, sherds, thermal fractured rock	11
49	Core tool, proj. pt. base	11
50	Lithics, plainware sherds, thermal fractured rock	11
51	Sherd scatter #2	11
52	Sherd scatter #1	11
53	Metate (granite)	11
54	Sherd scatter #8	11
55	Sherd scatter #9	11
56	Core tool (from Arizona U:5:12 source material)	11
57	Proj. pt. frag., core and flake tools	12

APPENDIX D

GLOSSARY OF ENGINEERING TERMS

ANGLE STRUCTURE -

A special structure of various designs to permit changing alinement or direction of the routing of a transmission line.

BAY -

Space in a switchyard or substation used to terminate or connect transmission facilities.

BENCHING -

Local leveling or grading of earth to facilitate design or construction of a structure or operation of equipment.

BUS -

A conductor, or group of conductors, that serve as a common connection for two or more circuits.

CABLE SPREADING YARD -

An installation comprising all necessary facilities to make the transition from overhead high voltage transmission line to underground high voltage insulated cable.

CAPACITY -

The load for which a machine, apparatus, station, or system is rated.

CASCADING -

A progressive failure of a power system or part of a system. Failure or loss of a single critical part such as a large, heavily loaded transformer or transmission line will cause the load to shift to other parts of the system in an attempt to supply the loads. If these parts of the system are then overloaded by this increase, the protective devices will trip, causing these parts to be taken out of service. This progressive loss of transmission capability may cause the entire power system to fail.

CHECK STRUCTURE -

A structure in a canal that regulates water surface elevation upstream of the structure flow in canal.

CIRCUIT BREAKER -

A mechanical switching device capable of making, carrying, and breaking currents under normal circuit conditions and also for certain abnormal circuit conditions such as those of short circuit.

CIRCULAR MIL -

The cross-sectional area of a circle with a radius of 1 mil (1/1000 of an inch).

CONDUCTOR -

The wire utilized in electrical circuits to carry current.

2-CONDUCTOR BUNDLES -

The common practice of using two wires properly spaced instead of one wire, to reduce electromagnetic effects.

CORONA -

The physical phenomena of exciting the molecules of air (or any gas) surrounding a high voltage conductor. At higher voltage, there is an actual spray of electrons into the atmosphere.

CORRIDOR -

A corridor is a strip of land used in transmission line planning stages which is sufficient in width to provide latitude in locating one or more transmission lines therein, using topography and vegetation, in a manner to achieve the greatest harmony with the natural surroundings and the least impact on the environment.

DEAD END STRUCTURE -

A special structure to permit attachment of each conductor at full line tension as opposed to suspension structures that only support the weight of the conductor. Dead end structures can be used for tangent and angle structures.

DEMAND -

The load at the terminals of an installation or system averaged over a specified interval of time. Example: hourly kilowatt demand.

DISCONNECT SWITCH -

A switch in an electrical circuit that enables an operator to conveniently separate a portion of the installation from the remainder of the circuit.

DISTRIBUTION LINES -

Low-voltage electric powerlines delivering power to final stepdown transformers at voltages from 2 to 34.5 kV.

DISTRIBUTION SYSTEM -

That portion of an electric system used to deliver electric energy from points on the transmission or bulk power system to the consumers.

DOUBLE CIRCUIT -

Two separate 3-wire power circuits on the same tower.

ELECTRIC POWER -

A term used in the electric power industry to mean inclusively power and energy.

EMERGENCY INTERCONNECTION -

An interconnection established to meet an emergency need.

ENERGY -

That which does or is capable of doing work. It is measured in terms of the work it is capable of doing; electric energy is usually measured in kilowatthours.

FAULT -

A malfunctioning of a transmission line usually due to the short-circuiting of two conductors or live (energized) conductors contacting ground.

FOSSIL-FUEL PLANT -

An electric powerplant utilizing fossil fuel, coal, lignite, oil, or natural gas, as its source of energy.

GENERATION -

The act or process of producing electric energy from other forms of energy; also the amount of electric energy so produced.

INSTALLED CAPACITY -

The total of the capacities as shown by the nameplates of similar kinds of apparatus such as generating units, turbines, synchronous condensers, transformers, or other equipment in a station or system.

INSULATING OIL -

A special oil, usually refined from petroleum, used to provide electrical insulation and heat transfer in many types of electrical equipment.

