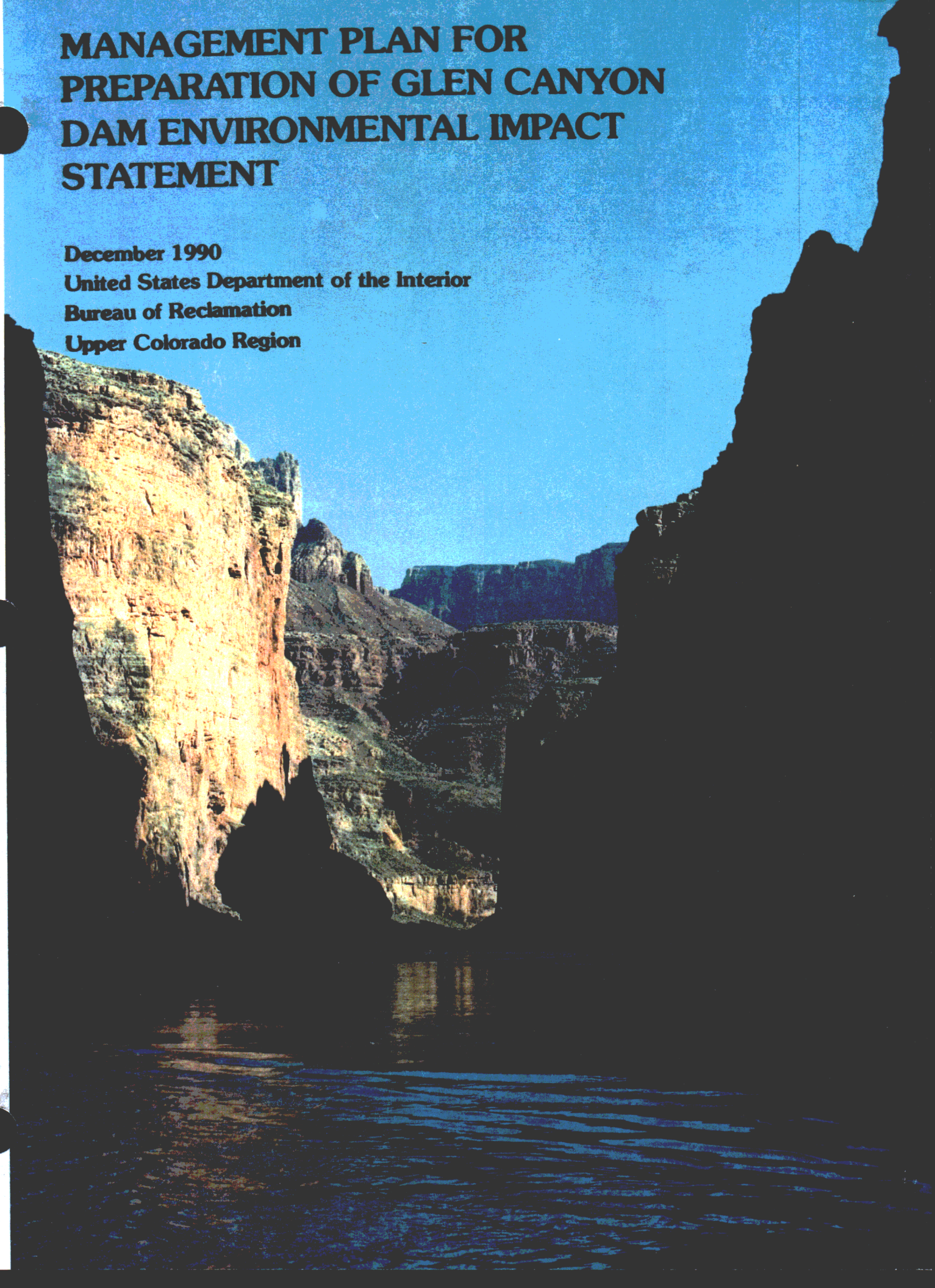
MANAGEMENT PLAN FOR PREPARATION OF GLEN CANYON DAM ENVIRONMENTAL IMPACT STATEMENT

December 1990
United States Department of the Interior
Bureau of Reclamation
Upper Colorado Region



CONTENTS

MANAGEMENT PLAN
FOR PREPARATION OF GLEN CANYON DAM ENVIRONMENTAL IMPACT STATEMENT

PURPOSE

The purpose of this management plan is to guide the Bureau of Reclamation (Reclamation) and cooperating agencies through the process of carrying out the preparation of the Glen Canyon Dam Environmental Impact Statement (EIS). The management plan will be used to communicate the overall intent and responsibilities. Since the EIS process is dynamic and subject to change, the document will be revised as needed and circulated to all appropriate entities and individuals.

BACKGROUND

Glen Canyon Dam was completed in 1963, prior to the passage of the National Environmental Policy Act (NEPA). Consequently, no requirement existed for an EIS on the project.

In December 1982, Reclamation published an environmental assessment on the impacts of a proposed uprate and rewind program for the dam. Reclamation proceeded with the uprate and rewind project but agreed not to use the increased powerplant capacity for flows above 31,500 cubic feet per second (ft^3/s) until completion of a more comprehensive study.

Beginning in December of 1982, Reclamation initiated the multiagency Glen Canyon Environmental Studies (GCES) to address the concerns of the public and other Federal and State agencies about possible negative effects of the operations of Glen Canyon Dam on the existing downstream environmental and recreational resources. Two previous Reclamation studies focused attention on the current operational effects and forwarded proposals for future changes. Both the Peaking Power Study and the Uprate and Rewind Study suggested the possibility for change in plant capacity and rates of water release.

Information currently available from GCES has identified three known relationships:

1. Glen Canyon Dam has had an impact on the downstream Glen Canyon and Grand Canyon resources. Changes have occurred and continue to occur to many of the sensitive ecosystem resources. Some changes are considered positive, and some are negative.

2. For negative impacts, operations and management may be modified to minimize losses of some resources in the canyon and to protect and enhance others.

3. The canyon is a dynamic resource and, with careful management, may be able to gradually reestablish more harmonious environmental relationships.

The Department will use the EIS to comply with statutory requirements to produce hydropower, to protect tribal interests, and to conserve the Park's and the Recreation Area's resources for the enjoyment of future generations.

OBJECTIVES OF THE GLEN CANYON DAM EIS

The primary objective of the Glen Canyon Dam EIS is to evaluate the impacts of current and alternative dam operations on the downstream environmental and ecological resources of the Glen Canyon National Recreational Area and Grand Canyon

National Park. The alternative dam operations to be examined will range from those that emphasize the potential to conserve and maintain the downstream resources to those that emphasize peaking power.

The EIS will identify and quantify, to the fullest extent possible, the benefits, values, and application of the dam and the resources affected by the dam, including, but not limited to, water supply, water quality, recreation, cultural resources, hydroelectric power generation, and fish and wildlife including threatened and endangered species, in light of the statutory responsibilities of the Secretary of the Interior (Secretary).

The focus of the EIS is to evaluate alternative operations of the dam. In addition, other mitigation measures may be identified to minimize impacts to resources of concern. Alternative dam operations and potential structural and institutional mitigation measures will be considered to formulate the range of reasonable alternatives.

Alternative dam operations may result in offsite cumulative impacts. Given the best available information, the magnitude of these impacts will be identified so that the Secretary is informed of the consequences and options available to address these issues.

