

Official File Copy	
File Code	PRJ-2.00/1995
Project	PRJ 5.10 (GCES)
Director	

GCES OFFICE COPY DO NOT REMOVE!

GCES NON-USE VALUE STUDY

Final Report

Prepared for:

Glen Canyon Environmental Studies
Non-Use Value Committee

Prepared by:

Hagler Bailly Consulting
University Research Park
455 Science Drive
Madison, WI 53711-1058

Authors:

Michael P. Welsh
Richard C. Bishop
Marcia L. Phillips
Robert M. Baumgartner

September 8, 1995

810.00
with 3.00
GCES,

control copy

CONTENTS

Chapter 1	Overview and Summary	
1.1	Background on the Relationship Between Power Production and Downstream Resources	1-2
1.2	Research Plan, Qualitative Research, Pilot Test	1-3
1.3	Final Survey Design and Implementation	1-4
1.4	Results	1-11
Chapter 2	Conceptual Context	
2.1	The Relation Between Power Production and Downstream Resources ...	2-1
Chapter 3	Non-Use Value Study Process	
3.1	The Research Plan	3-1
3.2	Qualitative Research	3-1
3.3	Pilot Test.	3-2
Chapter 4	Design and Implementation of the Non-Use Value Study	
4.1	Experimental Design	4-1
4.2	Sampling	4-3
4.3	Survey Implementation Procedures	4-5
4.4	Data Processing	4-6
4.5	Response Rates	4-7
Chapter 5	Results	
5.1	Background Characteristics of Respondents	5-1
5.2	Respondents' Understanding of the Background Information	5-15
5.3	Support of Dam Operation Alternatives	5-19
5.4	Consideration of Budget Constraints and Changes in Votes	5-22
5.5	Respondent Self-Reports on Data Quality	5-30
5.6	Discrete Choice Models of Willingness-to-Pay	5-35
5.7	Estimated Willingness-To-Pay	5-40

Chapter 5 (*Continued*)

5.8	The Role of Power Price Increases in the Scenarios	5-42
5.9	Calculation of Population Average Willingness-To-Pay	5-43
5.10	Statistical Variability in Willingness-to-Pay Estimates	5-51
5.11	Aggregation	5-55
5.12	Discussion of Assumptions Used	5-59

Chapter 6 Validity of Results

6.1	The Measurement Problem	6-1
6.2	Toward a Theory of Economic Measurement	6-3
6.3	Overall Validity of the CV Method	6-7
6.4	Content Validity Assessment of the GCES Non-Use Value Study	6-11
6.5	Construct Validity Assessment	6-22
6.6	Conclusion	6-27

References

Appendix A GCES Non-Use Value Study Timeline

Appendix B GCES Non-Use Value Qualitative Research

B.1	Introduction and Interpretation of Qualitative Research	B-2
B.2	Recruiting Participants for the Qualitative Research	B-2
B.3	Decision Rules for Evaluating Qualitative Research Results	B-3
B.4	Initial Focus Group Discussions	B-4
	B.4.1 Focus Group Discussion Topics	B-5
	B.4.2 Participants' Knowledge, Attitudes, and Beliefs About the Grand Canyon	B-6
	B.4.3 Information on Operations of Glen Canyon	B-6
	B.4.4 Understanding and Evaluating the Impacts of Dam Operations ...	B-7
	B.4.5 Contingent Valuation Questions	B-8
	B.4.6 Initial Focus Group Results	B-9
B.5	Second Phase of Qualitative Research	B-11

Appendix C Overview of Pilot Test

C.1	Study Objectives and Experimental Design	C-2
C.2	Distribution of Dollar Amounts	C-5
C.3	Sampling	C-6
C.4	Implementation	C-7

Appendix C (Continued)

C.5	Pilot Test Results	C-8
C.6	Tests of Hypotheses	C-12
C.7	Summary of Pilot Test Results	C-18
C.8	Changes to Survey Materials and Study Subsequent to the Pilot Test ...	C-18
C.8.1	Background Information	C-18
C.8.2	True-False Questions	C-19
C.8.3	Scenarios	C-21
C.8.4	Contingent Valuation Question Format	C-21
C.8.5	Emphasis of Budget Constraints	C-28
C.8.6	Respondents Self-Reports on Perceived Validity	C-28
C.8.7	Were Payment Vehicles Relevant?	C-29
C.8.8	Sampling	C-29
C.8.9	Monetary Incentive	C-34
C.8.10	Telephone Survey	C-35

Appendix D Quality of Samples

D.1	Sample Selection	D-2
D.2	Comparison of the Population, Sample Frame, and Survey Respondents	D-4
D.3	Conclusions	D-8

Appendix E Survey Materials

	Mail Survey Materials - National Sample	E-1
	Mail Survey Materials - Marketing Area Sample	E-34
	Telephone Survey	E-66

Appendix F Glen Canyon Non-Use Value Survey Frequencies

	Mail Survey - National Sample	F-1
	Mail Survey - Marketing Area Sample	F-19
	Telephone Survey - National Sample	F-35
	Telephone Survey - Marketing Area Sample	F-46

Appendix G Nonrespondent Support of a Change in Dam Operations

Appendix H Additional Analysis

H.1	Models with Interaction Terms	H-2
H.1.1	Belief that Respondents Would Pay if the Proposal Passed	H-2
H.1.2	Interaction Models Allowing Shifts in Coefficient on the Dollar Amount	H-8
H.2	Turnbull Estimation of Willingness-to-Pay	H-12
H.2.1	Overview of Turnbull Estimation Procedures	H-12
H.2.2	Application to GCES Non-Use Value Final Study Data	H-15
H.3	Influential Data Points	H-16
H.4	Trends in Percentage of “Yes” Votes in Definitely Yes Models	H-17

Appendix I Sensitivity Analysis

I.1	Treatment of Nonrespondents	I-2
I.2	Use of a “Definitely Yes” Model	I-2
I.3	Treatment of Out-of-Scope Sample Points	I-3

TABLE OF TABLES AND FIGURES

TABLES

Chapter 1	Overview and Summary	
Table 1-1	Identification of Glen Canyon Studies Non-Use Mail Questionnaire Versions	1-6
Table 1-2	Sample Sizes for the Glen Canyon Studies Mail Surveys and Follow-up Telephone Interviews	1-7
Table 1-3	Glen Canyon Studies Non-Use Mail Survey Response Rates	1-9
Table 1-4	Glen Canyon Studies Non-Use Telephone Survey Response Rates	1-10
Table 1-5	Summary of Estimated Willingness-to-Pay -- National Sample	1-12
Table 1-6	Summary of Estimated Willingness-to-Pay -- Marketing Area Sample	1-13
Chapter 4	Design and Implementation of the Non-Use Value Study	
Table 4-1	Identification of Glen Canyon Studies Non-Use Mail Questionnaire Versions	4-3
Table 4-2	Sample Sizes for the Glen Canyon Studies Mail Surveys and Follow-up Telephone Interviews	4-5
Table 4-3	Glen Canyon Studies Non-Use Mail Survey Response Rates	4-8
Table 4-4	Glen Canyon Studies Non-Use Telephone Survey Response Rates	4-9
Table 4-5	Glen Canyon Studies Non-Use Survey Response Rates for the Mail and Telephone Surveys Combined	4-10
Chapter 5	Results	
Table 5-1	Socioeconomic Characteristics of Mail and Telephone Survey Respondents	5-3
Table 5-2	Visitation of Glen Canyon Dam	5-4
Table 5-3	Visitation of Grand Canyon National Park	5-6

Chapter 5 Tables (*continued*)

