

THE GRAND CANON

A WORLDWIDE BIBLIOGRAPHY OF THE GRAND CANYON AND LOWER COLORADO RIVER REGIONS
IN THE UNITED STATES AND MEXICO



GCES

GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

Glen Canyon Environmental Studies program technical reports and related documents produced under the monitoring and research programs of the Glen Canyon Dam Environmental Impact Statement as mandated by Congress

[This part of the bibliography is complete and is no longer updated, the GCES program having ended. Continued research is under the auspices of the U.S. Geological Survey, Grand Canyon Monitoring and Research Center.]

OVERVIEW. The Glen Canyon Environmental Studies (GCES) program, based in Flagstaff, Arizona, was created to perform as an interagency body under the direction of the U.S. Department of the Interior, Bureau of Reclamation. It responded to a Congressional mandate to develop an Environmental Impact Statement on the effects of hydropower production at Glen Canyon Dam on the Colorado River and its riparian community downstream through lower Glen Canyon, Marble Canyon, and the Grand Canyon. The EIS also examined the potential impacts of management decisions on social and economic issues. The GCES went through two phases—1982–1988 and 1990–1996. Research functions were thereafter continued by the U.S. Geological Survey, Grand Canyon Environmental Research Center in Flagstaff, Arizona.

GCES was such an important part of the scientific and cultural study of the Grand Canyon, specifically in the previously little-studied Colorado River corridor, that the products of these studies are a bibliography in their own right. Many of the documents are interdisciplinary, thus also a justification for listing them separately, rather than in several places throughout this bibliography. Historians of science will also notice in this list that some of the subjects were reported in other scientific publications. A few of the reports were also released in their entirety as U.S. Geological Survey Open-File Reports or publications of the National Academy Press; these are itemized here. Most of the reports listed here, and voluminous supporting data, are accessible at the Grand Canyon Monitoring and Research Center, Flagstaff, Arizona (<http://www.gcmrc.gov/library/>).

Glen Canyon Environmental Studies Reports

Compiled by Richard D. Quartaroli ²³⁰

**Glen Canyon Environmental Studies
U.S. Bureau of Reclamation
Flagstaff, Arizona**

[Phase I \(1982–1988\)](#)

[Phase II \(1990–1996\)](#)

In Part 20, **ITEM NUMBERS** that follow the sequence of citation numbering for this bibliography are listed for bibliographical convenience only. They do not necessarily pertain to individual reports; some refer to study groups, various reports of which are archived now in the Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. Most of these, and more, are now accessible online at <http://www.gcmrc.gov/publications/library.aspx>

²³⁰ *Currently* The Special Collections Librarian (Emeritus), Special Collections and Archives, Cline Library, Northern Arizona University, Flagstaff, Arizona.

PHASE I (1982–1988)

Final Report

1. 20.1 U.S. Department of the Interior. *Glen Canyon Environmental Studies final report*. PB88-183348/AS. 403 pp.

NOTE: This item may be concordant with this citation from Part 13 of this bibliography [—E.E.S.]

U.S. Bureau of Reclamation, Glen Canyon Environmental Studies

- 1988 13.3866 *Glen Canyon Environmental Studies : executive summaries of technical reports : November 1988*. [No place]: Glen Canyon Environmental Studies, 411 pp. ("This volume contains executive summaries of the Glen Canyon Environmental Studies Technical Reports prepared by individuals representing the following: U.S. Department of the Interior, Bureau of Reclamation, Geological Survey, National Park Service; U.S. Department of Energy, Western Area Power Administration; Arizona Game and Fish Department; Private Consultants".) [Individual summaries are cited separately in this bibliography, and which are included in the break-downs for Phase I here in Part 20.]

Sediment and Hydrology Reports

2. 20.2 Webb, R. H.; Pringle, P. T.; and Rink, G. R. *Debris flows from tributaries of the Colorado River*. PB88-183355/AS. [Also as *U.S. Geological Survey Open-File Report 87-118*.] 70 pp.
3. 20.3 Kieffer, S. W. *The rapids and waves of the Colorado River, Grand Canyon, Arizona*. PB88-183363/AS. [Also as *U.S. Geological Survey Open-File Report 87-96*.] 106 pp.
4. 20.4 Wilson, R. P. *Sonar patterns of the Colorado River bed in the Grand Canyon*. PB88-183371/AS. 12 pp.
5. 20.5 Schmidt, J. C., and Graf, J. B. *Aggradation and degradation of alluvial sand deposits, 1965 to 1986, Colorado River, Grand Canyon National Park, Arizona*. PB88-195458/AS. [Also as *U.S. Geological Survey Open-File Report 87-555*.] 127 pp.
6. 20.6 Ferrari, R. *Sandy beach area survey along the Colorado River in the Grand Canyon National Park*. PB88-183389/AS. 15 pp.
7. 20.7 Burkham, D. E. *Trends in selected hydraulic variables for the Colorado River at Lees Ferry and near Grand Canyon for the period 1922-1984*. PB88-216098/AS. 63 pp.
8. 20.8 Pemberton, E. L. *Sediment data collection and analysis for five stations on the Colorado River from Lees Ferry to Diamond Creek*. PB88-183397/AS. 156 pp.
9. 20.9 Lazenby, J. *Unsteady flow modeling of the releases from Glen Canyon Dam at selected locations in Grand Canyon*. PB88-183405/AS. 12 pp.
10. 20.10 Orvis, C. J., and Randle, T. J. *Sediment transport and river simulation model*. PB88-183413/AS. 60 pp.
11. 20.11 Randle, T. J., and Pemberton, E. L. *Results and analysis of STARS modeling efforts of the Colorado River in Grand Canyon*. PB88-183421/AS. 190 pp.