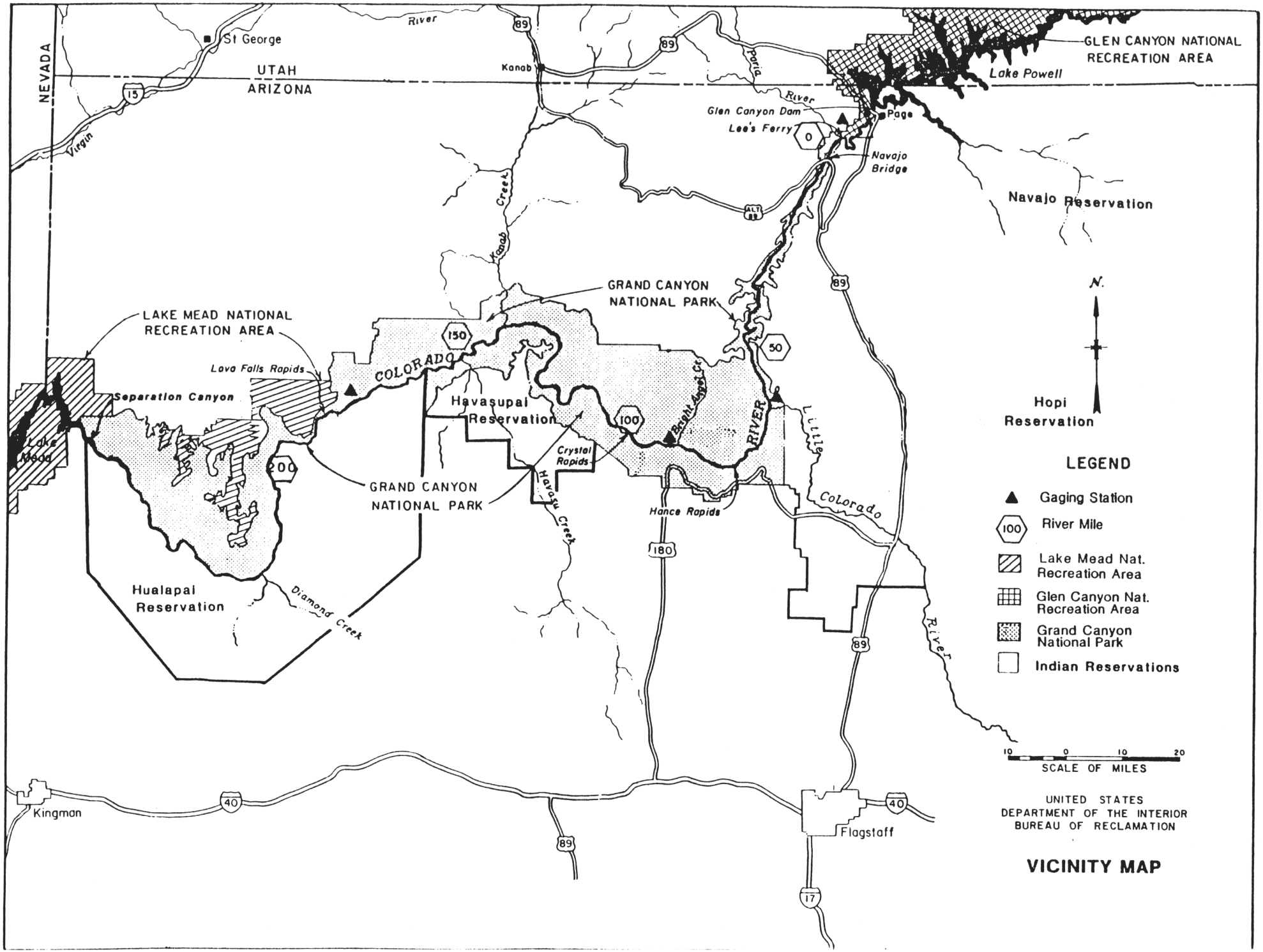
LOCATION AND GEOGRAPHIC EXTENT

The physical area defined for the focus of the EIS is from Glen Canyon Dam downstream 255 river miles to Separation Canyon on the Colorado River near the inflow to Lake Mead. All but about 15 miles of this area is within Grand Canyon National Park. Also involved are portions of Glen Canyon National Recreation Area, and Indian reservation lands (see map on next page). Although the major focus is the canyon reach described above, certain alternatives may involve areas outside the immediate geographic area. Also, the EIS analysis will trace impacts to wherever they may occur.

RELATIONSHIP OF GCES AND THE EIS

A final report of the GCES was completed in January 1988. Following its completion, review, and consideration by the involved agencies, the National Academy of Sciences, and the Department of the Interior (DOI), the Secretary of the Interior directed additional studies to more completely define research findings and to include the full component of considerations relative to power production and water conservation. This second effort, called GCES Phase II, is intended to provide additional information to allow a decision regarding the operation of Glen Canyon Dam. While conducting these Phase II studies, on July 27, 1989, the Secretary announced that Reclamation would prepare the Glen Canyon Dam Environmental Impact Statement (GCD-EIS) to consider alternatives to the operation of the dam as it affects the downstream ecological and environmental resources. (See appendix 1).

An additional principal purpose of the GCES, at this point, is to provide input to the EIS. Most of the research conducted or underway will facilitate the ability to describe the existing environment and the impacts of EIS alternatives on that environment. The original timing was for a 4- to 5-year effort in GCES Phase II. With the Secretary's July 1989 announcement, however, it became clear that the GCES Phase II effort would need to be condensed if it were to be effective in producing information for the EIS. Concern over shortening the research period has been expressed. In establishing the time frame for the EIS, the discussion centered on the conflict between the need for thorough (lengthy) research to completely answer the outstanding questions, the question of interim flows, and the need to complete the NEPA


NEVADA
UTAH
ARIZONA
St George
Virgin River
Kanab
Paria River
Glen Canyon Dam
Lee's Ferry
Page
Navajo Bridge
GLEN CANYON NATIONAL RECREATION AREA
Lake Powell
Navajo Reservation
Kaibab Creek
GRAND CANYON NATIONAL PARK
LAKE MEAD NATIONAL RECREATION AREA
Lava Falls Rapids
COLORADO RIVER
Separation Canyon
Lake Mead
Havasupai Reservation
Bright Angel Cr.
Crystal Rapids
Havasu Creek
Hance Rapids
Little Colorado River
Hopi Reservation
Hualapai Reservation
Diamond Creek
Kingman
Flagstaff
N.
LEGEND
Gaging Station
River Mile
Lake Mead Nat. Recreation Area
Glen Canyon Nat. Recreation Area
Grand Canyon National Park
Indian Reservations
10 0 10 20
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
VICINITY MAP

process in a timely manner. Topics covered in GCES Phase I and Phase II are shown in appendix 2. The EIS schedule (see page 12) has been revised to integrate, in a timely manner, the GCES Phase II studies. The schedule indicates where in the EIS process the studies will be incorporated into the preparation of the draft EIS and the final EIS.

RELATIONSHIP OF GCD-EIS TO WESTERN AREA POWER ADMINISTRATION MARKETING CRITERIA EIS

The Western Area Power Administration (Western) of the Department of Energy (DOE) will prepare an EIS on its Salt Lake City Area (SLCA) Integrated Projects Post-1989 General Power Marketing and Allocation Criteria. The criteria establish the terms used to allocate capacity and energy generated by the dams of the Colorado River Storage, Collbran, and Rio Grande Projects (collectively called the SLCA Integrated Projects). Powerplants in the SLCA Integrated Projects operated by the Bureau of Reclamation are Glen Canyon, Flaming Gorge, Blue Mesa, Morrow Point, Crystal, Upper Molina, Lower Molina, Fontenelle, and Elephant Butte. Glen Canyon Dam is the largest power producer within this group.

Although all of these hydroelectric powerplants, as well as other power sources, are interconnected, Glen Canyon operations by Reclamation and power marketing by Western are appropriately addressed as two separate (but related) matters. The primary focus of the Glen Canyon Dam EIS is the Colorado River downstream from the dam. The primary focus of the Western EIS is system-wide power marketing. Since both EIS efforts are to be comprised of interagency activities, the two documents are intended to be compatible. Western's EIS will consider issues related to power marketing and will account for alternative operations of Glen Canyon Dam. Likewise, Reclamation will look at issues related to operation of Glen Canyon Dam that may affect alternative power marketing criteria.

Western can evaluate alternative marketing criteria prior to and without knowing the specific operational changes that may be adopted for Glen Canyon Dam. Likewise, a DOI decision to change Glen Canyon water release operations can be made prior to DOE decisions on marketing criteria. Issuance of a combined single EIS or decision, therefore, is not essential nor desirable.

The scoping process for the Western EIS will begin in October 1990. The schedule for completion of the Western EIS has not been determined.

SUMMARY OF GLEN CANYON DAM EIS SCOPING ACTIVITIES AND ISSUES

The formal public scoping period for the EIS began with a *Federal Register* Notice on February 23, 1990. Eight public meetings were held from March 12, 1990, to April 3, 1990, in Salt Lake City, Denver, Phoenix, Flagstaff, Los Angeles, San Francisco, Washington, DC, and a second in Flagstaff (due to the previous large crowd).

- Meetings were attended by about 1,400 people. Comments were presented by about 250 people, a few of whom spoke at more than one meeting.

- About 18,000 scoping comment letters were received. The comment period was extended to May 4, 1990.

- A majority of speakers suggested taking more time for the EIS (a common request was for 1 additional year to the end of 1992) and the need for thorough studies in support of the EIS. (The EIS schedule has since been

extended.) Most of these same speakers wanted interim flows (minimum peaking operations) during the EIS preparation period. Also, many speakers emphasized the need for formulation and implementation of a long-term monitoring program.

- Many speakers asked that Arizona Game and Fish Department be a cooperating agency. (Arizona Game and Fish Department and four Indian tribes have since been added.)

- An Environmental Protection Agency (EPA) speaker in Denver expressed concern with NEPA compliance, wanted identification of alternatives beyond Reclamation's ability to implement, and wanted the Glen Canyon EIS and Western's system EIS to be integrated. The speaker stated that a letter from EPA would be forthcoming. (The letter has since been received and distributed to the cooperating agencies.)