Table 5-4	Factor Loadings for Attitude Statements Used in Factor Analysis	5-8
Table 5-5	Mean Response to Attitude Questions Included in Factors	5-12
Table 5-6	Mean Factor Scores Calculated for Combined Mail and Telephone Survey Data	5-14
Table 5-7	Percent of Correct Responses to True or False Questions	5-17
Table 5-8	Quiz Scores	5-19
Table 5-9	Support of Water Release Alternatives	5-21
Table 5-10	Results of Initial Vote on Alternative Proposals by Dollar Values for Respondents Who Supported a Change in Dam Operations	5-23
Table 5-11	Items That Would be Given Up to Pay for the Proposal if the Proposal Passed	5-24
Table 5-12	Percentage of Respondents Who Supported a Change in Dam Operations but Elected to Change Their Initial Votes on Alternative Proposals	5-25
Table 5-13	Initial and Changed Votes for Respondents Electing to Change Their Initial Votes on Alternative Proposals by Dollar Values for the National and Marketing Area Samples	5-26
Table 5-14	Direction of Vote Changes for Respondents Electing to Change Their Initial Votes on Alternative Proposal by Dollar Values for the National Sample	5-28
Table 5-15	Direction of Vote Changes for Respondents Electing to Change Their Initial Votes on Alternative Proposals by Dollar Values for the Marketing Area Sample	5-29
Table 5-16	Believability of the Payment Vehicle	5-32
Table 5-17	Binding Effects of the Payment Vehicle	5-33
Table 5-18	Respondent Opinions on the Use of Study Results in Future Decisions About the Operation of Glen Canyon Dam	5-34
Table 5-19	Estimated Logic Regression Model Parameters for the National Sample	5-37
Table 5-20	Estimated Logistic Regression Model Parameters for the Marketing Area Sample	5-38
Table 5-21	Model Variation Definitions	5-39
Table 5-22	Annual Estimated Mean Willingness-to-Pay for a Change in Dam Operations for the National Sample	5-41

Chapter 5 Tables (*continued*)

Table 5-23	Annual Estimated Mean Willingness-to-Pay for a Change in Dam Operations for the Marketing Area Sample	5-41
Table 5-24	Overview of Environmental Improvements and Power Price Impacts in the National Sample Survey	5-43
Table 5-25	Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations, National Sample Definitely Yes Models	5-46
Table 5-26	Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations, Marketing Area Sample Definitely Yes Models	5-47
Table 5-27	Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations, National Sample Definitely/Probably Yes Models	5-48
Table 5-28	Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations, Marketing Area Sample Definitely/Probably Yes Models	5-49
Table 5-29	Summary of National Sample Population Average Willingness-to-Pay	5-50
Table 5-30	Summary of Marketing Area Sample Population Average Willingness-to-Pay	5-51
Table 5-31	Percent Change in Mean Willingness-to-Pay Between Definitely Yes Models with Values Imputed for Nonrespondents and the Lower 95 Percent Confidence Interval for the Same Model	5-53
Table 5-32	Percent Change in Mean Willingness-to-Pay Between Definitely Yes Models with Values Imputed for Nonrespondents and the Upper 95 Percent Confidence Interval for the Same Model	5-54
Table 5-33	Aggregate Levelized Annual Willingness-to-Pay for Changes in Dam Operations for the National Sample (Millions of Dollars)	5-57
Table 5-34	Aggregate Levelized Annual Willingness-to-Pay for Changes in Dam Operations for the Marketing Area Sample (Millions of Dollars)	5-58
Table 5-35	Best Estimates of Willingness-to-Pay for Changes in the Operation of Glen Canyon Dam - National Sample	5-59
Table 5-36	Best Estimates of Willingness-to-Pay for Changes in the Operation of Glen Canyon Dam - Marketing Area Sample	5-59

Chapter 6 Validity of Results

Table 6-1 Characteristics of the Population, Sample Frame, and Survey Respondents 6-20

Appendix B GCES Non-Use Value Qualitative Research

Table B-1 Dates and Locations of the Focus Group Discussions B-5

Appendix C Overview of Pilot Test

Table C-1 Identification of Glen Canyon Studies Non-Use Questionnaire Versions C-5

Table C-2 Distribution of Dollar Amounts Used in Questionnaire Version 7 C-6

Table C-3 Glen Canyon Studies Non-Use Survey Response Rates -- Pilot Test C-7

Table C-4 Mean Willingness-to-Pay for Stated Proposal -- Discrete Choice Analysis of Data Collected Using Multiple Bounded Questioning Format C-10

Table C-5 Mean Willingness-to-Pay for Stated Proposal -- Payment Card Analysis C-11

Table C-6 Hypothesis Tests for Models in Which a Yes is Recorded for "Definitely Yes" and a No is Recorded for All Other Response Categories C-13

Table C-7 Hypothesis Tests for Models in Which a Yes is Recorded for "Definitely Yes" and "Probably Yes" and a No is Recorded for All Other Response Categories C-14

Table C-8 Comparison of Mean Willingness-to-Pay Estimates for Versions 3 and 7 C-15

Table C-9 Changes to the True/False Statements C-20

Appendix D Quality of Samples

Table D-1 Characteristics of the Population, Sample Frame, and Survey Respondents D-6

Appendix G Nonrespondent Support of a Change in Dam Operations

Table G-1	Estimated Logistic Regression Model Parameters for the National Sample to Predict Support for a Change in Dam Operations at Zero Cost	G-3
Table G-2	Estimated Logistic Regression Model Parameters for the Marketing Area Sample to Predict Support for a Change in Dam Operations at Zero Cost	G-4
Table G-3	Definition of Variables Used in Models to Predict Support of a Change in Dam Operations	G-5
Table G-4	Average Values of Independent Variables Used to Estimate Nonrespondent Support for a Change in Dam Operations at Zero Cost	G-6
Table G-5	Predicted Support for a Change in Dam Operations at Zero Cost for Mail Survey Nonrespondents	G-7

Appendix H Additional Analyses

Table H-1	Estimated Logistic Regression Model Parameters for the National Sample with Interactive Variables	H-3
Table H-2	Estimated Logistic Regression Model Parameters for the Marketing Area Sample with Interactive Variables	H-6
Table H-3	Estimated Logistic Regression Model Parameters for the National Sample with Slope Interaction Variables	H-9
Table H-4	Estimated Logistic Regression Model Parameters for the Marketing Area Sample with Slope Interaction Variables	H-10
Table H-5	Illustration of Nonparametric Estimation Techniques	H-14
Table H-6	Comparison of Turnbull Lower Bound and Parametric Estimates of Willingness-to-Pay	H-16
Table H-7	Overall Percentage “Yes” in Definitely Yes Models	H-18
Table H-8	Percentage of “Yes” votes in Definitely Yes Models, Female Respondents Disaggregated by Survey Version	H-19

Appendix I Sensitivity Analysis

Table I-1	Percentage Change in Mean Willingness-to-Pay between Definitely Yes Models with Values Imputed for Nonrespondents and Models with Zero Values Assumed for Nonrespondents	I-5
Table I-2	Percentage Change in the Mean Willingness-to-Pay between Definitely Yes and Definitely/Probably Yes Models with Values Imputed for Nonrespondents	I-6

Appendix I (*continued*)

Table I-3 Percent Change in Mean Willingness-to-Pay between
Definitely Yes Models with Values Imputed for Nonrespondents
and Models with Zero Values Assumed for Out-of-Scope
Sample Points I-7

FIGURES

Figure 5-1 Willingness-to-Pay Question Format (National Sample) 5-22
Figure 5-2 Payment Vehicle Questions 5-31
Figure 6-1 Content Validity Rating Form for Contingent Valuation Studies 6-12
Figure C-1 Moderate Fluctuating Flow Alternative C-22
Figure C-2 Low Fluctuating Flow Alternative C-24
Figure C-3 Seasonally Fluctuating Steady Flow Alternative C-26
Figure C-4 Contingent Valuation Question Formats C-30
Figure C-5 Procedures for Identifying ZIP Codes C-32

CHAPTER I

OVERVIEW AND SUMMARY

The operation of Glen Canyon Dam has been the focus of an ongoing controversy. Operations that increase the value of electric power produced at the dam tend to result in substantial daily fluctuations in river levels below the dam. These fluctuations have been found to decrease the size and number of beaches and change the habitat of terrestrial and aquatic species including endangered fish species. In addition, daily fluctuations tend to reduce the quality of recreation on the river downstream from Glen Canyon Dam.

Changes made in operations to benefit the downstream environment and the quality of recreation will reduce the value of power produced at the dam, resulting in a conflict between the type, level, and availability of environmental amenities and recreational opportunities along the Colorado River versus dam operations. This conflict can be partially evaluated by measuring the relative economic value placed on electric power, recreation, and preservation of river-related resources downstream from Glen Canyon Dam. In 1983, the Bureau of Reclamation established the Glen Canyon Environmental Studies (GCES) to explore these relationships between dam operations and downstream resources. As part of the GCES, the Bureau of Reclamation authorized and funded a series of economic studies to measure these three values in a theoretically consistent way. Previous studies resulted in estimates of the economic value of downstream recreation (Bishop et al., 1987) and the value of power produced at the dam (GCES Power Resources Committee, 1995). The Glen Canyon Non-Use Value Study is the third component of the GCES Economic Studies.