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

Aquatic Biology Reports

12. 20.12 Maddux, H. R.; Kubly, D. M.; deVos, J. C., Jr.; Persons, W. R.; Staedicke, R.; and Wright, R. L. *Effects of varied flow regimes on aquatic resources of Glen and Grand Canyons*. PB88-183439/AS. 315 pp.
13. 20.13 Ferrari, R. *Colorado River water temperature modeling below Glen Canyon Dam*. PB88-183447/AS. 19 pp.
14. 20.14 Wegner, D. L. *Instream flow microhabitat analysis and trends in the Glen Canyon Dam tailwater*. PB89-180236/AS. 13 pp.
15. 20.15 Leibfried, W. C., and Blinn, D. W. *The effects of steady state versus fluctuating flows on aquatic microinvertebrates in the Colorado River below Glen Canyon Dam, Arizona*. PB88-206362/AS. 66 pp.
16. 20.16 Usher, H. D.; Blinn, D. W.; Hardwick, G. G.; and Leibfried, W. C. *Cladophora glomerata and its diatom epiphytes in the Colorado River through Glen and Grand Canyons: distribution and desiccation tolerance*. PB88-183454/AS. 87 pp.
17. 20.17 Haury, L. R. *Zooplankton of the Colorado River: Glen Canyon Dam to Diamond Creek*. PB88-183462/AS. 64 pp.

Terrestrial Biology Reports

18. 20.18 Pucherelli, M. J. *Evaluation of riparian vegetation trends in the Grand Canyon using multitemporal remote sensing techniques*. PB88-183470/AS. 76 pp.
19. 20.19 Stevens, L. E., and Waring, G. L. *Effects of post-dam flooding on riparian substrates, vegetation, and invertebrate populations in the Colorado River corridor in Grand Canyon, Arizona*. PB88-183488/AS. 173 pp.
20. 20.20 Brian, N. J. *Aerial photography comparison of the 1983 high flow impacts to vegetation at eight Colorado River beaches*. PB89-180244/AS. 68 pp.
21. 20.21 Waring, G. L., and Stevens, L. E. *The effects of recent flooding on riparian plant establishment in Grand Canyon*. PB88-183496/AS. 85 pp.
22. 20.22 Anderson, L. S., and Ruffner, G. A. *Effects of post-Glen Canyon Dam flow regime on the old high water line plant community along the Colorado River in Grand Canyon*. PB88-183504/AS. 54 pp.
23. 20.23 Brown, B. T., and Johnson, R. R. *Fluctuating flows from Glen Canyon Dam and their effect on breeding birds of the Colorado River*. PB88-183512/AS. 95 pp.
24. 20.24 Brown, B. T. *Monitoring bird population densities along the Colorado River in Grand Canyon*. PB88-183520/AS. 31 pp.
25. 20.25 Brown, B. T. *Monitoring bird population densities along the Colorado River in Grand Canyon: 1987 breeding season*. PB89-103311/AS. 31 pp.
26. 20.26 Warren, P. L., and Schwalbe, C. R. *Lizards along the Colorado River in Grand Canyon National Park: possible effects of fluctuating river flows*. PB88-183538/AS. 17 pp.

Recreation Reports

27. 20.27 Bishop, R. C.; Boyle, K. J.; Welsh, M. P.; Baumgartner, R. M.; and Rathbun, P. R. *Glen Canyon Dam releases and downstream recreation: an analysis of user preferences and economic values*. PB88-183546/AS. 396 pp.