- Power interests favored careful study before changes in current normal operations are made. All reasonable alternatives must be studied, including nonstructural and structural mitigation measures (such as regulation changes affecting rafting and fishing, a small reregulation dam near Glen Canyon Dam, and beach rebuilding and protection), and cost sharing by nonpower river-using interests.

- Power and irrigation interests expressed concern about changes in power operations that may reduce availability of funds for other water development projects in the Upper Colorado River Basin.

- River rafting interests favored moderate release patterns and opposed structural alternatives in the canyon. Beaches and boater safety were major concerns. Several flow recommendations were given for lower maximum releases and higher minimum releases.

- Trout fishing interests favored moderate release patterns which they believe would maximize trout reproduction. These interests strongly opposed structural alternatives.

- Environmental speakers emphasized ecosystem protection and desired that river flows in Grand Canyon approximate predam conditions. Multilevel powerplant water intake units to allow an increase in river water temperature for native fish were requested. Strong objection to other structural alternatives was expressed.

- Many environmental speakers desired a power conservation (or pricing) alternative in the Western marketing area to reduce or eliminate peak power use patterns.

- A few speakers asked that the EIS be expanded to include all Upper Colorado River Basin project operations.

- A few speakers suggested removal of Glen Canyon Dam.

It is apparent that issues and potential alternatives are diverse, and compromise and consensus are difficult to reach. All reasonable concerns must be treated fairly and objectively in order to produce a quality document that will be useful in defining the impacts of alternatives and fully achieve the requirements of NEPA.

The results of scoping are contained in two separate reports: one providing a summary of the public meeting comments, and the other providing a comment analysis. Both documents were prepared by Bear West Consultants, who helped facilitate the scoping activities. Copies of the reports may be obtained from Reclamation's Upper Colorado Regional Office in Salt Lake City (SLC), Utah.

PRINCIPAL AGENCIES WITH MANAGEMENT RESPONSIBILITIES AND EXPERTISE

The following agencies/tribes have direct responsibilities for management of resources related to Glen Canyon Dam and the downstream environs:

Federal Agencies	Involvement
Bureau of Reclamation	Operates and maintains Glen Canyon Dam and Powerplant.
Fish and Wildlife Service	Provides Fish and Wildlife Coordination Act management information and administers the Endangered Species Act.
National Park Service	Manages Grand Canyon National Park, Glen Canyon National Recreation Area, and Lake Mead National Recreation Area.
Western Area Power Administration	Markets and transmits power produced by Glen Canyon Dam.
Bureau of Indian Affairs	Has trust responsibilities for Indian reservation management.
DOI Office of Environmental Affairs	Provides overview guidance and EIS approval for the Department of the Interior.
State Agencies	
Arizona Game and Fish Department	Manages fish and wildlife.
Indian Tribes	
Navajo Nation Hopi Hualapai Havasupai	Manage natural and cultural resources on reservation lands adjacent to or in the vicinity of the Colorado River. Concerned with cultural resources, water rights, etc.

OTHER AGENCIES WITH JURISDICTION OR EXPERTISE

The following agencies have a role as a result of their jurisdiction or expertise.

Federal Agencies	Involvement
Geological Survey	Has expertise related to geologic conditions, water, and sedimentation research.
Environmental Protection Agency	Repository for EIS and has official EIS review responsibility.
Council on Environmental Quality	Provides NEPA regulations and guidelines and, if needed, arbitrates differences among agencies.
Regional Agencies	
Upper Colorado River Commission	Coordinates with Upper Colorado River Basin States and reviews any changes in monthly flow volumes.
State Agencies	
Arizona California Colorado	State clearinghouse for each provides coordinated State and local agency review of EIS.
Nevada New Mexico Utah Wyoming	Specific State agencies have varied responsibilities pertaining to water and related resources.

LEAD AGENCY AND COOPERATING AGENCIES FOR EIS PREPARATION

Reclamation has been designated the lead agency for preparation of the EIS by the Secretary of the Interior, with responsibility delegated to the Regional Director in Salt Lake City. Agencies formally identified (per Section 1501.6 of CEQ guidelines) as cooperating are: Fish and Wildlife Service (FWS), Arizona Game and Fish Department (AGF), National Park Service (NPS), Western Area Power Administration, Bureau of Indian Affairs (BIA), Navajo Nation, Hopi Tribe, Hualapai Tribe, Havasupai Tribe, and DOI Office of Environmental Affairs (OEA).

A management-level coordinating group representing the cooperating agencies has been established to oversee both the GCES research activities and the EIS preparation. The chairperson of the coordinating group is Rick Gold - Reclamation (Upper Colorado Region), and the Executive Secretary is Sarah Bransom - Reclamation (Denver). Other members of the group are:

Jack Davis, National Park Service
Jim Young, Fish & Wildlife Service
Patricia Port, DOI, Office of Environmental Affairs
Amy Heuslein, Bureau of Indian Affairs
Ken Maxey, Western Area Power Administration
Duane Shroufe, Arizona Game and Fish Department
Peter Deswood, Navajo Nation
Leigh Jenkins or Nat Nutongla, Hopi Tribe
Don Watahomigie, Havasupai Tribe
Don Bay, Hualapai Tribe

Advisors are:

Bob Moeller, DOI Solicitors Office
Dr. Duncan Patten, Arizona State University, GCES Senior Scientist

The main purposes of the group as related to the EIS are to:

- Carry out full coordination of substantive policy and management actions.
- Provide overview perspective on interagency activities to facilitate EIS preparation, including GCES overview.
- Serve as principal "cooperating agency" point of contact with respective agencies to which Reclamation's Regional Director can focus coordination, review of draft materials, and other items for feedback as may be appropriate.
- Participate in the EIS scoping process, including providing input and review comments during formulation of alternatives.
- Facilitate determination of a proposed action for the EIS, with consensus to the extent possible.

APPROACH TO EIS PREPARATION

The EIS will be a major interagency effort to bring together alternatives, research, and environmental analysis. The effort will require an approach different from a normal intra-agency EIS.

Cooperating agencies have been and will continue to be involved in substantial research and data collection. This expertise needs to be utilized.

The Reclamation NEPA Coordinator who will provide guidance during preparation of the EIS is Sarah Bransom, Reclamation (Denver).

Interagency EIS Team

The basic concept of the EIS team approach is to use a small group of knowledgeable people as a core team. This team becomes the focus

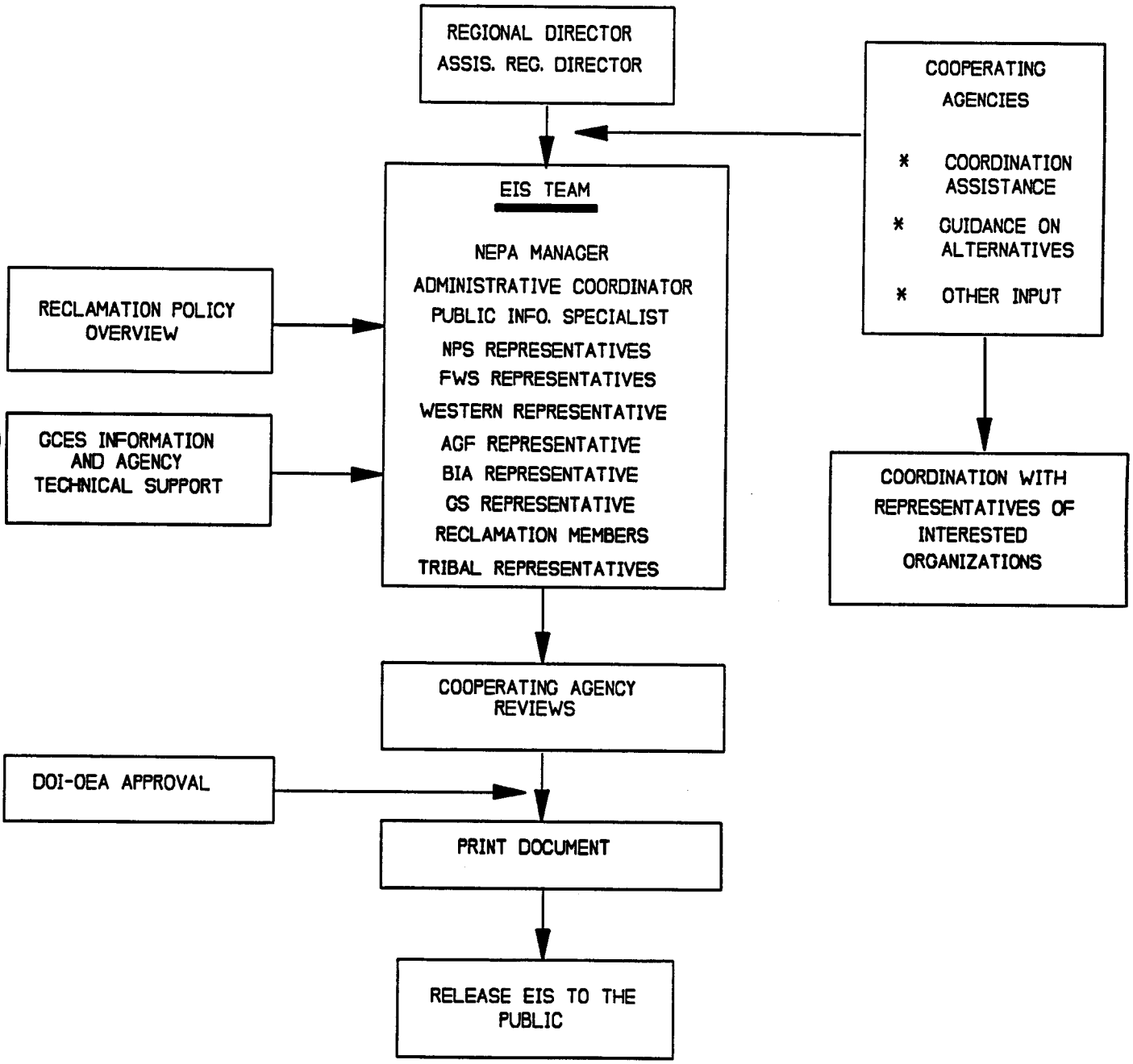
of the EIS effort, generally as diagrammed on the next page. Participation of the team members will be formalized with a Memorandum of Understanding (MOU) between Reclamation and each cooperating agency. Participation of Reclamation's Denver Office — Assistant Commissioner - Resources Management (ACRM) will be formalized in a Service Agreement with Reclamation's Upper Colorado Region. All team members are expected to devote highest priority, if not full time, to the Glen Canyon Dam EIS. The initial team meeting was an EIS training session and a detailed organizational discussion. Following meetings included field orientation and briefings by GCES researchers. The EIS team is encouraged to work with GCES researchers and with the Senior Scientist, in order to obtain and correctly present technical information in the EIS analysis.