This report describes the GCES Non-Use Value Study, a study of values associated with preserving the river-related resources on the Colorado River downstream from Glen Canyon Dam. The value associated with environmental preservation is often referred to as "non-use value."¹ While the concept may be unfamiliar to non-economists, it has been a part of economic theory for over 30 years. Beginning with an article written by John Krutilla (1967), economists have come to recognize that economic values for public resources may not be limited to direct use values. For a variety of reasons, people may value environmental

¹ The term non-use value will be used in this report to denote a value placed on a resource in the absence of any direct or indirect use of the resource. This type of value is sometimes referred to as passive use value. The term total value denotes the value placed on a resource regardless of the motivation for the value. While the study presented in this report technically measured total values, because very few respondents have use values for resources affected by dam operations, the measured total values are likely to consist primarily of non-use values.

resources even though they do not benefit from directly consuming produced goods or recreational opportunities. They may, for example, be sympathetic toward animals, altruistic toward others in the current generation or future generations, or be concerned about maintaining the resource for future personal use. It is now widely agreed among economists (see, for example, Freeman, 1993) that the value of a public resource may include non-use values in addition to the more traditionally measured use values. It follows that a full accounting of the values associated with changes in dam operations will include the non-use values, if they are present, as well as direct use values.

In this study, non-use values were measured using a contingent valuation mail survey. This chapter provides an overview of the study and a summary of the survey results. A more detailed presentation of the study, implementation, and results is provided in the chapters that follow. Chapter 2 provides a detailed discussion of the conceptual basis of the study. This is followed by a discussion of the study process, including the research plan, the qualitative research conducted in the early stages of the study, and the pilot test implemented to test the field-readiness of the survey instruments. Chapter 4 provides information on the design and implementation of the final survey. Results are presented and discussed in Chapter 5. A discussion of the validity of these results is provided in Chapter 6.

1.1 BACKGROUND ON THE RELATIONSHIP BETWEEN POWER PRODUCTION AND DOWNSTREAM RESOURCES

Glen Canyon Dam is an energy-constrained hydroelectric facility. This means that in a typical year, the annual release from the dam is not sufficient to sustain peak generation for the entire year. The economic benefits of energy-constrained hydroelectric facilities are maximized by concentrating water releases during periods of highest electrical demand. Historically, Glen Canyon Dam has been operated in this way. The consequence of this type of operation has been substantial daily fluctuations in the river flows below Glen Canyon Dam. These daily fluctuations tended to result in a net loss of sediment in the Colorado River below Glen Canyon Dam, resulting in a decrease in the size and number of beaches, as well as changes in habitat for terrestrial and aquatic animals, including endangered species of fish. Daily fluctuations in water levels were also documented as having decreased the quality of rafting and fishing on the Colorado River below Glen Canyon Dam (Bishop, et al., 1987).

These linkages form the basis for the conflicts that have resulted over issues of dam operation. A change in dam operations that decreases the range of daily fluctuations is likely to reduce impacts to the downstream resources and to increase the quality of recreation. On the other hand, such a change will also reduce the value of the power produced at Glen Canyon Dam. From an economic perspective, this problem can be addressed by measuring the relative values placed on power, recreation, and the protection of resources affected by

the operations of Glen Canyon Dam. To this end, GCES has carried out a series of economic studies designed to measure each of these values. This report summarizes the GCES effort to measure the non-use values associated with alternative dam operations.

1.2 RESEARCH PLAN, QUALITATIVE RESEARCH, PILOT TEST

Each step in the evolution of this study was guided by the GCES Non-Use Value Committee. The committee consisted of representatives of federal agencies, American Indian tribes, and power consumer groups. A peer review panel consisting of four nationally prominent resource economists reviewed research plans and results at each key stage in the research. In addition, the Office of Management and Budget (OMB), which is required to approve all federally sponsored surveys, provided insightful suggestions during the approval process.

The initial step in the GCES Non-Use Value Study was the completion of a report assessing the feasibility of estimating total values associated with the preservation of environmental resources in and along the Colorado River below Glen Canyon Dam. This effort was initiated in 1990 and completed in 1991. The report concluded that a total value study, including the measurement of non-use values, should be a component of the GCES economic studies (Bishop and Welsh, 1992). The report further concluded that although the prospects appeared favorable, such a study should proceed in phases and be subjected to a peer review process at the conclusion of each phase. Subsequent phases would be recommended only with the approval of committee members and peer reviewers.

The Non-Use Value Study was initiated with a qualitative research effort involving focus groups and in-depth personal interviews. The qualitative research phase had several objectives. These included:

- ▶ Exploring whether potential survey respondents could focus on affected resources as distinct from the Grand Canyon in its entirety;
- ▶ Exploring whether potential survey respondents care about the status of the affected resources;
- ▶ Exploring whether individuals geographically distant from Glen Canyon Dam care about the status of the affected resources;
- ▶ Exploring alternative methods for describing the environmental effects of dam operations; and
- ▶ Evaluating the performance of prototype survey instruments.

Results from the qualitative research reinforced the conclusion of the feasibility report. The results suggested that many citizens across the United States were concerned about the status of the resources affected by the operation of Glen Canyon Dam. Issues of particular concern included beaches and vegetation, archeological sites, American Indian traditional use areas, native fish, trout, and price impacts to consumers of power produced at Glen Canyon Dam. Furthermore, the qualitative research also suggested that the study could be implemented using a mail survey instrument for primary data collection. In the summer of 1993, the results of the qualitative research phase and prototype mail survey instruments were reviewed by the both the GCES Non-Use Value Committee and an external peer review panel. The decision was made to proceed with a pilot test.

The fall of 1993 was devoted to finalizing the design of survey instruments to be used in the pilot test and securing clearance from OMB to proceed with implementation of a pilot test. Implementation of the pilot test began in January 1994. Purposes of the pilot test included evaluating the performance of mail survey instruments, examining methodological concerns related to the validity of the contingent valuation method, and testing survey implementation procedures. The results of the pilot test suggested that the survey instrument and implementation procedures would result in valid estimates of non-use values associated with resources affected by the operation of Glen Canyon Dam. After review by the committee and external peer review panel, a decision was made to proceed with a final study.

The final study design was the end product of an extensive research process that has been overseen at every step by the GCES Non-Use Value Committee. Review by the committee provided valuable insights from a broad range of perspectives. In addition, members of the committee worked closely with members of the GCDEIS team to ensure that the survey instruments contained accurate descriptions of the expected consequences of each dam operation alternative. We believe the input from the committee, peer reviewers, and OMB has greatly enhanced the quality and overall validity of the GCES Non-Use Value Study.

1.3 FINAL SURVEY DESIGN AND IMPLEMENTATION

The GCES Non-Use Value Study was designed to evaluate three of the alternatives assessed in the Glen Canyon Dam Environmental Impact Statement (GCDEIS). In the survey, the no-action alternative was defined as the baseline (or current) dam operation condition. This baseline condition consisted of maintaining the maximum daily fluctuation in flows, ranging from 3,000 cubic feet per second (cfs) to 31,500 cfs between Easter and Labor Day and from 1,000 cfs to 31,500 cfs between Labor Day and Easter. Given the similarities in resource impacts between several of the remaining eight alternatives and the depth of detail required to describe them, the GCES Non-Use Value Committee recommended that only three main alternatives be considered for the final study:

1. Moderate fluctuating flow alternative - featuring a moderate reduction in the magnitude of the daily fluctuations;
2. Low fluctuating flow alternative - featuring reductions in the magnitude of the daily fluctuations; and
3. Seasonally adjusted steady flow alternative - providing steady flows on a seasonally adjusted or monthly basis.

These three alternatives covered most of the range of alternative dam operations being examined and were considered to include the set of alternatives most likely to contain the eventual preferred alternative.² Therefore, the experimental design was planned around these three alternatives.

The experimental design included two samples, seven versions of a mail questionnaire, and a follow-up telephone interview with nonrespondents. Because water releases from Glen Canyon Dam affect resources located in the Grand Canyon National Park, the sampling frame included all residents of the United States. Two separate random samples were identified within this frame: a national sample and a marketing area sample. The national sample consisted of residents of the United States. The marketing area sample was a subset of the national sample whose energy needs were serviced by Salt Lake City Area Integrated Projects (SLCA/IP). This design ensured that estimates of non-use values reflected both the values held by United States residents as well as the values held by individuals who would be directly affected by increases in utility bills. Samples were purchased from Survey Sampling, Inc., an independent firm that specializes in maintaining national marketing databases.