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

28. 20.28 Brown, C. A., and Hahn, M. G. *The effect of flows in the Colorado River on reported and observed boating accidents in Grand Canyon.* PB88-183553/AS. 59 pp.
29. 20.29 Belli, L., and Pilk, R. *Boating accidents at Lees Ferry: a boater survey and analysis of accident reports.* PB88-183561/AS. 17 pp.
30. 20.30 Underhill, A. H., and Borkan, R. E. *Simulating the effects of dam releases on Grand Canyon river trips.* PB88-183579/AS. 46 pp.
31. 20.31 Underhill, A. H.; Hoffman, M. H.; and Borkan, R. E. *An analysis of recorded Colorado River boating accidents in Glen Canyon for 1980, 1982, and 1984, and in Grand Canyon for 1981 through 1983.* PB88-195441/AS. 28 pp.
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Dam Operations Reports

32. 20.32 Wegner, D. L. *Colorado River Storage Project constraints and operation of Glen Canyon Dam.* PB89-143515/AS. 19 pp.
33. 20.33 Wegner, D. L. *Colorado River law.* PB89-143523/AS. 21 pp.
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Related Documents

34. 20.34 (Committee to Review the Glen Canyon Environmental Studies.) *River and dam I: a review of the Bureau of Reclamation's Glen Canyon Environmental Studies.* PB88-177175/AS. [National Academy Press, 203 pp.]
35. 20.35 (Glen Canyon Environmental Studies Executive Review Committee.) *Executive Review Committee final report.* PB89-119622/AS. 135 pp.
36. 20.36 (Glen Canyon Environmental Studies Executive Review Committee.) *Executive summaries of technical reports.* PB89-217160/AS. 411 pp.
37. 20.37 Carrell, T. (ed.). *Submerged cultural resources site report: Charles H. Spencer mining operation and paddle wheel steamboat.* PB89-217152/AS. 166 pp.
38. 20.38 (Bureau of Reclamation.) *Glen Canyon Environmental Studies phase II and plan for implementation.* PB89-180228/AS. 48 pp.
39. 20.39 (Bureau of Reclamation.) *Glen Canyon Environmental Studies phase II technical study plan outline: fiscal year 1989 and process for completion of the technical studies.* PB89-217178/AS. 33 pp.
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PHASE II (1990–1996)

Most of these reports are archived; some have been distributed as “gray literature” of limited or restricted availability, and as such they have been cited separately and more conventionally throughout this bibliography.

A. Arizona State University

Endangered Fish Study in the Little Colorado River

A		<i>Ecology and conservation biology of humpback chub, <i>Gila cypha</i>, in the Little Colorado River, Arizona.</i> Principal Investigators: Paul Marsh, Michael Douglas
A1(1)	20.40	Annual — 31 January 1993
A1(2)	20.41	Annual — 31 January 1994
A1(3)	20.42	Annual — 31 January 1995
A2(1)	20.43	Draft — 1 November 1995
A2(2)	20.44	Final — 1 February 1996

B. Arizona Game and Fish Department

Native Fish Studies in the Mainstem Colorado River and in the Little Colorado River

B1		Ecosystem Level Process and Lower Trophic Level
B1(1)	20.45	<i>Effects of different flow regimes on primary production and organic matter and nutrient loading rates and budgets for the Glen Canyon Dam tailwater to Lee’s Ferry.</i>
B1(2)	20.46	<i>Effects of operations of Glen Canyon Dam on the <i>Gammarus lacustris</i> in the Glen Canyon Dam tailwater.</i>
B1(3)	20.47	<i>Effects of varying flow levels on the algal and invertebrate species of the Glen Canyon Dam tailwater.</i>
B1(4)		<i>Effects of varying flow levels on desiccation and nutritive quality of the exposed algae.</i> Principal Investigators: Dennis Kubly, Andy Ayers, Ted Angradi
	20.48	Draft — 30 September 1993
	20.49	Final — 31 December 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

B2 Interim Flow Monitoring

Effects of the interim flows on the water chemistry and aquatic food base for Lake Powell and in the Lee's Ferry tailwater.

Principal Investigator: William Persons

20.50 Draft — 30 September 1994

20.51 Final — 31 December 1994

B3 Trout Studies

B3(1) 20.52 ***Effects of the operations of Glen Canyon Dam on the loss of trout spawning in the reach between Glen Canyon Dam and Lee's Ferry.***

B3(2) 20.53 ***Effects of the operations of Glen Canyon Dam on the rate of stranding and mortality of naturally reproduced and stocked trout from Glen Canyon Dam to Lee's Ferry.***

B3(3) 20.54 ***Effects of fluctuating flows on the age and growth relationships of stocked trout between Glen Canyon Dam and Lee's Ferry.***

B3(4) ***Effects of fluctuating flows on the behavioral response of trout in the Glen Canyon Dam tailwater.***

Principal Investigators: William Persons, Dennis Kubly

20.55 Draft — 30 September 1993

20.56 Final — 31 December 1993

B4 Native Fish Studies

B4(1) 20.57 ***Identify the temporal and spatial distribution patterns and movements of early life history stages of fishes in the Little Colorado River.***

B4(2) 20.58 ***Determine changes in environmental conditions in mainstream and tributary confluence areas for native fish rearing habitats under different flow regimes.***