Team Members and General Assignments

Although the team will work as a group to discuss and analyze impacts, each person has specific topics assigned for the EIS preparation, generally as follows:

Name	Agency	Assignments
Thomas Slater	Reclamation SLC	NEPA Manager
Suzanne Garcia	Reclamation SLC	Administrative Coordinator
Mike O'Donnell	Reclamation SLC	Description of alternatives, various other topics, assistance with research interpretation
Mary Ann Facer	Reclamation SLC	Public Information Specialist
Raymond Gunn	NPS SLC	Recreation - cultural resources
Jerry Mitchell	NPS Grand Canyon	
Jan Balsom	NPS Grand Canyon	
Debra Bills	FWS Phoenix	Fish and wildlife, including endangered species and trout
Frank Baucom	FWS Phoenix	
Larry Riley	AGF Phoenix	
Diane Cherry	Western SLC	Power production and use
Jane Bremner	Hopi Tribe	Tribal concerns
Bruce Glenn	Reclamation Den	Denver Office activity manager
Tim Randle	Reclamation Den	Sediment
Jim Wilson	Geological Survey Cheyenne	
Craig Phillips	Reclamation Den	Hydrology
Mike Roluti	Reclamation Den	Power resources
Kent Shuyler	Reclamation Den	Economics, except power
Debbie Saint	Reclamation Den	Social considerations
Mike Armbruster	Reclamation Den	Impact assessment assistance
Gary Baker	Reclamation Den	Technical Writer, document preparation, and printing arrangements

GLEN CANYON EIS
GENERAL PROCESS CHART



Agency Support Needs

The EIS preparation concept provides that core team members obtain information from GCES researchers and technical support from other agency personnel. As data are needed or questions arise, knowledgeable people outside the core team may be requested to provide input, participate in discussions, and/or review material. The cooperating agencies can facilitate this effort by communicating management authorization to those from whom support is needed. Coordination between the NEPA Manager and the GCES Manager will be maintained throughout the process.

Logistical Factors for EIS Preparation

Since team members are in several locations, specific logistical arrangements are needed. The NEPA Manager and Administrative Coordinator (Reclamation SLC) will be the focal point for team interaction, although team members should communicate directly with each other on specific data items.

All team members should use WordPerfect 5.0 or 5.1 with transmittal by electronic mail or floppy disks for EIS text material in order to minimize retyping. EIS text, tables, and graphics are to be forwarded to the Administrative Coordinator, who will keep a tracking record. The Administrative Coordinator will be the direct link between the resource specialists and the Technical Writer. The Administrative Coordinator and the Technical Writer will work out a system to support each other.

EIS Format

A preliminary outline for EIS content is given in appendix 2.

Team Meetings and Work Flow

Team meetings will be held on a regular basis at convenient locations, considering travel expenses and other factors. Most likely the meetings will be in Salt Lake City, Denver, Las Vegas, or Phoenix. The meetings will be devoted primarily to interdisciplinary discussions. Writing assignments will be carried out in each team member's home office. Considerable coordination will be needed by phone as the writing occurs.

Work flow will be established and monitored by use of the project management computer program Super Project. Printout copies (the PERT chart) periodically will be furnished to cooperating agencies, the EIS team, and others.

Availability and Use of Data

A considerable amount of information and resource data is available from previous documents or studies or will be available from GCES Phase II, but in some cases information will not be complete. In such cases, the approach will be to examine available knowledge, synthesize it, combine it with expert opinion (in consultation with others where appropriate), and make predictions about the consequences of alternatives. In doing this, it is important to note the source of available data, the data limitations, the assumptions used in the analysis, and the confidence level of the impact determinations.

Internal Reviews

Internal reviews will be of three types:

- Working Level - The working-level review will be interdisciplinary and will focus on completeness and consistency within and among the members of the EIS team. When the team reaches a reasonable comfort level, the material

will be prepared for further consideration by others. The GCES Senior Scientist and selected GCES researchers will participate in the final working-level reviews.

Each cooperating agency will need to conduct reviews of preliminary drafts. It is important that these internal reviews be expedited in order to provide useful input and to allow the schedule to be maintained. Agency reviews will include a NEPA policy review by Reclamation and content review by all involved agencies. Both types of internal reviews are anticipated to occur concurrently.

- Reclamation - As lead agency, Reclamation has responsibility to assure NEPA procedural and quality standards within the agency. Selected staff will be requested to provide review at key points in the process.

- Interagency - All of the cooperating agencies share in the responsibility for EIS content and quality and will participate in reviews.

All reviews should focus on corrections and contribute solutions rather than merely pointing out problems.

Department of the Interior Approval to Print

The DOI Office of Environmental Affairs will provide final review and approval before the draft EIS and the final EIS are printed.

Estimated Cost of EIS

The cost of the EIS has been estimated based on the interagency team approach and a continued high level of public interest. Anticipated costs are estimated as shown in the following table.

	FY90	FY91	FY92	FY93
Management and coordination	$260,000	460,000	540,000	405,000
EIS preparation	128,000	520,000	650,000	505,000
Public involvement	84,000	80,000	190,000	70,000
Other	10,000	80,000	100,000	20,000
Total	$482,000	1,140,000	1,480,000	1,000,000

Management and coordination includes the cost of interagency agreements (MOU's, etc.), cooperating agency meetings, interagency reviews of draft materials, and related activities.

EIS preparation includes work by the EIS team to write the draft and final documents, prepare them for printing, and the cost of printing.

Public involvement includes EIS scoping activities, newsletters, announcements and hearings facilitating public review of the draft EIS, and compilation of public comments.

Other costs include special briefings of elected officials and others, supplies and equipment, and supporting activities.

EIS SCHEDULE

The major schedule milestone dates for the EIS are listed on the following page. The target dates include release of the draft EIS to the public in July 1992 and the final EIS in September 1993. This schedule is intended to accommodate the current dates for availability of GCES Phase II research studies in both the draft and final documents.

As previously mentioned, a Super Project work flow chart has been prepared and used by the EIS team and GCES in order to assure that major milestones are met.