There were two primary differences between surveys administered to the marketing area sample and those administered to the national sample. First, the surveys differed in the payment vehicle used to solicit non-use values in the contingent valuation question. For the national sample, the payment vehicle consisted of an annual payment in increased taxes. For residents of the marketing area, increases in utility bills were used as a payment vehicle. Surveys administered to each sample also differed in the description of resources included in the dam operation alternative. In the national sample, the survey contained a description of the environmental and power cost impacts of the dam operation alternative. In contrast, the marketing area survey described only the environmental impacts of the dam operation alternative.

Separate survey versions were designed in order to address the three water release alternatives chosen, resulting in a total of six survey versions (three for the national sample and three for the marketing area sample). One additional survey version was developed for

² For more detailed information on alternative dam operations, refer to the GCDEIS (U.S. Bureau of Reclamation, 1995).

the national sample to examine in more detail the effects on the study of including the impacts that water flow alternatives would have on power costs. Table 1-1 identifies the differences between questionnaire versions.

Table 1-1
Identification of Glen Canyon Studies Non-Use Mail Questionnaire Versions

Questionnaire Version	Water Release Alternative
National Sample	
Version 1	Moderate Fluctuating Flow
Version 2	Low Fluctuating Flow
Version 3	Seasonally Adjusted Steady Flow
Version 4	Seasonally Adjusted Steady Flow with Moderate Fluctuating Flow Impact Costs to Power
Marketing Area Sample	
Version 5	Moderate Fluctuating Flow
Version 6	Low Fluctuating Flow
Version 7	Seasonally Adjusted Steady Flow

Four of the seven questionnaire versions were administered to the national sample, and three were administered to the marketing area sample. Each version was administered to 850 sample points (Table 1-2). The sample for the follow-up telephone survey consisted of the portion of national and marketing area samples for which no final mail disposition had been reached. Interviews were attempted with 1,708 individuals: 1,102 from the national sample and 606 from the marketing area sample.

Table 1-2
Sample Sizes for the Glen Canyon Studies Mail Surveys
and Follow-up Telephone Interviews

Questionnaire Version	Sample Size	
	Mail Survey	Telephone Survey
National Sample		
Moderate Fluctuating Flow (Version 1)	850	286
Low Fluctuating Flow (Version 2)	850	267
Seasonally Adjusted Steady Flow (Version 3)	850	272
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	<u>850</u>	<u>277</u>
Total	3,400	1,102
Marketing Area Sample		
Moderate Fluctuating Flow (Version 5)	850	207
Low Fluctuating Flow (Version 6)	850	205
Seasonally Adjusted Steady Flow (Version 7)	<u>850</u>	<u>204</u>
Total	2,550	606
Overall Total	5,950	1,708

Mail questionnaires were administered using the Dillman (1978) method, which consisted of the following procedures:

1. An advance, introductory letter on U.S. Bureau of Reclamation letterhead, signed by the GCES manager. The letter explained the study and advised that a questionnaire would be sent within the week.
2. A survey mailing package containing a copy of the questionnaire, background information materials, a cover letter on U.S. Bureau of Reclamation letterhead, a stamped return envelope, and a \$3 cash incentive.

3. A thank you/reminder postcard sent to all respondents, thanking those who had already responded to the survey and encouraging those who had not responded to please do so.
4. A second survey package containing a second copy of the questionnaire and background materials, a different cover letter, and a stamped return envelope.
5. A third survey package delivered via certified mail. This package also contained a copy of the questionnaire and background materials, a different cover letter, and a stamped return envelope.

Mail survey implementation began in October 1994 and was concluded in early January 1995. All mail survey versions were administered concurrently.

Follow-up telephone interviewing began on January 19, 1995, four weeks after the final survey mailing. Telephone interviews were attempted for all nonrespondents for whom telephone numbers could be obtained. All telephone interviews were conducted by experienced interviewers using Computer Assisted Telephone Interviewing (CATI) software at an in-house telephone laboratory in Madison, Wisconsin.

Response rates for completed mail surveys were calculated as a percentage of deliverable questionnaires. The study achieved a response rate of 66 percent for the national sample, and 75 percent for the marketing area sample (Table 1-3).

**Table 1-3
Glen Canyon Studies Non-Use Mail Survey Response Rates**

	Sample Size	Out of Scope ^a	Completed Surveys	Response Rate ^b
National Sample				
Moderate Fluctuating Flow (Version 1)	850	188	426	64%
Low Fluctuating Flow (Version 2)	850	202	431	66%
Seasonally Adjusted Steady Flow (Version 3)	850	1,196	439	67%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	<u>850</u>	<u>190</u>	<u>432</u>	<u>65%</u>
Total	3,400	776	1,728	66%
Marketing Area Sample				
Moderate Fluctuating Flow (Version 5)	850	219	467	74%
Low Fluctuating Flow (Version 6)	850	226	467	75%
Seasonally Adjusted Steady Flow (Version 7)	<u>850</u>	<u>200</u>	<u>489</u>	<u>75%</u>
Total	2,550	645	1,423	75%

^a Includes cases where the addressee was deceased or the survey mailing was returned as undeliverable.

^b Calculated as a percentage of deliverable questionnaires (sample size minus out-of-scope cases).

Response rates to the telephone survey of nonrespondents are shown in Table 1-4. Telephone interviews were completed with 35 percent of nonrespondents from the national sample, and with 46 percent of nonrespondents to the marketing area sample.

Table 1-4
Glen Canyon Studies Non-Use Telephone Survey Response Rates

	Sample Size	Out of Sample ^a	Withdrawn from Sample ^b	Completed Interviews	Response Rate ^c
National Sample					
Moderate Fluctuating Flow (Version 1)	286	90	9	66	35%
Low Fluctuating Flow (Version 2)	267	92	6	53	31%
Seasonally Adjusted Steady Flow (Version 3)	272	79	9	69	37%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	277	80	14	63	34%
Total	1,102	341	38	251	35%
Marketing Area Sample					
Moderate Fluctuating Flow (Version 5)	207	57	7	62	43%
Low Fluctuating Flow (Version 6)	205	63	7	58	43%
Seasonally Adjusted Steady Flow (Version 7)	<u>194</u>	<u>42</u>	<u>6</u>	<u>74</u>	<u>51%</u>
Total	606	62	20	194	46%

^a Includes disconnected, no listing available, wrong phone numbers, and cases where the identified respondent was unavailable for the study duration, unable to participate due to physical or mental impairment, deceased, or had moved.

^b Includes cases pulled from the sample before a final disposition was reached because a mail questionnaire was received during implementation of the telephone survey.

^c Calculated as a percentage of available (reachable) respondents.

1.4 RESULTS

Non-use values were measured using the contingent valuation method. In a contingent valuation survey, respondents are asked questions about how much they would be willing to pay to either maintain or acquire a preferred level of an environmental good. In this survey, respondents were first asked if they would vote in favor of a proposal to change dam operations if it cost them nothing. Those in favor of the proposal were then asked how they would vote if passage of the proposal cost them a specified amount of money. Responses to this second question were used to make inferences about the value, or willingness-to-pay, placed by respondents on the proposal being evaluated.

Proposals evaluated by members of the national sample included descriptions of the impacts the proposal would have on the number and size of beaches, archaeological sites and American Indian traditional uses, native fish, trout, electric bills for consumers of power produced at Glen Canyon Dam, and farm incomes. In the national sample, willingness-to-pay was measured by asking respondents whether they would vote for a proposal to change dam operations if passage meant they would have to pay increased taxes. Proposals evaluated by members of the marketing area sample included descriptions of the proposal's impacts on the number and size of beaches, archaeological sites and American Indian traditional uses, native fish, and trout. In the marketing area sample, willingness-to-pay was measured by asking respondents how they would vote on a proposal to change dam operations if passage increased their monthly electric utility bill.³

Estimates of average willingness-to-pay in the national sample for each of the three alternatives evaluated are shown in Table 1-5. These numbers reveal substantial non-use values for each of the three alternatives. The low fluctuating flow alternative and the seasonally adjusted steady flow alternative would result in non-use values that are approximately 50 percent greater than the non-use values associated with the moderate fluctuating flow alternative.

³ Copies of survey instruments are found in Appendix E.

Table 1-5
Summary of Estimated Willingness-to-Pay -- National Sample

Water Release Alternative	Average Annual Value Per Household ^a	Aggregate Annual Value ^b (Millions of Dollars)
Moderate fluctuating flow (Version 1)	\$13.56	\$2,286.4
Low fluctuating flow (Version 2)	\$20.15	\$3,375.2
Seasonally adjusted steady flow (Version 3)	\$20.55	\$3,442.2

^a Best estimates based on "Definitely Yes" models, adjusted to reflect values of nonrespondents and to reflect the belief that the respondent would actually have to pay if the proposal passed. For details see Chapter 5.