B4(3) 20.59 ***Determine the algal and invertebrate standing crops and their relative contributions to the diets of young native fish.***

B4(4) 20.60 ***Determine the behavioral responses of larval to juvenile native fishes to changing environmental conditions in rearing habitats.***

B4(5) 20.61 ***Determine the age structure and growth rates of native fishes related to hydrologic and thermal conditions.***

B4(6) 20.62 ***Comparison of otolith edge chemistry of native fishes collected in tributary and mainstream habitats for use in growth and movement analysis.***

Principal Investigators: Dennis Kubly, Rob Clarkson

B4(7) 20.63 ***Determination of the effects of limnological changes on the distribution of native fishes in the Little Colorado River and other tributaries.***

Principal Investigator: Rob Clarkson

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

B4(8)		<i>Determination of thermal tolerance of young-of-the-year humpback chub.</i> Principal Investigator: William Persons
20.64		Draft — 30 September 1994
20.65		Final — 30 November 1994

B5 Propagation of Native Fish Study

Propagation of native fish for studies in the Grand Canyon. Protocol report.

Principal Investigator: William Persons

20.66		Draft — 30 January 1993
20.67		Final — 30 November 1993

C. Bio/West

Endangered Fish Studies in the Mainstem Colorado River

C *Characterization of the life history and ecology of the humpback chub, Gila cypha, in the Grand Canyon, Arizona.*

Principal Investigators: Richard A. Valdez, W. J. Masslich, W. C. Leibfried

20.68		Annual — 31 March 1991
20.69		Annual — 31 March 1992
20.70		Annual — 31 March 1993
20.71		Draft — 31 March 1994
20.72		Final — 15 August 1994

D. U.S. Fish and Wildlife Service

Little Colorado River Endangered Fish Studies and Tributary Evaluation

D1 20.73 *Habitat use by humpback chub, Gila cypha, in the Little Colorado River and other tributaries of the Colorado River, Arizona.*

D2 20.74 *Refinement of habitat model for the Little Colorado River.*

D3 20.75 *Quantification of Gila cypha habitat in selected tributaries in the Grand Canyon, Arizona.*

D4 *Determination of impacts of increased discharges to humpback chub habitat availability in the Little Colorado River.*

Principal Investigators: Stuart C. Leon, Owen T. Gorman, O. E. (Gene) Maughn

20.77		Draft — 15 June 1994
20.78		Final — 30 September 1994

E. U.S. Geological Survey, Arizona District Office and National Research Program

E1 Eddy Deposition Study

Movement and deposition of sediments from the main channel to the eddies of the Colorado River in the Grand Canyon.

Principal Investigators: Jon Nelson, Ned Andrews

20.79 Draft — 31 March 1993 (anticipated)

20.80 Final —

E2 Velocity Field Simulations

Simulation of the velocity fields of the Colorado River in the Grand Canyon, Arizona (preliminary title)

Principal Investigators: James Smith, *et al.*

20.81 Draft — 30 June 1993

20.82 Final —

E3 Beach and Eddy Linkage

Linkage in the main channel and eddy dynamics of the flow of the Colorado River in the Grand Canyon, Arizona.

Principal Investigators: James Smith, *et al.*

20.83 Draft — 30 June 1993

20.84 Final —

E4 Sediment Transport Simulations

Sediment transport simulations, Colorado River, Grand Canyon, Arizona.

Principal Investigator: Jim Bennett [James P. Bennett]

20.85 Draft — 31 March 1993

20.86 Final —

E5 Water Quality Characteristics of Lake Powell

Water quality characteristics of the Lake Powell forebay and draft tubes of Glen Canyon Dam.

Principal Investigators: Robert Hart, K. M. Sherman

20.87 Draft — 31 March 1993

20.88 Final —

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

E6 Channel Margin Stratigraphy

Internal structure of bars in Grand Canyon and evaluation of proposed alternatives for Glen Canyon Dam.

Principal Investigators: Dave Rubin, et al.

20.89 Draft — 31 March 1993

20.90 Final —

E7 Sediment Transport Study

Flow and sediment transport in the Colorado River between Lake Powell and Lake Mead.

Principal Investigators: Jim Smith, Steve Wiele

20.91 Draft — 31 March 1993

20.92 Final —

E8 Beach Deformation Study

Hydrogeology of sand bars 43.1L and 172.3L and the implications on flow alternatives along the Colorado River in Grand Canyon.

Principal Investigators: Michael Carpenter, Carruth, Fink, Boling, Brian Cluer

20.93 Draft — 30 June 1993

20.94 Final —

E9 Debris Flow Study

Magnitude and frequency data for debris flows in Grand Canyon National Park and vicinity, Arizona.

Principal Investigators: Ted Melis, Robert Webb

20.95 Draft — 30 September 1993

20.96 Final —

E10 Synoptic Water Quality Report

Synoptic water-quality experiments on the Colorado River in the Grand Canyon, Arizona.