GLEN CANYON DAM EIS
MAJOR MILESTONES

7/27/89	Secretary of the Interior announces preparation of EIS
10/27/89	Federal Register Notice of Intent to prepare EIS
2/23/90	Federal Register Notice of scoping meetings
3/12/90-5/4/90	Public scoping meetings held
7/10-11/90	Ad-Hoc Alternatives work session–Flagstaff
11/14/90	GCES researchers brief EIS team on Phase II studies
12/12/90	Cooperating agencies meeting to discuss alternatives
12/28/90	Notice of public meeting on alternatives
1/5/91	EIS team prepares alternatives for public review
1/28/91	Public meeting on alternatives
2/15/91	EIS team prepares detailed EIS outlines
2/28/91	EIS team prepares Chapter II, Description of Alternatives
4/30/91	Preliminary DEIS prepared for team review
6/13/91	Preliminary DEIS revised and prepared for cooperating agency review
9/30/91	Preliminary DEIS revised based on cooperating agency comments
1/29/92	DEIS revised to include GCES Phase II data provided through 12/31/91 and for final review by cooperating agencies
3/19/92	DEIS prepared for printing
4/2/92	Cooperating agencies briefed on DEIS; DEIS forwarded to Washington for review
4/16/92	Washington completes review of DEIS
5/07/92	DOI-OEA approves DEIS for printing
6/19/92	Printing of DEIS completed
7/03/92	DEIS filed with EPA and distributed to public
10/05/92	Public comment period on DEIS concluded
1/04/93	Preliminary FEIS prepared for team review (includes GCES Phase II data provided through 8/1/92)
3/10/93	Preliminary FEIS revised and prepared for cooperating agency review
5/27/93	FEIS prepared for printing
6/4/93	Cooperating agencies briefed on FEIS; FEIS forwarded to Washington for review
6/18/93	Washington completes review of FEIS
7/16/93	DOI-OEA approves FEIS for printing
8/27/93	Printing of FEIS completed
9/13/93	FEIS filed with EPA and distributed to public
9/20/93	Draft Record of Decision prepared for cooperating agency review
10/26/93	Record of Decision

Extenuating circumstances requiring changes in the EIS schedule will be coordinated with the cooperating agencies and cleared through Reclamation's top management and with DOI officials. As lead agency, Reclamation will advise the public of any required changes.

FORMULATION OF ALTERNATIVES

The focus of the alternatives analysis is on the operational aspects of the dam. Resources of concern, as identified by the public and involved agencies during the scoping process, will be the focus of the EIS. In addition to analyzing the operation of the dam, other measures may be identified to address resources of concern.

A conceptual framework for formulation of alternatives has been created to focus on "integrated' (or multiple-purpose) alternatives. Selected elements of dam operation, in addition to an array of nonoperational measures to address public issues and concerns, will be combined to formulate a range of reasonable alternatives.

All alternatives and mitigation measures suggested during scoping (as well as those identified during an Ad-Hoc Alternatives Work Session, those suggested by the cooperating agencies, and those identified by the EIS team) will be considered consistent with CEQ Regulation 1502.14. Alternatives determined to be suitable for evaluation in detail in the EIS will be described and analyzed.

An adjustment in flow releases from the dam would consider the requirements for specific annual volumes of water to be delivered to the Lower Colorado River Basin. Operational alternatives would be outlined for low, medium, and high water year situations, in a manner that can be understood by the general public. Description and analysis of varying water years, including extended drought periods, will be important. Since Lake Powell filled in 1980, the volumes of downstream releases have varied from the specified minimum of 8.23 million to over 21 million acre-feet per year. More operational flexibility may exist in medium water years than in low or high water years. Also, operational flexibility can be influenced by available Lake Powell storage space, time of year, and inflow. Operational alternatives could span a range of maximum peaking to base load (though seasonally adjusted) releases.

In addition to elements of dam operation, the EIS will consider additional mitigation such as potential adjustments in plans or activities of the various agencies, related to conditions downstream for the dam but apart from water releases.

Additional mitigation may also include structural and/or restorative measures involving direct modification to the dam or to specific features of the river or canyon. These could be comprised of temporary or permanent actions.

Integrated and/or phased alternatives would be a combination of operational changes, management actions, and structural or restorative measures. Some of these could be applied over an extended period of time. Several different combination scenarios could be formulated and analyzed to address these objectives:

- Identification of a phased approach to implementing changes in operation and future management.
- Exploration of a concept of not only minimizing future loss of resources associated with the Colorado River downstream of Glen Canyon Dam, but also looking at ways to restore parts of the ecosystem that have been lost.
- Formulation of a program to adjust to dynamic future conditions in response to long-term monitoring.

Through the scoping process, and in many subsequent discussions, it appears that the complexity of the situation will require an array of alternatives comprised of several elements (or subparts) and mitigation measures. The formulation of alternatives is expected to "mix and match" various issues and resource-related elements and to provide a broad range of reasonable alternatives for analysis, consistent with NEPA and CEQ regulations.

PUBLIC PARTICIPATION

Public participation associated with GCES has been underway for several years and was formally initiated for the EIS with the scoping process previously described. Although public participation will continue throughout preparation of the EIS, key points will be shared with the public at the time alternatives are identified, during public review of the draft EIS (through public hearings and written input to the lead agency), and at the completion of the EIS (through input directed to the decisionmaker).

Bear West Consultants was retained to facilitate public participation at scoping meetings and hearings on the draft EIS, and to summarize public comments.

Reclamation intends to provide information, and request public feedback from time to time during the process in accordance with a public involvement plan that has been prepared as a separate document.

IDENTIFICATION OF PROPOSED ACTION FOR THE EIS

The EIS team will provide information (options with pros and cons) to assist the cooperating agencies in discussing a "proposed action." The cooperating agencies will have a major role in coordinating, describing, and (to the extent possible) arriving at interagency consensus for the EIS. A substantial effort in this regard will be associated with the draft EIS. Should circumstances warrant, however, the draft may be released with none of the alternatives identified as the "proposed action." Such identification is required for the final EIS, even if it becomes necessary to present differing agency positions.

IDENTIFICATION OF ENVIRONMENTALLY PREFERRED ALTERNATIVE

CEQ Regulation 1505.2 requires that the Record of Decision (ROD) specify the alternative or alternatives considered to be environmentally preferable. The basis for such findings, therefore, must be contained in the EIS.

In addition, the EIS must provide the foundation for identifying practicable mitigation for each alternative that may be considered in the decisionmaking process. Also, a monitoring program will be described in the EIS and the draft ROD, implementation of which will enable cross-checking, over time, on the effectiveness of any changes in dam operations, other management decisions, or mitigations to minimize or eliminate adverse impacts to downstream resources. Thus, refinements in operations to achieve management goals for resource protection and preservation can be facilitated.

According to CEQ, the environmentally preferable alternative will be that alternative which best promotes national environmental policy as expressed in Section 101 of NEPA and most specifically in Section 101(6).

DECISION PROCESS AND PREPARATION OF DRAFT RECORD OF DECISION

The EIS will not be a decision document. The proposed action in the EIS may or may not be selected as the eventual decision. The environmental impacts of the EIS alternatives will be considered, along with other factors, in a separate document.

At the conclusion of the EIS process, a draft Record of Decision (ROD) will be prepared, consistent with CEQ Regulation 1505.2. That document will have five major topics and a signature sheet. The topics are:

- Required decision - type or nature of decision to be made and the decisionmaking level.
- Forcing event - reason for the decision.
- Background - concise information significant to an understanding of the situation.
- Issues and decision factors - objective presentation of significant factors and legal aspects.
- Options (alternatives) - clear description of decision options, with balancing of essential considerations including pros and cons. Options should match the signature sheet.

As lead for the EIS, Reclamation's Upper Colorado Region will initiate a draft ROD for review and comment by the cooperating agencies. Following this interagency coordination (which may take more than one iteration), a revised draft will be forwarded to Reclamation's Washington Office for further coordination and completion.

Decision documents usually do not include recommendations. Agency recommendations may, however, be transmitted separately by memorandum or given verbally during briefings at the headquarters (agency and departmental) level.

DEPARTMENT of the INTERIOR

OFFICE OF THE SECRETARY

news release

Steve Goldstein (O) 202-343-6416
(H) 202-887-5248

For Release: July 27, 1989

INTERIOR SECRETARY LUJAN DIRECTS BUREAU OF RECLAMATION TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT OF GLEN CANYON DAM OPERATIONS

Secretary of the Interior Manuel Lujan announces today that, he is directing the Bureau of Reclamation to prepare an Environmental Impact Statement (EIS) to determine the impact of operations of the Glen Canyon Dam on the downstream ecological and environmental resources within the Grand Canyon National Park and the Glen Canyon National Recreation Area.

"It is time to gather the facts about this issue, to give all interested parties a chance to explain their positions, and to do so in full view of the American people, states Lujan. The Department will use the EIS to comply with statutory requirements to produce hydropower, and to protect the Park's and the Recreation Area's resources for the enjoyment of future generations."

The dam is located on the Colorado River, near the Arizona-Utah border, within the Glen Canyon National Recreation Area. It is approximately 15 miles upstream from Grand Canyon National Park. Lake Powell, the key feature of Glen Canyon National Recreation Area, is located behind the Dam. The National Park Service operates both areas, while the Bureau of Reclamation is responsible for the Dam. Both bureaus are within the Department of the Interior.

These bureaus, along with the Fish and Wildlife Service and the Western Area Power Administration have been sponsoring studies to determine whether the Dam's operations could be affecting the Park and its immediate environment, including the habitat for the humpback chub -- an endangered species. The studies will be continued and can now be built upon by initiating formal public involvement.