^b Levelized annual values extrapolated to the national population. See Chapter 5 for additional details on the procedures used to calculate these numbers.

Estimates of average willingness-to-pay in the marketing area sample for each of the three alternatives evaluated are shown in Table 1-6. Survey respondents in the marketing area are individuals who will likely bear the costs of any changes in dam operations, and this may give their responses added importance in decisions regarding the future operations of Glen Canyon Dam. Residents of the marketing area also expressed significant non-use values for each of the three alternatives evaluated. Non-use values were approximately equal for the moderate and fluctuating flow proposal and were about one-third higher for the seasonally adjusted steady flow alternative.

Table 1-6
Summary of Estimated Willingness-to-Pay -- Marketing Area Sample

Water Release Alternative	Average Annual Value Per Household ^a	Aggregate Annual Value ^b (Millions of Dollars)
Moderate fluctuating flow (Version 5)	\$22.06	\$62.2
Low fluctuating flow (Version 6)	\$21.45	\$60.5
Seasonally adjusted steady flow (Version 7)	\$28.87	\$81.4

^a Best estimates based on "Definitely Yes" models, adjusted to reflect values of nonrespondents and to reflect the belief that the respondent would actually have to pay if the proposal passed. For details see Chapter 5.

^b Levelized annual values extrapolated to the population of households residing in areas served by utilities with firm power contracts for power produced at Glen Canyon Dam. See Chapter 5 for additional details on the procedures used to calculate these numbers.

The non-use values contained in this report are just one of many factors that might be considered in making decisions regarding future operations of Glen Canyon Dam. The extent to which these values might be considered will depend, at least in part, on the perceived validity of the values. Given the substantial controversy among economists regarding the validity of the non-use values measured using contingent valuation method, we conclude this chapter with some observations about the validity of the study results.

As discussed in Chapter 6, the validity of a contingent valuation study can be assessed in terms of content validity (how well the study was designed and implemented), and construct validity (the consistency of the results with economic theory).

A contingent valuation study with a high level of content validity would have many characteristics. For example, a content valid study would be based on a clear theoretical definition of the value to be measured. Based on well-documented evidence of the respondent-relevant effects of the intervention, a sound study effectively communicates the potential effects of the intervention to respondents. The scenario describing the intervention must include whatever information respondents might need regarding potential substitutes for the environmental resources in question and reminds them of their context for valuation. The scenario also includes a fully specified and incentive-compatible context for valuation. A sound study will do all of this in ways that potential respondents can accept and, if possible, believe. Beyond the scenario, a content-valid survey instrument also includes well-designed questions to support construct validity testing and achieve other goals. The mode chosen for administering the survey must be appropriate for the complexity of the scenario and the ultimate goals of the study. Prior to administration, the instrument must be subjected to sufficient qualitative investigation, pretesting, and, if needed, pilot testing to eliminate as many problems as possible. Econometric analysis of the results must be adequately performed and the final results effectively reported. We believe that the GCES Non-Use Value Study meets these standards well.

A contingent valuation study with high construct validity is one that would pass both rudimentary and advanced theoretical validity tests. The valuation equations estimated in this study showed a high degree of consistency between study results and prior expectations. Furthermore, subject to a few caveats discussed in Chapter 6 regarding the marketing area surveys, we were able to achieve considerable success in passing scope tests.

Our conclusion, then, is that the GCES Non-Use Value Study has demonstrated sufficiently high levels of content and construct validity to be used in choosing the criteria for operating Glen Canyon Dam in the future. Integrating the results of this study with recreation valuation studies should help to judge the economic implications of alternative criteria for operation of Glen Canyon Dam.

CHAPTER 2

CONCEPTUAL CONTEXT

Glen Canyon Dam has been producing electric power for over 30 years. For most of this time, typical power operations resulted in large daily fluctuations in the level of the Colorado River downstream from the dam. Concern about the environmental consequences of these daily fluctuations resulted in the initiation of the Glen Canyon Environmental Studies (GCES) in 1982. The initial phase of GCES demonstrated a link between the operation of the dam and downstream environmental conditions. This link, and continued concern about the effects of dam operations on the Grand Canyon River environment, led then Secretary of the Interior Lujan, in 1989, to order the preparation of an environmental impact statement for the operations of Glen Canyon Dam. At that time, the GCES were directed to further document effects of dam operations on the downstream environment for use in the preparation of the Glen Canyon Dam Environmental Impact Statement (GCDEIS).

From the early days, the GCES recognized that in addition to affecting the natural environment, the operations of Glen Canyon Dam also affect the human environment. The initial phase of the GCES targeted the effects of dam operations on downstream recreation, including whitewater rafting and fishing. In a review of the initial GCES research, the National Academy of Sciences identified two additional aspects of the human environment for future study. These areas included the impact of changes in dam operations on the value of power produced at that dam and the existence, or non-use, values that would be placed on resources affected by dam operations. Each of these topics has been the subject of additional research in subsequent phases of GCES.

2.1 THE RELATION BETWEEN POWER PRODUCTION AND DOWNSTREAM RESOURCES

Glen Canyon Dam is an energy-constrained hydroelectric facility. This means that in a typical year, the annual release from the dam is not sufficient to sustain peak generation for the entire year. The economic benefits of energy-constrained hydroelectric facilities are maximized by concentrating water releases during periods of highest electrical demand. Historically, Glen Canyon Dam has been operated in this way. The consequence of this type of operation has been substantial daily fluctuations in the river flows below Glen Canyon Dam. These daily fluctuations tended to result in a net loss of sediment in the Colorado River below Glen Canyon Dam. This resulted in a decrease in the size and number of beaches, and changes in habitat for both terrestrial and aquatic animals, including endangered species of

fish. Daily fluctuations in water levels were also shown to decrease the quality of rafting and fishing on the Colorado River below Glen Canyon Dam (Bishop et al., 1987).

These linkages form the basis for conflicts over dam operation. A change in dam operations that decreases the amount of daily fluctuations is likely to reduce impacts on the downstream resources and increase the quality of recreation. On the other hand, such a change will also reduce the value of the power produced at Glen Canyon Dam. From an economic perspective, this problem can be addressed by measuring the relative values placed on power, recreation, and the protection of resources affected by the operations of Glen Canyon Dam. To achieve this, GCES has carried out a series of economic studies designed to measure each of these values.

The value associated with environmental preservation is often referred to as "non-use value." While the concept may be unfamiliar to non-economists, it has been a part of economic theory for over 30 years. Beginning with an article written by John Krutilla (1967), economists have come to recognize that economic values for public resources may not be limited to direct use values. For a variety of reasons, people may value environmental resources even though they do not benefit from directly consuming produced goods or recreational opportunities. They may, for example, be sympathetic toward animals, altruistic toward others in the current generation or future generations, or be concerned about maintaining the resource for future personal use. Economists now widely agree that the value of a public resource may include non-use values in addition to the more traditionally measured use values (see, for example, Freeman, 1993). It follows that a full accounting of the values associated with changes in dam operations will include the non-use values, if they are present, as well as direct use values.

It should be noted that the value of a resource, regardless of the motivation for the value, is commonly referred to as a "total value." The values measured in this report are total values in that respondents are asked about their willingness-to-pay for a change in dam operations. Theoretically, the values expressed by survey respondents could arise from any one (or all) of the following motivations: a direct use of the resource (for example, rafting the Colorado River or hiking along the river below Glen Canyon Dam), a desire to preserve the option for future direct uses, and a desire to preserve the resources even in the absence of current or future use. This latter type of value is typically referred to as non-use value. Practically speaking, we suspect that non-use value is likely to be the primary motivation for total value of the resources affected by the operation of Glen Canyon Dam. For this reason, although the survey technically measures a total value, it is referred to in this report as a non-use value.

CHAPTER 3

NON-USE VALUE STUDY PROCESS

The Glen Canyon Non-Use Value Study is the third component of the GCES Economic Studies. Previous studies have resulted in estimates of the economic value of downstream recreation (Bishop et al., 1987) and the value of power produced at the dam (GCES Power Resources Committee, 1995). The GCES Non-Use Value Study is the product of a series of research steps carried out over the last five years.