Principal Investigators: Robert Averett, H. E. Taylor

20.97 Draft — 31 March 1993

20.98 Final —

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

E11 Sand Thickness in Grand Canyon

Measurement of sand thickness in Grand Canyon and a conceptual model for characterizing changes in sand-bar volume through time and space.

Principal Investigators: Dave Rubin, et al.

20.99 Draft — 31 March 1993

20.100 Final —

E12 Stanton Photo Reevaluation

A century of environmental changes in Grand Canyon: Repeat photography of the 1889-90 Stanton Expedition on the Colorado River.

Principal Investigator: Robert Webb

20.101 Draft — 30 June 1993

20.102 Final — 30 September 1993

E13 Paria River Flood and Sediment Relationships

Relation of sediment load and flood-plain formation to climatic variability, Paria River drainage basin, Utah and Arizona.

Principal Investigators: Julia Graf, Robert Webb, Richard Hereford

20.103 Draft — 31 December 1992

20.104 Final —

E14 Traveltime and Dispersion

Traveltime and longitudinal dispersion at steady and unsteady flows, Colorado River, Glen Canyon Dam to Lake Mead.

Principal Investigator: Julia Graf

20.105 Draft — 31 March 1993

20.106 Final —

F. U.S. Geological Survey, Geomorphic and Geologic Analysis in Support of the Cultural Resource Program

F1 Geoarchaeology and Mapping

Surficial geology, geomorphology, AND erosion of archaeological sites along the Colorado River, eastern Grand Canyon, Grand Canyon National Park, Arizona.

Principal Investigators: Richard Hereford, Helen Fairley, Kate Thompson, Jan Balsom

20.107 Draft — 30 September 1993

20.108 Final — 31 December 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

F2 Historic Climate Condition

Historic variation of warm-season rainfall, southern Colorado Plateau, southwestern U.S.A.: Climate change.

Principal Investigators: Richard Hereford, Robert Webb

20.109 Draft — 31 December 1992

20.110 Final —

F3 Geologic Report

Quaternary geology, geomorphology, and erosional processes in the eastern Grand Canyon.

Principal Investigator: Ivo Lucchitta

20.111 Draft — 30 September 1993

20.112 Final — 20 December 1993

G. HBRS, Inc.

Recreation and Economics Reports

G1 Recreation Studies

20.113 ***Evaluation of the recreation economic impact related to the operations of Glen Canyon Dam.***

Principal Investigators: Michael Welsh, Richard Bishop

G2 Non-Use Value Studies

Evaluation of the non-use values of the Grand Canyon as related to the operations of Glen Canyon Dam.

Principal Investigators: Michael Welsh, Richard Bishop

20.114 Draft — 30 September 1993

20.115 Final — 31 December 1993

G3 Power Modeling Studies

Evaluation of the impact of changes in the operations of Glen Canyon Dam on power resources.

Principal Investigators: Michael Roluti, Power Resource Committee

20.116 Draft — 30 June 1993

20.117 Final — 30 September 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

H. Hopi Tribe

Cultural Resource Studies in the Grand Canyon

H1 *Cultural resource inventory of the lower Little Colorado River.*

Principal Investigator: Michael Yeatts

20.118 Draft — 30 September 1994

20.119 Final — 31 December 1994

H2 *Pisis'vavu: An ethnohistory of Hopi use of the Grand Canyon.*

Principal Investigator: T. J. Ferguson

20.120 Draft — 30 September 1994

20.121 Final — 31 December 1994

H3 *Hopi Tribe interpretation and use of cultural sites in the Grand Canyon.*

Principal Investigators: Kurt Dongoske, Michael Yeats

20.122 Draft — 30 September 1994

20.123 Final — 31 December 1994

I. Hopi Tribe

Hydrology Study of the Little Colorado River

I *Assessment of the historic hydrology and water quality of the Little Colorado River.*

Principal Investigator: Ron Morgan

20.124 Draft — 30 September 1993

20.125 Final — 31 December 1993

J. Hualapai Tribe

Cultural Resource Studies in the Grand Canyon

J *Evaluation of the ethnohistory of the Hualapai Tribe's use of the Grand Canyon.*

Principal Investigator: Loretta Jackson

20.126 Draft — 31 December 1992

20.127 Revision — 11 January 1993

20.128 Final — 31 March 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

K. Hualapai Tribe

Recreation Studies

K ***Evaluation of the effects of Glen Canyon Dam operations on the Hualapai Tribe's recreation use of the lower Grand Canyon.***
Principal Investigator: Laura Duncan

20.129 Draft — 30 June 1993

20.130 Final — 30 September 1993

K1 ***Monitoring of attraction sites and crowding in the lower Grand Canyon.***
Principal Investigators: Brice Hoskin/Amis Holm (SWCA)