The Secretary also noted that this issue is an example of an opportunity to balance energy and environment needs. During the past year, Glen Canyon Dam produced over 4 billion kilowatt-hours of electricity, or the equivalent of about 6.7 million barrels of oil. This power is produced without any air pollution.

The Secretary made his decision after achieving a consensus recommendation from the Acting Assistant Secretaries for Water and Science and Fish and Wildlife and Parks. He also consulted with representatives of the Colorado River Basin States, power users, the environmental community and Members of Congress.

-DOI-

Bureau of Reclamation

Analysis of the Operating Criteria and Alternatives of Glen Canyon Dam, AZ, Colorado River Storage Project

AGENCY: Bureau of Reclamation (USBR).

ACTION: Notice of intent to prepare a draft environmental impact statement.

SUMMARY: Pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), as amended, the Bureau of Reclamation (Reclamation) proposes to prepare a draft environmental impact statement (DEIS) to analyze the existing operating criteria of Glen Canyon Dam, Arizona, Colorado River Storage Project, and to develop a set of environmental criteria that will be used by the Department of the Interior during the development of the Annual Operating Plan for the operation of Glen Canyon Dam. This information is necessary to determine specific options to the operation of Glen Canyon Dam that could be enacted to minimize, consistent with law, the impact of operation on the natural resources of the Grand Canyon. The statement will discuss: the requirements of the Colorado River Compact, Colorado River Storage Project Act, Endangered Species Act, National Park Service mandates, recreation issues, and requirements of the Department of Energy.

The DEIS will present an analysis of the impacts of various alternative management practices, including existing ones, as affected by changes in the operating criteria for Glen Canyon Dam.

Reclamation will conduct scoping meetings in several locations to obtain information on which to base management options to be analyzed in the NEPA process. Reclamation will be the lead agency in the development of the DEIS. The U.S. Fish and Wildlife Service, the National Park Service, and Western Area Power Administration of the Department of Energy will be cooperating agencies.

DATE: The formal public involvement process and scoping efforts will begin in January 1990.

ADDRESSES: The scoping meetings will be held in several locations and will be published when the specific locations are selected.

FOR FURTHER INFORMATION CONTACT: Mr. Steve Robinson, Director, Colorado River Studies and Initiatives Office, U.S. Bureau of Reclamation, 125 South State Street, P.O. Box 11568, Salt Lake City, Utah 84147, telephone: (801) 524–3595.

SUPPLEMENTARY INFORMATION: Glen Canyon Dam was authorized and constructed prior to the enactment of NEPA. Consequently, no NEPA documentation on the overall operations of the facility has ever been completed. Reclamation completed an Environmental Assessment/Finding of No Significant Impact on the uprating and the rewinding of the generators at Glen Canyon Dam in 1982. The Department of the Interior initiated the Glen Canyon Environmental Studies in 1982 with the objective of collecting the technical information required to assess the impact of operations on the natural and recreation resources in Glen Canyon and Grand Canyon. The Glen Canyon Environmental Studies have produced multiple technical reports on the impacts of high and steady flow operations, and studies have recently been initiated on the impacts of fluctuating and minimum flows.

Anyone interested in more information concerning the studies or who has suggestions as to significant environmental issues should contact Mr. Robinson at the above address.

The DEIS is expected to be completed and available for review and comment by the end of 1991.

Joe D. Hall,

Deputy Commissioner.

[FR Doc. 89–25337 Filed 10–26–89; 8:45 am]

BILLING CODE 4310-09-M

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Analysis of the Impact of the Operation of Glen Canyon Dam, Colorado River Storage Project, AZ, and Alternative Measures, on Specific Downstream Resources

AGENCY: Bureau of Reclamation (Interior).

ACTION: Notice of environmental scoping meetings and correction of notice of intent.

SUMMARY: Pursuant to Council on Environmental Quality regulations and Bureau of Reclamation policy, the Department of the Interior announces seven environmental scoping meetings to invite public participation in the development and analysis of alternative measures to minimize the impact of the operation of Glen Canyon Dam, Arizona, Colorado River Storage Project, on the downstream environmental and ecological resources of the Glen Canyon National Recreation Area and the Grand Canyon National Park, to be used in preparing a draft environmental impact statement (DEIS).

On October 27, 1989, Reclamation published a Notice of Intent in the Federal Register (54 FR 43670) to prepare a DEIS which would be used to determine specific options to minimize, consistent with law, the impact of operation of Glen Canyon Dam on downstream environmental and ecological resources of the Glen Canyon National Recreation Area and the Grand Canyon National Park. That notice should read: "The final environmental impact statement (FEIS) will be filed in December 1991."

Further, the sentence that begins on 54 FR 43870 and concludes on 54 FR 43871 should read: "This information is necessary to determine specific options to the operation of Glen Canyon Dam that could be implemented to minimize, consistent with law, the impact of the operation of Glen Canyon Dam on the downstream environmental and ecological resources of the Glen Canyon National Recreation Area and the Grand Canyon National Park."

Reclamation, the lead agency in the development of the DEIS, will conduct scoping meetings throughout the project area and in several key locations nationwide. Cooperating agencies are the U.S. Fish and Wildlife Service, National Park Service, and Western Area Power Administration of the Department of Energy.

In addition to this notice, interested government agencies, public groups, and private citizens will be informed of scoping meeting times and locations by invitation and by news releases no later than 15 days before meetings. Information packages will be distributed to interested parties prior to the meeting and will be available to the door. Oral and written comments will be accepted at the scoping meetings; written comments can also be submitted by mail or in person from March 12 through April 16, 1990. Anyone wishing to be placed on the mailing list to receive a copy of the information package or to submit comments for scoping should contact the Director, Colorado River Studies and Initiatives Office, at the address listed below.

DATES AND LOCATIONS: There will be seven public meetings, held at the following times and locations:

- Salt Lake City UT, March 12, 1990, 7 p.m., Salt Lake Hilton, 150 West 500 South.
- Denver CO, March 13, 1990, 7 p.m., Denver Sheraton Airport Hotel, 3535 Quebec Street.
- Phoenix AZ, March 15, 1990, 7 p.m., Sheraton Pheonix Hotel, 111 North Central Avenue.
- Flagstaff AZ, March 16, 1990, 7 p.m., City Countil Chambers, 211 West Aspen Street.
- Los Angeles CA, March 20, 1990, 7:30 p.m., Airport Marina Hotel, 8601 Lincoln Boulevard.
- San Francisco CA, March 21, 1990, 7 p.m., Fort Mason Conference Center, Landmark Building A, Laguna and Marina Boulevard.
- Washington DC, March 27, 1990, 9:30 a.m., Interior South Building, 1951 Constitution Avenue, NW.

FOR FURTHER INFORMATION CONTACT: Director, Colorado River Studies and Initiatives Office, U.S. Bureau of Reclamation, 125 South State Street, PO Box 11568, Salt Lake City UT 84147, telephone: (801) 524–3315.

SUPPLEMENTARY INFORMATION: Glen Canyon Dam was authorized and constructed prior to the enactment of the National Environmental Policy Act of 1969 (NEPA), as amended. Consequently, no NEPA documentation on the overall operation has ever been completed. Reclamation completed an Environmental Assessment/Finding of No Significant Impact on the uprating and rewinding of the generators at Glen Canyon Dam in 1982. The Department of the Interior initiated the Glen Canyon Environmental Studies in 1982 with the objective of collecting the technical information required to assess the impact of the operation on the natural and recreational resources in Glen Canyon and Grand Canyon. The Glen Canyon Environmental Studies have produced multiple reports on the impacts of high and steady flow operations, and studies have recently been initiated on the impacts of fluctuating and minimim flows. Public comment will be combined with technical data to develop alternatives for analysis in the DEIS.

Anyone interested in more information concerning the studies, or anyone who has suggestions about significant environmental issues which should be considered in the DEIS, should contact the Director at the above address.

Dated: February 20, 1990.

Dennis Underwood,

Commissioner.

[FR Doc. 90–4227 Filed 2–22–90; 8:45 am]

BILLING CODE 4310–09–M

PHASE I GLEN CANYON ENVIRONMENTAL STUDIES COMPLETED

4 OVERALL REPORTS

Glen Canyon Environmental Studies Final Report. Department of the Interior.

Executive Review Committee Final Report. Department of the Interior, Fish and Wildlife Service, National Park Service, Bureau of Reclamation, Western Area Power Administration.

Executive Summaries of Technical Reports. Department of the Interior, Fish and Wildlife Service, National Park Service, Bureau of Reclamation, Western Area Power Administration.

River and Dam Management. National Research Council.