At each step, the study was guided by the GCES Non-Use Value Committee. The committee consisted of representatives of federal agencies, American Indian tribes, and power consumer groups. A peer review panel consisting of four nationally prominent resource economists reviewed research plans and results at each key stage in the research. In addition, the Office of Management and Budget (OMB), which is required to approve all federally sponsored surveys, provided insightful suggestions during the approval process.

3.1 THE RESEARCH PLAN

The initial step in the GCES Non-Use Value Study was the completion of a report assessing the feasibility of estimating total values associated with the preservation of environmental resources in and along the Colorado River below Glen Canyon Dam. This effort was initiated in 1990 and completed in 1991. The report concluded that a total-value study, including the measurement of non-use values, should be a component of the GCES economic studies (Bishop and Welsh, 1992). The report further concluded that although the prospects appeared favorable, such a study should proceed in phases and be subjected to a peer review process at the conclusion of each phase. Subsequent phases would be recommended only with the approval of committee members and peer reviewers.

3.2 QUALITATIVE RESEARCH

The Non-Use Value Study was initiated with a qualitative research effort involving focus groups and in-depth personal interviews. The qualitative research phase had several objectives. These included:

- ▶ Exploring whether potential survey respondents could focus on affected resources as distinct from the Grand Canyon in its entirety;
- ▶ Exploring whether potential survey respondents care about the status of the affected resources;
- ▶ Exploring whether individuals geographically distant from Glen Canyon Dam care about the status of the affected resources;
- ▶ Exploring alternative methods for describing the environmental effects of dam operations; and
- ▶ Evaluating the performance of prototype survey instruments.

The qualitative research reinforced the conclusion of the original research plan. Specifically, the results suggested that many citizens across the United States were concerned about the status of the affected resources. Issues of particular concern included beaches and vegetation, archeological sites, American Indian traditional use areas, native fish, trout, and price impacts to consumers of power produced at Glen Canyon Dam. Furthermore, the qualitative research also suggested that the study could be implemented using a mail survey instrument as the primary data collection tool.¹ In the summer of 1993, the results of the qualitative research phase and prototype mail survey instruments were reviewed by both the GCES Non-Use Value Committee and an external peer review panel, and a decision was made to proceed with a pilot test.

3.3 PILOT TEST

The summer and fall of 1993 were spent on finalizing the design of survey instruments and obtaining clearance from OMB to proceed with the implementation of a pilot test. In addition to obtaining information required to assess implementation issues for a possible final study, the pilot test was designed to test several methodological issues. A primary methodological issue was whether the pilot test instruments could provide willingness-to-pay estimates that were sensitive to details of the water release alternatives being evaluated. A second methodological issue was whether the pilot test instruments could provide estimates of willingness-to-pay that were not sensitive to minor changes in wording. Implementation of the pilot test began in January of 1994. Like the final study described in the next chapter, the pilot test involved a series of survey instruments, each administered to a separate sample.

¹ More detailed discussion of the qualitative research plan can be found in Appendix B.

The pilot test consisted of nine survey versions, each administered to an initial sample of 250 in the pilot test.²

Three of these survey versions, each addressing different water flow alternatives, were administered to samples of U. S. residents (national samples). Respondents were asked to evaluate the moderate fluctuating flow alternative, the low fluctuating flow alternative, and the seasonally adjusted steady flow alternative. Two surveys were administered to a sample of individuals residing in areas served by utilities receiving power produced at Glen Canyon Dam (the marketing area). The marketing area versions asked respondents to evaluate the moderate fluctuating flow alternative and the seasonally adjusted steady flow alternative. Comparisons of mean willingness-to-pay derived from these five versions revealed that among the national samples, mean willingness-to-pay was significantly lower for the moderate fluctuating flow alternative than for the seasonally adjusted steady flow alternative. In the marketing area, willingness-to-pay was highest for the seasonally adjusted steady flow alternative. However in the marketing area samples, this difference was not statistically significant.

The remaining four versions of the survey were administered to national samples and all represented variations on the seasonally adjusted steady flow alternative. These variations allowed the exploration of additional methodological issues. For example, the scenario in one of the additional versions was modified so that the respondents were asked to evaluate only a small subset of the resources actually affected by a change in dam operations. This version resulted in a significantly lower estimate of mean willingness-to-pay. Another version was developed by making small changes in the wording of the survey. This version produced estimates of mean willingness-to-pay that were statistically indistinguishable from estimates derived from the original seasonally adjusted steady flow version. Another survey version differed in the format of the contingent valuation question format used. Eight of the nine survey versions used in the pilot test used a multiple-bounded contingent valuation question format. This particular format is relatively new. At the time of the pilot test its performance, relative to more traditional question formats, had not been evaluated. Therefore, one survey version was modified so that it used a standard single-bounded dichotomous choice contingent valuation question. The estimates of mean willingness-to-pay produced by this version were consistent with estimates of willingness-to-pay developed using data collected using the multiple-bounded questioning format.

These results indicated favorable prospects for implementing a final study. Pilot test results indicated a positive willingness-to-pay for all three of the alternative dam operations evaluated. Furthermore, estimated willingness-to-pay was higher for operations providing

² A more detailed discussion of the pilot test, including implementation and results, can be found in Appendix C.

higher levels of environmental benefits. In the national sample, willingness-to-pay was significantly higher for the seasonally adjusted steady flow alternative than for the moderate fluctuating flow alternative. Estimates of willingness-to-pay dropped significantly when the range of the environmental benefits was reduced, and were stable with respect to minor changes in the wording of the survey materials. In light of these results, members of the GCES Non-Use Value Committee and the external peer review panel recommended implementation of the final study discussed in the next two chapters.

CHAPTER 4

DESIGN AND IMPLEMENTATION OF THE NON-USE VALUE STUDY

The final study design was the end product of an extensive research process overseen at every step by the GCES Non-Use Value Committee. Review by the committee provided valuable insights from a broad range of perspectives. In addition, members of the committee worked closely with members of the GCDEIS team to ensure that the survey instruments contained accurate descriptions of the expected consequences of each dam operation alternative. The input from the committee, peer reviewers, and OMB greatly enhanced the quality and overall validity of the GCES Non-Use Value Study.

The GCDEIS evaluated nine different dam operations alternatives in detail, including a no-action alternative. For the non-use survey, the no-action alternative was defined as the baseline (or current) dam operation condition. This baseline condition consisted of flows ranging from 3,000 cubic feet per second (cfs) to 31,500 cfs between Easter and Labor Day and from 1,000 cfs to 31,500 cfs between Labor Day and Easter. Given the similarities in resource impacts for several of the alternatives and the depth of detail required to describe them, the GCES Non-Use Value Committee recommended that only three main alternatives be evaluated in the final study. These three alternatives included:

1. Moderate fluctuating flow alternative - featuring a moderate reduction in the magnitude of the daily fluctuations;
2. Low fluctuating flow alternative - featuring large reductions in the magnitude of the daily fluctuations; and
3. Seasonally adjusted steady flow alternative - providing steady flows on a seasonally adjusted or monthly basis.

These three alternatives covered most of the range of alternative dam operations being studied and were considered to include the set of alternatives most likely to contain the eventual preferred alternative. For more detailed information on alternative dam operations, refer to the GCDEIS (U.S. Bureau of Reclamation, 1995).

4.1 EXPERIMENTAL DESIGN

The experimental design included seven versions of a mail questionnaire, two samples, and a follow-up telephone interview with nonrespondents. Because any alternative water release from Glen Canyon Dam would affect resources found in the Grand Canyon National Park,

the sampling frame included all residents of the United States. Two separate random samples were identified within this frame: a national sample and a marketing area sample. The national sample consisted of residents of the United States. The marketing area sample was a subset of the national sample consisting of households receiving power from the Salt Lake City Area Integrated Projects (SLCA/IP). There were two primary differences between surveys administered to the marketing area sample and those administered to the national sample. First, the surveys differed in the payment vehicle used to solicit non-use values in the contingent valuation question between the national sample and the marketing area sample. For the national sample, the payment vehicle consisted of an annual payment in increased taxes. For residents of the marketing area, increases in utility bills were used as a payment vehicle. Surveys administered to each sample also differed in the description of resources affected by the dam operation alternative. In the national sample, each survey contained a description of the environmental and power cost impacts associated with a particular dam operation alternative. In contrast, the marketing area surveys described only the environmental impacts of the dam operation alternative.

Separate survey versions were designed in order to evaluate the three dam operation alternatives chosen for detailed study. This resulted in a total of six survey versions (three for the national sample and three for the marketing area sample).