20.131 Draft Annual Report — October 1993

K2 ***Evaluation of recreational use patterns on tribal sediment resources in the lower Grand Canyon.***
Principal Investigators: Brice Hoskin/Amis Holm (SWCA)

20.132 Draft Annual Report — October 1993

K3 20.133 ***Economic evaluation.***
Principal Investigator: SWCA

L. Hualapai Tribe

Fisheries Study

L ***Evaluation of the effects of Glen Canyon Dam operations on the fishery in the lower Grand Canyon.***
Principal Investigator: Richard Valdez

20.134 Draft — 30 September 1994

20.135 Final — 31 December 1994

M. Hualapai Tribe

Riparian Study

M ***Monitoring and evaluating the impacts of Glen Canyon Dam interim flows on riparian communities in the lower Grand Canyon.***
Principal Investigators: Brice Hoskin, Amis Holm

20.136 Annual — 31 January 1993

20.137 Annual — 31 January 1994

20.138 Draft — 30 September 1994

20.139 Final — 31 December 1994

N. Navajo Nation

Cultural Resources Study

N1 *A cultural resources inventory of the lower Little Colorado River and Grand Canyon.*

N2 *An evaluation of the ethnohistorical use of the Grand Canyon by the Navajo Nation.*

Principal Investigators: Alexis Roberts, Richard Begay

20.140 Draft — 30 September 1993

20.141 Final — 31 December 1993

O. Navajo Nation

Little Colorado River Endangered Fish Study

O *The development of a literature data base and geographic evaluation of the Little Colorado River basin.*

Principal Investigator: Michael Tremble

20.142 Draft — 30 September 1993

20.143 Final — 31 December 1993

P. National Park Service, Grand Canyon National Park

Aquatic Productivity Studies

P1 *The effects of Glen Canyon Dam on the aquatic food base in the Colorado River corridor in Grand Canyon, Arizona.*

Principal Investigators: Dean Blinn, Joseph Shannon, Lawrence Stevens

20.144 Draft — 31 October 1992

20.145 Final — 31 December 1992

P2 Riparian Studies

Impacts of Glen Canyon Dam on riparian vegetation and soil stability in the Colorado River corridor, Grand Canyon National Park, Arizona.

Principal Investigators: Lawrence Stevens, Tina Ayers

20.146 Draft — 31 January 1993

20.147 Final — 30 April 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

P3 Sediment Studies

- 20.148 ***The influence of variable discharge regimes on Colorado River sand bars below Glen Canyon Dam.***
Principal Investigators: Stanley Beus, Charles Avery
- P3(1) 20.149 ***Mechanisms of erosion and a model to predict seepage driven erosion due to transient flow.***
Principal Investigator: Muni Budhu
- P3(2) 20.150 ***Beach face erosion in Grand Canyon National Park: A response to ground water seepage during fluctuating flow releases from Glen Canyon Dam.***
Principal Investigators: William Werrell, Rick Inglis, Larry Martin
- P3(3) 20.151 ***Daily responses of Colorado River sand bars to Glen Canyon Dam test flows, Grand Canyon, Arizona.***
Principal Investigators: Brian Cluer, Lee Dexter
- P3(4) 20.152 ***Analysis of sand bar response along the Colorado River in Glen and Grand Canyons to test flows from Glen Canyon Dam using aerial photography.***
Principal Investigator: Brian Cluer
- P3(5) 20.153 ***Historic changes in sediment deposits in Grand Canyon 1965-1990.***
Principal Investigators: Jack Schidt, J. Clark, E. Kyle, P. Grams
- P3(6) 20.154 ***Colorado River sand budget: Lee's Ferry to Little Colorado River including Marble Canyon.***
Principal Investigators: Gary Smillie, William L. Jackson, D. Tucker
- P3(7) ***The influence of variable discharge regimes on Colorado River sand bars below Glen Canyon Dam, Arizona.***
Principal Investigators: Stanley Beus, Charles Avery, Lawrence Stevens, Matt Kaplinski, Hilary Mayes, Brian Cluer
- 20.155 Draft — 31 October 1992
- 20.156 Final — 31 January 1993

P4 Cultural Resource Studies

- An inventory of the cultural resources of the Grand Canyon, Arizona.***
Principal Investigators: Helen C. Fairley, Peter W. Bungart, Christopher M. Coder, Jim Huffman, Terry L. Samples, Janet R. Balsom
- 20.157 Draft — 31 December 1992
- 20.158 Final — 31 March 1993

P5 Bald Eagle Report

- Influences of Glen Canyon Dam fluctuating flows on spawning rainbow trout and wintering bald eagles, with observations on the effects of human-bald eagle interactions on the Colorado River in Grand Canyon National Park, Arizona.***
Principal Investigators: Linn Montgomery, Charles van Riper III, Bryan Brown, William Leibfried
- 20.159 Draft — 31 December 1992
- 20.160 Final — 31 March 1993

P6 Nutrient Cycling

Influence on geochemical processes on nutrient spiralling within the recirculation zones of the Colorado River in the Grand Canyon.