8 REPORTS ON AQUATIC LIFE

Effects of varied flow regimes on aquatic resources of Glen and Grand Canyons. (H.R. Maddux, D.M. Kubly, J.C. deVos Jr., W.R. Persons, R. Staedicke, and R.L. Wright)

Colorado River water temperature modeling below Glen Canyon Dam. (R. Ferrari)

Instream flow microhabitat analysis and trends in the Glen Canyon Dam tailwater. (D.L. Wegner)

The effects of steady versus fluctuating flows on aquatic macroinvertebrates in the Colorado River below Glen Canyon Dam. (W.C. Leibfried and D.W. Blinn)

Cladophora glomerata and its diatom epiphytes in the Colorado River through Glen and Grand Canyons; distribution and desiccation tolerance. (H.D. Usher, D.W. Blinn, G.G. Hardwick, and W.C. Leibfried)

Zooplankton of the Colorado River: Glen Canyon Dam to Diamond Creek. (L.R.Haury)

Exposure of Cladophora glomerata to the atmosphere during regulated flows: exposure of biomass and chlorophyll a. (Howell D. Usher and Dean W. Blinn)

Distribution of epiphytic diatoms on Cladophora glomerata in the Colorado River through Glen and Grand Canyons, Arizona. (G.G. Hardwich, D.W. Blinn, and H.D. Usher)

5 REPORTS ON RECREATION AND RAFTING

Glen Canyon Dam releases and downstream recreation: an analysis of user preferences and economic values. (R.C. Bishop, K.J. Boyle, M.P. Welsh, R.M. Baumgartner, and P.R. Rathbun)

The effect of flows in the Colorado River on reported and observed boating accidents in Grand Canyon. (C.A. Brown and M.G. Hahn)

Boating accidents at Lees Ferry: a boater survey and analysis of accident reports. (L. Belli and R. Pilk)

Simulating the effects of dam releases on Grand Canyon river trips. (A.H. Underhill and R.E. Borkan)

An analysis of recorded Colorado River Boating Accidents in Glen Canyon for 1980, 1982, and 1984, and in Grand Canyon for 1981 through 1983. (A.H. Underhill, M.H. Hoffman, and R.E. Borkan)

4 REPORTS ON BIRDS AND LIZARDS

Monitoring bird population densities along the Colorado River in Grand Canyon. (B.T. Brown)

Monitoring bird population densities along the Colorado River in Grand Canyon: 1987 breeding season. (B.T. Brown)

Lizards along the Colorado River in Grand Canyon National Park: possible effects of fluctuating river flows. (P.L. Warren and C.R. Schwalbe)

Fluctuating flows from Glen Canyon Dam and their effect on breeding birds of the Colorado River. (B.T. Brown and R.R. Johnson)

PROPOSED PHASE II
GLEN CANYON ENVIRONMENTAL STUDIES

1. Sediment and Hydrology
   - Sediment Transport
   - Beaches and Sediment Deposit
   - Grand Canyon Beach Evolution
   - Paleoflood Deposits
   - Riparian Vegetation and Soil Stability
   - Hydrologic Database Maintenance

2. Water Quality and Limnology
   - Limnology of Lake Powell and Lake Mead
   - Grand Canyon Water Quality
   - Ecology of Aquatic Diptera
   - Water Quality and Productivity

3. Geomorphic and Geologic Studies
   - Surficial Geologic Maps
   - Geomorphic and Geologic Evaluation

4. Biological Resources
   - Trout Studies

5. Native and Endangered Species
   - Native Fish Studies
   - Humpback Chub Studies
   - Bald Eagle Studies

6. Recreation
   - Availability of Camping Beaches
   - Carrying Capacity in Lee Ferry Reach
   - Flow Effects on Congestion and Safety

7. Archeology
   - Survey of Riverbanks

8. Economics
   - Power Resource Studies
   - Recreation Economics
   - Resource (Nonuse) Economics

9. Long-Term Monitoring Program

PRELIMINARY OUTLINE
GLEN CANYON DAM ENVIRONMENTAL IMPACT STATEMENT

COVER SHEET

SUMMARY

PREFACE

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

Purpose and Need for Action
- Environmental Impact Statement and Record of Decision
- Cooperating Agencies
- Decisionmaking Responsibility
- Identification of Agency Proposed Action

Scope of the Analysis and Geographic Limits

Historical Perspective
- Predam (1922-1962)
- Postdam (1963-present)
- River System
- Construction (1962-1964)
- Filling (1964-1980)
- Operation (1980-present)

Authorities and Institutional Constraints Unique to This Study
- Colorado River Acts and Treaty
- Glen Canyon Acts 1956-1968
- Grand Canyon National Park Enabling Legislation
- National Park Service 1916 Organic Act
- National Park Service 1970 General Authorities Act
- Native American Treaties
- "Law of the River"
- Tradition and Institutional Patterns
- Other

Glen Canyon Dam Operational Factors
- Compact Requirements
  - Water Storage
  - Water Delivery
  - Other

CHAPTER I - Continued

1983-85 High Flows and Subsequent Adjustments
Extended Drought Periods
Physical Considerations

Water and Power Use Distribution

Glen Canyon Research Studies
Phase I (1983-1988)
Phase II (1988-present)

Relationship Between Glen Canyon Dam EIS and Western Area Power Administration Marketing Criteria EIS

Relationship of Glen Canyon Dam EIS to other elements of the Colorado River System

CHAPTER II - DESCRIPTION OF ALTERNATIVES

Glen Canyon Dam EIS Scoping Issues
Identification of public issues and concerns
Identification of issues for detailed analysis

Glen Canyon Dam EIS Process for Formulation of Alternatives

Alternatives Identified for Detailed Analysis
a. No Action
b.
c.
d.
etc.

Summary of Alternatives and Environmental Impacts
a.
b.
c.
d.
etc.

Alternatives Considered and Eliminated from Detailed Study

CHAPTER III - DESCRIPTION OF THE AFFECTED ENVIRONMENT

Introduction
Location
Geographic Relationships and Access

CHAPTER III - Continued

Issues and Resources Evaluated (Per Chapter II)

General Description of Resources (Not Requiring Indepth Analysis)
- Climate
- Geology
- Paleontology
- Air Quality
- Others

Physical Resources
- Water
  - Colorado River
    - Hydrologic Patterns
      - High Water Periods
      - Average Water Years
      - Extended Drought Periods
    - Geomorphology
      - Channel Configuration
      - Bed Configuration
      - Rapids Formation
        - Debris Flow
        - Flash Floods
    - Water Quality
    - Temperature
    - Limnological Characteristics
  - Tributaries
    - Hydrologic Patterns
    - Water Quality
    - Temperature
    - Limnological Characteristics
- Sediments
  - Sources
    - Colorado River Channel
    - Gauged Tributaries
      - Paria River
      - Little Colorado River
      - Kanab Creek
    - Ungauged Tributaries
      - Debris Flows
      - Flash Floods
    - Lake Powell
      - Main Stem
      - Navajo Creek
      - San Juan River
      - Escalante River
      - Dirty Devil River

CHAPTER III - Continued

- Transport and Deposition
  - Riffles and Pools
  - Beaches (Alluvial Sand Deposits)
    - Channel Margin Deposits
    - Debris Fans
      - Separation Deposits
      - Reattachment Deposits
      - Eddies and Backwaters
    - Upper Pool Deposits

- Biological Resources
  - Vegetation
    - Old High Water Zone
    - New High Water Zone
      - Native Vegetation
      - Exotic Plants
    - Aquatic (Marsh) Vegetation
  - Wildlife and Habitat Potential
    - Mammals
    - Birds
    - Herpetofauna
  - Fisheries
    - Native Fishes
    - Trout and other Exotic Species
  - Threatened and Endangered Species
    - Category 1 and 2 Candidate Species
    - Peregrine Falcon
    - Bald Eagle
    - Humpback Chub
    - Arizona Species of Concern

- Recreational Resources
  - Glen Canyon National Recreation Area
    - Lake Powell
    - Glen Canyon Dam to Lee's Ferry
      - Day-Rafting
      - Trout Fishing
  - Grand Canyon National Park
    - River Corridor
      - Extended Boat Trips
        - Commercial
        - Private
      - Sightseeing/Photography
    - Tributaries
      - Hiking Trails
      - Sightseeing/Photography

CHAPTER III - Continued

- Uplands
  - Hiking Trails
  - Sightseeing/Photography
- Health and Safety Concerns
  - Waste and Sanitation
  - Fishing Areas
  - Rapids
- Proposed Wilderness Areas
- Other Concerns (Include Search and Rescue)

Lake Mead National Recreation Area
- Boating
- Fishing

Hydropower Resources
- Western Upper Colorado Load Control Area and Interconnected System
  - Description
  - NERC Responsibilities
- Inland Power Pool
- Relationship of Glen Canyon Powerplant Operation
  - Normal Operation
  - Emergency Operation
- Western's Marketing Criteria

Socio-Cultural Resources
- Archeological
  - Prehistoric
  - Historic
- Native American Sacred Sites
- Social Parameters
  - Population
  - Economic Conditions
  - Values and Attitudes