One additional survey version was developed for the national sample. The purpose of this version was to examine in more detail the effects on the study of including the impacts of alternatives on power costs in the national sample versions.

Thus a total of seven versions of the Glen Canyon Studies non-use value mail questionnaire were developed to be administered to two samples. Table 4-1 identifies the differences between questionnaire versions.

Table 4-1
Identification of Glen Canyon Studies Non-Use Mail Questionnaire Versions

Questionnaire Version	Water Release Alternative
National Sample	
Version 1	Moderate Fluctuating Flow
Version 2	Low Fluctuating Flow
Version 3	Seasonally Adjusted Steady Flow
Version 4	Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts to Power
Marketing Area Sample	
Version 5	Moderate Fluctuating Flow
Version 6	Low Fluctuating Flow
Version 7	Seasonally Adjusted Steady Flow

4.2 SAMPLING

The sampling frame included all residents of the United States. Two separate random samples were identified within this frame: a national sample and a marketing area sample. This design was chosen to reflect the values held by United States residents as well as values held by the individuals who would be affected by changing power prices.

Both the national sample and the marketing area sample were purchased from Survey Sampling, Inc. (SSI), an independent firm that specializes in maintaining national marketing databases. A sample of 5,950 individuals was selected: 3,400 for the national sample and 2,550 for the marketing area sample (Table 4-2).

Prior to selecting a sample of households, SSI screens all samples to exclude nonresidential addresses. The national sample was drawn from a list of total households where the number of households was proportional to the number of households in each state, not from listed households only, and supplemented with motor vehicle records and postal additions in states which release such records. (Postal additions refer to address changes that are available on postal tapes.) The marketing sample was drawn to be proportional to the total number of households in a predetermined sample of ZIP code areas. As with the national sample, the

marketing area sample was drawn from SSI's data base, supplemented with motor vehicle records and postal additions where available.

All sample points were submitted to a "deduping" process in which all sample points were compared to the sample used for the pilot test to ensure that there would be no overlap of cases. This process is done by comparing the telephone numbers of each case. Since a portion of the sample purchased did not have telephone numbers (sample points from motor vehicle records or postal additions), there is a very small possibility that there could be some overlap between the two samples. However, given the size of SSI's data base and the total number of households that exist, the likelihood of overlap between the pilot sample and the final sample is remote.

Four of the seven questionnaire versions were administered to the national sample, and three were administered to the marketing area sample. Each version was administered to 850 sample points.

An attempt was made to contact all nonrespondents to the mail survey via telephone. Thus, the sample for the follow-up telephone survey consisted of the portion of national and marketing area samples for which no final mail disposition had been reached. Interviews were attempted with 1,708 individuals: 1,102 from the national sample and 606 from the marketing area sample (Table 4-2).

Table 4-2
Sample Sizes for the Glen Canyon Studies Mail Surveys
and Follow-up Telephone Interviews

Questionnaire Version	Sample Size	
	Mail Survey	Telephone Survey
National Sample		
Moderate Fluctuating Flow (Version 1)	850	286
Low Fluctuating Flow (Version 2)	850	267
Seasonally Adjusted Steady Flow (Version 3)	850	272
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	<u>850</u>	<u>277</u>
Total	3,400	1,102
Marketing Area Sample		
Moderate Fluctuating Flow (Version 5)	850	207
Low Fluctuating Flow (Version 6)	850	205
Seasonally Adjusted Steady Flow (Version 7)	<u>850</u>	<u>194</u>
Total	2,550	606
Overall Total	5,950	1,708

4.3 SURVEY IMPLEMENTATION PROCEDURES

Mail questionnaires were administered using the Dillman (1978) method, which included the following procedures:

1. An advance, introductory letter on U.S. Bureau of Reclamation letterhead, signed by the GCES manager was sent via U.S. first class mail. The letter explained the study and advised that a questionnaire would be sent within the week.

2. A survey package containing a copy of the questionnaire, background information materials, a cover letter on U.S. Bureau of Reclamation letterhead, a stamped return envelope, and a \$3 cash incentive was mailed via U.S. first class mail.
3. A thank you/reminder postcard was sent to all respondents, thanking those who had already responded to the survey and encouraging those who had not responded to please do so. This mailing was sent first class through the U.S. postal service.
4. A second survey package containing a second copy of the questionnaire and background materials, a different cover letter, and a stamped return envelope, was sent using U.S. first class mail.
5. A third survey package was delivered via certified mail. This package also contained a copy of the questionnaire and background materials, a different cover letter, and a stamped return envelope.

The mail survey implementation began in October 1994 and was concluded in early January 1995. All mail survey versions were administered concurrently.

Follow-up telephone interviewing began on January 19, 1995, four weeks after the final survey mailing. Telephone interviews were attempted for all nonrespondents for whom telephone numbers could be obtained. All telephone interviews were conducted by experienced interviewers using Computer Assisted Telephone Interviewing (CATI) software at an in-house telephone laboratory.

A complete description of mail and telephone survey materials can be found in Appendix E.

4.4 DATA PROCESSING

The disposition of all mail questionnaires was entered into a tracking database. The categories consisted of a completed questionnaire, an undeliverable questionnaire, a deceased individual, or a refusal. Completed questionnaires went through three stages of data processing: editing, data entry, and cleaning. Completed questionnaires were coded and prepared for data entry by data editors. Open-ended responses were coded, missing data were checked, and all fields were checked to ensure that invalid codes were not included. Missing data were studied to determine if the correct skip patterns had been followed. After editing, data entry personnel entered the completed questionnaires into an SPSS database. All data were subjected to 100 percent verification. All verified data were subject to a cleaning process. Data cleaning was carried out using a series of computer programs that identify out-

of-range data points for each variable and cross-check related questions. A survey research supervisor also inspected missing data for each of the survey variables.

All responses to the telephone survey were directly entered into computer files as the interview was carried out. Upon completion of the telephone survey, the CATI system was used to clean the data. A data editor reviewed each completed interview, provided response codes to open-ended questions, and conducted consistency checks. Upon completion of the cleaning and coding process, the data were exported from the CATI system and imported to an SPSS data file.

4.5 RESPONSE RATES

Response rates for completed mail surveys are calculated as a percentage of deliverable questionnaires. The study achieved a response rate of 66 percent for the national sample, and 75 percent for the marketing area sample (Table 4-3).

Response rates to the telephone survey of nonrespondents are shown in Table 4-4. Telephone interviews were completed with 35 percent of nonrespondents from the national sample, and with 46 percent of nonrespondents to the marketing area sample.

Finally, Table 4-5 shows an overall response rate for the entire study. A combined response rate for the mail and telephone surveys shows that data was collected from 74 percent of the national sample and 83 percent of the marketing area sample who could be contacted.

Table 4-3
Glen Canyon Studies Non-Use Mail Survey Response Rates

	Sample Size	Out of Scope ^a	Completed Surveys	Response Rate ^b
National Sample				
Moderate Fluctuating Flow (Version 1)	850	188	426	64%
Low Fluctuating Flow (Version 2)	850	202	431	66%
Seasonally Adjusted Steady Flow (Version 3)	850	196	439	67%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	<u>850</u>	<u>190</u>	<u>432</u>	<u>65%</u>
Total	3,400	776	1,728	66%
Marketing Area Sample				
Moderate Fluctuating Flow (Version 5)	850	219	467	74%
Low Fluctuating Flow (Version 6)	850	226	467	75%
Seasonally Adjusted Steady Flow (Version 7)	<u>850</u>	<u>200</u>	<u>489</u>	<u>75%</u>
Total	2,550	645	1,423	75%

^a Includes cases where the addressee was deceased or the survey materials were returned as undeliverable.

^b Calculated as a percentage of deliverable questionnaires (sample size minus out-of-scope cases).

Table 4-4
Glen Canyon Studies Non-Use Telephone Survey Response Rates

	Sample Size	Out of Sample ^a	Withdrawn from Sample ^b	Completed Interviews	Response Rate ^c
National Sample					
Moderate Fluctuating Flow (Version 1)	286	90	9	66	35%
Low Fluctuating Flow (Version 2)	267	92	6	53	31%
Seasonally Adjusted Steady Flow (Version 3)	272	79	9	69	38%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	<u>277</u>	<u>80</u>	<u>14</u>	<u>63</u>	<u>34%</u>
Total	1,102	341	38	251	35%
Marketing Area Sample					
Moderate Fluctuating Flow (Version 5)	207	57	7	62	43%
Low Fluctuating Flow (Version 6)	205	63	7	58	43%
Seasonally Adjusted Steady Flow (Version 7)	<u>194</u>	<u>42</u>	<u>6</u>	<u>74</u>	<u>51%</u>
Total	606	162	20	194	46%

^a Includes disconnected, no listing available, wrong phone numbers, and cases where the identified respondent was unavailable for the study duration, unable to participate due to physical or mental impairment, deceased, or had moved.