Principal Investigators: Rod Parnell, Jeff Bennett

20.161 Draft — 30 April 1995

20.162 Final — 1 July 1995

P7 Historic Vegetation Changes

Evaluation of the current and historical riparian vegetation trends in Grand Canyon using multitemporal remote sensing analyses at the Geographic Information System long-term monitoring study sites.

Principal Investigator: Gwen Waring

20.163 Draft — 30 September 1994

20.164 Final — 31 December 1994

P8 Fluvial Marsh Study

Effects of interim flows from Glen Canyon Dam on riparian vegetation along the dam regulated Colorado River in Grand Canyon, Arizona.

Principal Investigators: Lawrence Stevens, Tina Ayers

20.165 Draft — 1 October 1994

20.166 Final — 1 January 1995

P9 Paleoflood Study

A 4500-year record of large floods on the Colorado River in the Grand Canyon, Arizona.

Principal Investigators: Jim E. O'Connor, Lisa L. Ely, Ellen E. Wohl, Lawrence E. Stevens, Theodore S. Melis, Vishwas S. Kale, Victor R. Baker

20.167 Draft — 31 January 1993

20.168 Final — 30 April 1993

P10 Recreation Study

Effects of the operation of Glen Canyon Dam on campsite size in the Grand Canyon, Arizona.

Principal Investigators: Lisa Kearsley, Kathy Warren

20.169 Draft — 30 April 1993

20.170 Final — 30 August 1993

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

P11 Evaluation of Daily Beach Changes

An evaluation of the effects of the interim flows from Glen Canyon Dam on the daily change of beach area in Grand Canyon, Arizona.

Principal Investigators: Brian Cluer, Lee Dexter

20.171 Draft — 30 June 1994

20.172 Final — 30 September 1994

P12 Evaluation of Aerial Photography of Sediment Deposits

An evaluation of the annual effects of the interim flows from Glen Canyon Dam on the sediment deposits in the Grand Canyon, Arizona.

Principal Investigator: Brian Cluer

20.173 Draft — 31 March 1994

20.174 Final — 28 June 1994

P13 Eddy Dynamics

Evaluation of the effects of interim flows on the deposition of sediment in eddies in the Grand Canyon, Arizona.

Principal Investigator: Brian Cluer

20.175 Draft — 31 January 1995

20.176 Final — 30 April 1995

P14 Waterfowl Study

An evaluation of the effects of the operations of Glen Canyon Dam on the waterfowl resources in the Grand Canyon, Arizona.

Principal Investigators: Lawrence Stevens, Natasha Kline

20.177 Draft — 30 April 1995 (21 October 1991)

20.178 Final — 30 August 1995 (31 October 1993)

P15 Willow Flycatcher Survey

Southwestern willow flycatcher surveys along the Colorado River in Grand Canyon National Park and Glen Canyon National Recreation Area, 1992.

Principal Investigators: Mark Sogge, Timothy Tibbitts

20.179 Draft — 7 December 1992 (draft ?)

20.180 Final —

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

P16 Lower Trophic Level Study

Interim flow effects on lower aquatic trophic levels in the Colorado River in Grand Canyon, Arizona.

Principal Investigators: Lawrence Stevens, Dean Blinn

20.181 Draft — 1 October 1994

20.182 Final — 1 January 1995

P17 Avifaunal Monitoring

Avifaunal monitoring during the interim flows, including the southwestern willow flycatcher, the bald eagle, AND obligate riparian avifauna.

Principal Investigator: Mark Sogge

20.183 Draft — 1 October 1994

20.184 Final — 1 January 1995

P18 Recreation Monitoring

Monitoring the effects of interim flows from Glen Canyon Dam on sand bar dynamics and campsite size in the Colorado River corridor, Grand Canyon National Park, Arizona.

Principal Investigators: Stanley Beus, Matt A. Kaplinski, Joseph E. Hazel, Linda A. Tedrow, Lisa H. Kearsley

20.185 Quarterly Reports

20.186 Annual Reports

20.187 Draft — 1 October 1994

20.188 Final — 1 January 1995

Q. National Park Service, Glen Canyon National Recreation Area

Q1 Water Quality Study

An evaluation of the effects of interim flow operations on the water quality of the Colorado River from Glen Canyon Dam to Lee's Ferry, Arizona.

Principal Investigators: Clive Pinnock, C. Wood, D. Tinker

20.189 Draft — 30 June 1993

20.190 Final — 30 September 1993

Q2 Waterfowl Study

An evaluation of the effects of interim flow operations on the waterfowl in the Colorado River from Glen Canyon Dam to Lee's Ferry, Arizona.