INTERCONNECTION -

A tie permitting a flow of energy between the facilities of two electric systems.

INTERTIE -

Same as Interconnection.

kV (kilovolt) -

The term for thousand volts.

kWh (kilowatthour) -

The term for thousand-watt-hours (electrical energy).

LIGHTNING ARRESTER(s) -

A device installed on power systems to protect equipment from damaging currents resulting from lightning strike.

LINE LOSS -

Energy loss and power loss on a transmission or distribution line.

LOAD -

This is used in a number of ways: to indicate a device or collection of devices which consume electricity; to indicate the power required from a given supply circuit; the power or current being passed through a line or machine.

MW (megawatt) -

One million watts.

NESC -

The abbreviation of the National Electrical Safety Code.

NETWORK -

A system of transmission or distribution lines so cross-connected and operated as to permit multiple power supply to any principal point on it.

OFFPEAK ENERGY -

Electric energy supplied during periods of relatively low system demands as specified by the supplier.

OFFPEAK POWER -

Power supplied during designated periods of relatively low system demands.

OVERHEAD GROUND WIRES -

Conductors erected along the top of towers and poles to protect insulators and conductors from lightning damage. Sometimes called static or shield wires.

PEAK LOAD -

The maximum load consumed or produced by a unit or group of units in a stated period of time. It may be the instantaneous load or the maximum average load over a designated interval of time.

PHASE SHIFTING TRANSFORMER -

A device which can control the power flow as desired, on a line operated in parallel with other lines.

PHASE TO GROUND -

The difference in electrical potential between an energized conductor of a multiphase power system and the earth.

PHASE-TO-PHASE -

The difference in electrical potential between any two energized conductors in a multiphase power system.

POTHEAD -

A device that seals the end of an insulated cable and provides insulated egress for the conductor or conductors.

POWER RESOURCES -

Installation capable of converting hydro or thermal energy into electric power.

PUMP DROPPING -

The curtailing of electric power load in the form of removing electric pumps from the electric system at the supplier's discretion, or in accordance with a contractual agreement.

RADIAL TRANSMISSION LINES -

A transmission line supplying electric energy to a substation or a load that receives energy by no other means. The normal flow of energy in such a transmission line is in one direction only.

RELIABILITY -

Measure of an electric power system's ability to provide a continuous uninterrupted flow of power.

RIGHT-OF-WAY -

A legal right to use a strip of land belonging to others for construction and operation of a transmission line. This right restricts the use of the land to uses that are compatible with the transmission line. In some areas, additional right-of-way would be acquired for operation and maintenance roads.

SERIES CAPACITORS -

Devices inserted in a transmission line which make it possible to carry more load without instability than would be the case without them, usually used on long, extra-high-voltage lines.

SERVICE AREA -

Territory in which a utility system is required or has the right to supply or make available electric service to ultimate consumers.

SHOOFLY -

A temporary transmission line constructed to provide electrical service during the reconstruction or repair of a permanent facility.

SPINNING RESERVE -

Generating capacity connected to the bus and ready to take load.

STRUCTURE -

A means of supporting the conductor. A structure may be made of many types of material and constructed in various shapes.

SUBSTATION -

A single facility at which connections between the various components of a system, such as lines and transformers, are made and the switching of these components is carried out. A typical example is Liberty Substation.

SUSPENSION STRUCTURE -

A tower supporting conductors on vertical suspension insulators so that the tower carries only wind and vertical loads.

SWITCHING STATION -

See "Substation." Los Angeles Department of Water and Power describes their facility as "McCullough Switching Station."

SWITCHYARD -

A facility that is part of a larger feature such as a pumping plant or powerplant at which connections between the various components of a system are made and the switching of these components is carried out. A typical example is Parker Dam 230-kV switchyard.

TEMPORARY SERVICE -

Electric service to a load which exists for a relatively short time. Examples of temporary services are those supplying construction power, carnivals, and street decorations for celebrations.

TRANSFORMER -

An electrical device which changes electric energy from one voltage to another at the same frequency.

TRANSMISSION LINE -

A facility for transmitting electrical energy at high voltage from one point to another point. Transmission line voltages are normally 115-kV or larger.