Economic Resources
- Primary (or Direct) Effects
  - Water Storage
  - Power Production
  - Recreation
  - Resource (Nonuse) Economics
  - Other
- Secondary (or Indirect) Effects

Esthetic Resources
- Visual Qualities
- Flow Regimes

CHAPTER III - Continued

- Resource Management Plans
  - Management Plan: Glen Canyon National Recreation Area
  - Management Plan: Grand Canyon National Park
  - Management Plan: Lake Mead National Recreation Area
  - Colorado River Management Plan
  - Little Colorado River Management Plan
  - Management of Indian Reservation Lands
  - State and Local Management Plans
  - Other Plans

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES (Resource Focus)

- Introduction
  - Overview of Environmental Consequences
  - (Track with Chapters II and III)
    - Analysis Assumptions
      - Direct Effects
      - Indirect Effects
      - Cumulative Analysis
    - Chapter Format

- Physical Resources
  - Comparative Impact Analysis by Alternative
    - Alternative A (No Action)
      - Water
        - Colorado River
          - Hydrologic Patterns
          - Geomorphology
          - Water Quality
          - Temperature
          - Limnological Characteristics
        - Tributaries
          - Hydrologic Patterns
          - Water Quality
          - Temperature
          - Limnological Characteristics
      - Sediments
        - Sources
          - Colorado River Channel
          - Gauged Tributaries
          - Ungauged Tributaries
          - Lake Powell
        - Transport and Deposition
          - Riffles and Pools
          - Beaches

Chapter IV - Continued

- Alternative B
  - Water
    - Colorado River
      - Hydrologic Patterns
      - Geomorphology
      - Water Quality
      - Temperature
      - Limnological Characteristics
    - Tributaries
      - Hydrologic Patterns
      - Water Quality
      - Temperature
      - Limnological Characteristics
  - Sediments
    - Sources
      - Colorado River Channel
      - Gauged Tributaries
      - Ungauged Tributaries
      - Lake Powell
    - Transport and Deposition
      - Riffles and Pools
      - Beaches
  - Mitigation Measures and Monitoring Plans
    - Water
    - Sediments
  - Unresolved Issues

- Alternative C
  - Water
    - Colorado River
      - Hydrologic Patterns
      - Geomorphology
      - Water Quality
      - Temperature
      - Limnological Characteristics
    - Tributaries
      - Hydrologic Patterns
      - Water Quality
      - Temperature
      - Limnological Characteristics
  - Sediments
    - Sources
      - Colorado River Channel
      - Gauged Tributaries
      - Ungauged Tributaries
      - Lake Powell

Chapter IV - Continued

Chapter IV - Continued

Chapter IV - Continued

- Recreational Resources
  - Comparative Impact Analysis by Alternative
    - Alternative A (No Action)
      - Glen Canyon National Recreation Area
        - Lake Powell
        - Glen Canyon Dam to Lee's Ferry
          - Day-Rafting
          - Trout Fishing
      - Grand Canyon National Park
        - River Corridor
          - Extended Boat Trips
            - Commercial
            - Private
          - Sightseeing/Photography
        - Tributaries
          - Hiking Trails
          - Sightseeing/Photography
        - Uplands
          - Hiking Trails
          - Sightseeing/Photography
        - Health and Safety Concerns
          - Waste and Sanitation
          - Fishing Areas
          - Rapids
        - Proposed Wilderness Areas
        - Other Concerns
      - Lake Mead National Recreation Area
        - Boating
        - Fishing

    - Alternative B
      - Glen Canyon National Recreation Area
        - Lake Powell
        - Glen Canyon Dam to Lee's Ferry
          - Day-Rafting
          - Trout Fishing
      - Grand Canyon National Park
        - River Corridor
          - Extended Boat Trips
            - Commercial
            - Private
          - Sightseeing/Photography
        - Tributaries
          - Hiking Trails
          - Sightseeing

Chapter IV - Continued
(Alternative B - continued)

- Uplands
  - Hiking Trails
  - Sightseeing/Photography
- Health and Safety Concerns
  - Waste and Sanitation
  - Fishing Areas
  - Rapids
- Proposed Wilderness Areas
- Other Concerns

Lake Mead National Recreation Area
- Boating
- Fishing

Mitigation Measures and Monitoring Plans
- Glen Canyon National Recreation Area
- Grand Canyon National Park
- Lake Mead National Recreation Area

Unresolved Issues

Alternative C

Glen Canyon National Recreation Area
- Lake Powell
- Glen Canyon Dam to Lee's Ferry
  - Day-Rafting
  - Trout Fishing

Grand Canyon National Park
- River Corridor
  - Extended Boat Trips
    - Commercial
    - Private
  - Sightseeing/Photography
- Tributaries
  - Hiking Trails
  - Sightseeing/Photography
- Uplands
  - Hiking Trails
  - Sightseeing/Photography
- Health and Safety Concerns
  - Waste and Sanitation
  - Fishing Areas
  - Rapids
- Proposed Wilderness Areas
- Other Concerns

Lake Mead National Recreation Area
- Boating
- Fishing

CHAPTER IV - Continued
(Alternative C - continued)

Mitigation Measures and Monitoring Plans
Glen Canyon National Recreation Area
Grand Canyon National Park
Lake Mead National Recreation Area
Unresolved Issues

Alternative D (Same Topics as Alternatives B-C)

Summary of Impacts: Recreational Resources

Hydropower Resources
Western Upper Colorado Load Control Area and Interconnected System
Description
NERC Responsibilities
Inland Power Pool
Relationship of Glen Canyon Powerplant Operation
Normal Operation
Emergency Operation
Western's Marketing Criteria

Summary of Impacts: Hydropower Resources

Socio-Cultural Resources
Comparative Impact Analysis by Alternative
Alternative A (No Action)
Archeological
Prehistoric
Historic
Native American Sacred Sites
Social Parameters
Population
Economic Conditions
Values and Attitudes

Alternative B
Archeological
Prehistoric
Historic
Native American Sacred Sites
Social Parameters
Population
Economic Conditions
Values and Attitudes

CHAPTER IV - Continued
(Alternative B - continued)

- Mitigation Measures and Monitoring Plans
  - Archeological
  - Native American Sacred Sites
  - Social Parameters
- Unresolved Issues

- Alternative C
  - Archeological
    - Prehistoric
    - Historic
  - Native American Sacred Sites
  - Social Parameters
    - Population
    - Economic Conditions
    - Values and Attitudes
  - Mitigation Measures and Monitoring Plans
    - Archeological
    - Native American Sacred Sites
    - Social Parameters
  - Unresolved Issues

- Alternative D (Same Topics as Alternatives B-C)

- Summary of Impacts: Socio-Cultural Resources

- Economic Resources
  - Comparative Impact Analysis by Alternative
    - Alternative A (No Action)
      - Primary (or Direct) Effects
        - Water Storage
        - Power Production
        - Recreation
        - Resource (Nonuse) Economics
        - Other
      - Secondary (or Indirect) Effects

    - Alternative B
      - Primary (or Direct) Effects
        - Water Storage
        - Power Production
        - Recreation
        - Resource (Nonuse) Economics
        - Other
      - Secondary (or Indirect) Effects

CHAPTER IV - Continued

(Alternative B - continued)

- Mitigation Measures and Monitoring Plans
  - Primary (or Direct) Effects
  - Secondary (or Indirect) Effects
- Unresolved Issues

Alternative C

- Primary (or Direct) Effects
  - Water Storage
  - Power Production
  - Recreation
  - Resource (Nonuse)Economics
  - Other
- Secondary (or Indirect) Effects
- Mitigation Measures and Monitoring Plans
  - Primary (or Direct) Effects
  - Secondary (or Indirect) Effects
- Unresolved Issues

Alternative D (Same Topics as Alternatives B-C)

Summary of Impacts: Economic Resources

Esthetic Resources

- Comparative Impact Analysis by Alternative
  - Alternative A (No Action)
    - Visual Qualities
    - Flow Regimes

  - Alternative B
    - Visual Qualities
    - Flow Regimes
    - Mitigation Measures and Monitoring Plans
    - Unresolved Issues

  - Alternative C
    - Visual Qualities
    - Flow Regimes
    - Mitigation Measures and Monitoring Plans
    - Unresolved Issues

  - Alternative D (Same Topics as B-C)

- Summary of Impacts: Esthetic Resources

CHAPTER IV - Continued

CHAPTER IV - Continued

APPENDICES

1. List and Summary of Glen Canyon Research Studies
   Phase I
   Phase II

2. Further Monitoring and Research
   Short-Term
   Long-Term

3. Long-Term Hydrological Patterns

4. Fish and Wildlife Coordination
   a. Biological Opinion
   b. Coordination Act Report

5. Consultation with SHPO and Advisory Council

6. EIS Team

INDEX

NTIS SUMMARY WITH KEY WORDS

POCKET MAP