Principal Investigators: Clive Pinnock, C. Wood

20.191 Draft — 30 June 1993

20.192 Final — 30 September 1993

Q3 Cultural Resource Report

An evaluation of the effects of the operations of Glen Canyon Dam on the cultural resources from Glen Canyon Dam to Lee's Ferry.

Principal Investigators: Christine Kincaid, Tim W. Burchett

20.193 Draft —

20.194 Final —

Q4 Paiute Ethnographic Report

An ethnographic evaluation of the use of the Grand Canyon, Arizona by the Paiute tribes of Arizona and Utah.

Principal Investigators: Richard W. Stouffle, David B. Halmo, Michael J. Evans, Diane E. Austin

20.195 1st preliminary draft — 24 June 1993

20.196 2nd preliminary draft — 15 July 1993

20.197 Draft —

20.198 Final —

Q5 Marsh Study

Effects of the interim flows from Glen Canyon Dam on the fluvial marshes of the lower Glen Canyon, Arizona.

Principal Investigators: Lawrence Stevens, Tina Ayers

20.199 Draft — 31 January 1993

20.200 Final — 30 April 1993

R. Northern Arizona University

Trout Spawning Study

R *Impact of fluctuating water levels on early life history of rainbow trout.*

Principal Investigators: W. Linn Montgomery, Kirsten Tinning

20.201 Draft — 28 February 1993 (3 August 1993)

20.202 Final — 31 May 1993

S. Northern Arizona University

Humpback Chub Literature Review

S ***Synthesis of information on humpback chub, Gila cypha, in the Colorado River basin.***

Principal Investigators: Linn Montgomery, Charles Minckley

20.203 Draft — 31 July 1993

20.204 Final — 31 October 1993

T. Glen Canyon Environmental Studies

T1 Light Attenuation Study

Photosynthetically available radiation (PAR) in the Colorado River, Glen and Grand Canyon, Arizona.

Principal Investigator: Michael Yard

20.205 Draft — 11 January 1993

20.206 Final — 31 August 1993

T2 Historical Review of Lake Powell Water Quality

Evaluation of the historic high water quality trends in Lake Powell, Arizona and Utah: A review of the available data.

Principal Investigator: William Vernieu

20.207 Draft — 28 June 1994

20.208 Final — 30 September 1994

T3 Native Fish Report

Non-native fishes of the Grand Canyon, Arizona: A review with regards to their effects upon native fish.

Principal Investigator: Allen Haden

20.209 Draft — 18 November 1992

20.210 Final — 31 January 1993

T4 Backwaters Evaluation

The relationship between flow and backwater fish habitat of the Colorado River in Grand Canyon, Arizona.

Principal Investigator: Judy Weiss

20.211 Draft — 13 August 1993

20.212 Final — 30 September 1993

U. University of Arizona

U Beach Deformation Study

Monitoring of sand bar instability during the interim flows: a seepage erosion approach.

Principal Investigators: Muni Budhu, Roger Gobin

20.213 Draft — 30 September 1994

20.214 Final — 31 December 1994

V. Utah State University

V *Development of a monitoring program of sediment storage changes in alluvial banks and bars, Colorado River, Grand Canyon, Arizona.*

Principal Investigator: Jack Schmidt

20.215 Draft — 30 September 1994

20.216 Final — 31 December 1994

W. Zuni Pueblo

W Ethnohistory Study

Ethnohistorical evaluation of the Zuni Pueblo's use of the Grand Canyon, Arizona.

Principal Investigators: Roger Anyon, Richard Hart

20.217 Draft — 30 September 1994

20.218 Final — 31 December 1994

X. Glen Canyon Environmental Studies

X Integrated Technical Reports

X(1) 20.219 ***Sediment and physical resources***

X(2) ***Aquatic resources***

X(2a) 20.220 ***Native fish***

X(2b) 20.221 ***Endangered fish***

X(2c) 20.222 ***Trout***

X(3) 20.223 ***Riparian resources***

X(4) 20.224 ***Cultural resources***

X(5) 20.225 ***Archaeological resources***

X(6) 20.226 ***Economic resources***

PART 20. GLEN CANYON ENVIRONMENTAL STUDIES PROGRAM

X(7) **Recreation resources**
Principal Investigator: Glen Canyon Environmental Studies

20.227 Draft — 1 October 1994

20.228 Final — 1 January 1995

Y **Glen Canyon Environmental Studies integrated final report.**
Principal Investigator: Glen Canyon Environmental Studies

20.229 Draft — 1 January 1995

20.230 Final — 30 April 1995

Z **Glen Canyon Environmental Studies long term monitoring plan.**
Principal Investigator: Glen Canyon Environmental Studies

20.231 Draft — 1 May 1993

20.232 Final — 30 September 1993