TRANSMISSION LINE CAPACITY -

The maximum continuous rating of a transmission line. The rating may be limited by thermal considerations, capacity of associated equipment, voltage regulation, system stability or other factors.

TRANSMISSION SYSTEM -

An interconnected group of electric transmission lines and associated equipment for the movement or transfer of electric energy in bulk between points of supply and points at which it is transformed for delivery to ultimate consumers, or is delivered to electric systems of others.

UTILITY LINES -

Low voltage, usually 69-kV or less, electric powerlines, telephone lines, or other like facilities.

WATT -

The unit of power in the International System of Units; equivalent to 1/746 of a horsepower.

WATT-HOUR -

Unit of electrical energy, or work, equal to one watt acting for one hour.

WHEELING POWER -

The transfer of power through a system without use.

WHEELING SERVICE -

An electric operation wherein transmission facilities of one system are utilized to transmit power of another system. Wheeling service may be accomplished by displacement.

GLOSSARY OF ENVIRONMENTAL TERMS

AVIFAUNA -

All birds of a given region.

BIOME -

A complex community of all living organisms, e.g., tundra biome, grassland biome, desert biome.

BIOTA -

All fauna and flora of a given region.

BOSQUE -

A grove or community of trees in a given area.

CARNIVORE -

An organism which acquires life-sustaining nutrients by utilizing living organisms as food.

CARRYING CAPACITY -

The number of animals that can be maintained in a given habitat.

CREPUSCULAR -

Animals that appear or become active at twilight or just before sunrise.

DIURNAL -

Occurring every day, generally in daylight.

ECOLOGY -

That branch of the biological sciences which deals with relationship between living organisms and their surrounding habitat.

ECOSYSTEM -

A complex system composed of a community of fauna and flora taking into account the chemical and physical environment with which the system is interrelated.

EXOTIC SPECIES -

Introduced species. Not indigenous to a given area.

FAMILY -

In taxonomy, a category containing one or more genera which have similar characteristics.

FAUNA -

All animal life associated with a given habitat, country, area, or period.

FERAL -

An organism which has escaped from cultivation or domestication and exists in the wild.

FLORA -

All plantlife associated with a given habitat, country, or period. Bacteria are considered flora.

FLYWAY -

The migration route of birds.

FORB -

Any herb other than grass.

GENUS -

In taxonomy, a group of closely related species comprised of common distinguishing characteristics.

HABITAT -

An area where a plant or animal lives. (Sum total of environmental conditions in the area.)

HERBIVORE -

An organism which acquires life-sustaining nutrients by feeding on vegetation.

INVERTEBRATE -

Literally, all animals without a vertebral column.

NICHE -

The place or status of an organism in its environment, i.e., the niche of a lake trout is the deep portion of a lake.

NOCTURNAL -

Animals that are active at night.

PHREATOPHYTE -

A plant that habitually obtains its water supply from the zone of saturation, either directly or through the capillary fringe.

PLAYAS -

Drainage basins with no outlet usually high in salinity and alkalinity.

PREDATOR -

Gaining nutrients by capturing and feeding upon other animals.

PREY -

An animal hunted or killed and used as a food source by another animal.

RAPTOR -

A predatory bird that catches its prey by using its talons (i.e., hawks and owls)

SPECIES -

In taxonomy, a subdivision of a genus which (1) has a high degree of similarity, (2) is capable of interbreeding only among themselves, and (3) shows persistent differences from members of allied species.

STATUS UNDETERMINED -

A species or subspecies which has been suggested for threatened or endangered classification, but about which further information is needed to clarify its status.

TAXONOMY -

The science of classification according to relationships of organisms.

THREATENED SPECIES -

Any species which has the potential of becoming endangered in the near future.

TURBIDITY -

A measure of the extent to which light passing through water is reduced due to suspended materials. Excessive turbidity may interfer with light penetration and minimize photosynthesis, thereby causing a decrease in primary productivity. It may interfer directly with essential physiological functions of fish and other aquatic organisms, making it difficult for fish to locate a food source, and alter water temperature.

VERTEBRATE -

Animals which have backbones or vertebral columns.

XEROPHYTE -

Plants which are structurally adapted to growing in dry or desert conditions. The plants often have a greatly reduced leaf surface area to prevent water loss, thick, fleshy parts for water storage, and many possess hairs, spines, or thorns.
Examples: cacti, Joshua tree, yucca.

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