^b Includes cases pulled from the telephone survey sample before a final disposition was reached because a mail questionnaire was received during implementation of the telephone survey.

^c Calculated as a percentage of available (reachable) respondents.

Table 4-5
Glen Canyon Studies Non-Use Survey Response Rates for the
Mail and Telephone Surveys Combined

	Sample Size	Out of Scope ^a	Completed Surveys	Response Rate ^b
National Sample				
Moderate fluctuating flow	850	197	480	74%
Low fluctuating flow	850	211	472	74%
Seasonally adjusted steady flow	850	198	491	75%
Seasonally adjusted steady flow with moderate fluctuating flow impact costs to power	<u>850</u>	<u>196</u>	<u>485</u>	<u>74%</u>
Total	3,400	802	1,928	74%
Marketing Area Sample				
Moderate fluctuating flow	850	224	521	83%
Low fluctuating flow	850	233	508	82%
Seasonally adjusted steady flow	<u>850</u>	<u>207</u>	<u>543</u>	<u>84%</u>
Total	2,550	664	1,572	83%

^a Includes cases identified as out of scope in either the mail or the telephone survey.

^b Calculated as a percentage of deliverable questionnaires (sample size minus out of scope).

CHAPTER 5

RESULTS

In the analyses that follow, percentages are calculated to represent all cases for which data exist for the variable being reported. The number of valid cases, shown in parentheses in most tables, excludes cases with user-missing codes (where respondents did not answer a given question).

5.1 BACKGROUND CHARACTERISTICS OF RESPONDENTS

Selected socioeconomic characteristics were collected in both the mail and telephone surveys and then compared across the two surveys. Characteristics included the respondent's age, sex, and education, as well as household size and 1993 household income. Results are reported in Table 5-1 and discussed below.

Some differences were observed between mail survey respondents in the national sample and mail survey respondents in the marketing area sample. Mail survey respondents in the national sample averaged 49 years of age, whereas respondents from the marketing area sample were slightly older, averaging 52 years of age. In both samples, just over half of the respondents to the mail survey were male (54 percent in the national sample versus 57 percent in the marketing area sample). Average education of mail survey respondents also differed between samples, with respondents from the national sample reporting a slightly higher educational level than respondents from the marketing area. Household size in the national sample averaged 2.69 people per household. In contrast, household size for marketing area respondents was significantly higher, averaging 2.85 people per household. Respondents in the national and marketing area samples also differed in average household income. National-sample respondents reported an average household income of approximately \$43,400, whereas respondents from the marketing area had an average household income of approximately \$39,000.¹

Fewer differences existed between the two samples in the telephone survey. In fact, the only socioeconomic characteristic that differed was the percent of respondents who were male.

¹ Note that age and income figures reported for the national sample are higher than those reported for the U.S. population by the Census Bureau. This result is an artifact of sampling that cannot be avoided. As a consequence, even with high quality samples such as those purchased for this study, some groups will be under represented. For a more in-depth comparison of sample demographics with U.S. Census data, see Appendix D.

Telephone survey results for the national sample show that 44 percent of respondents were male in comparison to 53 percent in the marketing area sample. Although the average age of respondents was lower in the national sample than in the marketing area sample (46 years versus 49 years, respectively), this difference was not significant.

Comparing the national sample mail survey respondents to telephone survey respondents shows that on average telephone survey respondents were younger, more likely to be female, and more likely to have a lower education level. In contrast, national respondents did not differ significantly with respect to average household size (2.69 people in the mail survey versus 2.74 people in the telephone survey) or average household income (\$43,460 versus \$41,797). Marketing area sample respondents also differed between the mail and telephone surveys with respect to average age and education. Telephone survey marketing area respondents were slightly younger and had less education in comparison to mail survey respondents. However, the percent of male respondents did not differ significantly between the survey types, nor did household size or income.

Table 5-1
Socioeconomic Characteristics of Mail and Telephone Survey Respondents

	Mail Survey		Telephone Survey	
	National Sample	Marketing Area Sample	National Sample	Marketing Area Sample
Average Age (years)^{a,c,d}	49 (1,630)	52 (1,353)	46 (243)	49 (189)
Percent Male^{b,c}	54% (1,647)	57% (1,361)	44% (247)	53% (193)
Average Education^{a,c,d}				
Less than 8 years	2%	3%	6%	4%
Some high school	5	4	9	5
High school graduate	20	19	27	28
Some college or technical school	27	32	26	31
College or technical school graduate	27	25	20	19
Post graduate work	19	17	12	13
	100% (1,642)	100% (1,353)	100% (243)	100% (191)
Average Household Size^a	2.69 people (1,535)	2.85 people (1,258)	2.74 people (245)	2.94 people (193)
Average 1993 Household Income^a	\$43,460 (1,540)	\$39,180 (1,292)	\$41,797 (217)	\$36,918 (176)

^a Significant differences exist between the national sample and the marketing area sample in the mail survey.

^b Significant differences exist between the national sample and the marketing area sample in the telephone interview.

^c Significant differences exist between the mail survey and the telephone interviews in the national sample.

^d Significant differences exist between the mail survey and the telephone interview in the marketing area sample.

() Numbers in parentheses indicate the number of valid cases.

Both the mail and the telephone surveys included several questions that addressed respondents' familiarity with Glen Canyon Dam and Grand Canyon National Park. First, respondents were asked if they had ever visited Glen Canyon Dam and whether they had heard of the dam prior to receiving the questionnaire (Table 5-2). In both surveys, marketing area respondents were more likely than national respondents to have either visited the dam or

heard of it. Only 11 percent of mail survey respondents from the national sample reported they had visited Glen Canyon Dam, and less than 30 percent said they had heard of it prior to receiving the survey. In contrast, 45 percent of mail survey respondents from the marketing area sample said they had visited the dam, and 72 percent had heard of the dam.

Results from the telephone interviews also show that a higher percentage of respondents from the marketing area sample had heard of, or visited, the Glen Canyon Dam compared to the national telephone sample. Only seven percent of the telephone survey respondents from the national sample reported they had visited Glen Canyon Dam compared to 23 percent of respondents from the marketing area sample. When asked if they had heard of the dam before receiving the survey, 25 percent of national sample respondents said yes in contrast to 54 percent of marketing area respondents.

Table 5-2
Visitation of Glen Canyon Dam

	Mail Survey		Telephone Survey	
	National Sample	Marketing Area Sample	National Sample	Marketing Area Sample
Visited Glen Canyon Dam ^{a,b,c,d}	11%	45%	7%	23%
	(1,661)	(1,351)	(246)	(192)
Heard of Glen Canyon Dam before receiving the survey ^{a,b,d}	29%	72%	25%	54%
	(1,652)	(1,351)	(246)	(192)

^a Significant differences exist between the national sample and the marketing area sample in the mail survey.

^b Significant differences exist between the national sample and the marketing area sample in the telephone interview.

^c Significant differences exist between the mail survey and the telephone interviews in the national sample.

^d Significant differences exist between the mail survey and the telephone interview in the marketing area sample.

() Numbers in parentheses indicate the number of valid cases.

Regardless of sample, higher percentages of mail survey respondents reported having visited the dam in comparison with the telephone survey respondents. This result could indicate that for mail survey nonrespondents (telephone survey respondents), the survey topic was less salient than for mail survey respondents. This salience could be one factor that influenced survey response rates.

A similar set of questions was asked about Grand Canyon National Park. For the mail survey, comparison of the national and marketing area samples shows that respondents in the national sample were less likely to have visited Grand Canyon National Park than respondents from the marketing area sample (Table 5-3). Only 34 percent of respondents in the national sample reported they had visited the park compared to 66 percent of respondents from the marketing area. This is not surprising given that the marketing area respondents are geographically closer to the park than the majority of the national respondents. Among the mail survey respondents who had visited the park, the percentage who saw the Colorado River or went down to the river did not differ significantly between national and marketing area samples: 92 percent of mail survey respondents in both samples said they saw the Colorado River while at the park. Substantially fewer respondents in either sample reported going down to the river.

When asked about their expected likelihood of visiting Grand Canyon National Park in the future, approximately one-third of the national mail survey sample said it was not at all likely or was somewhat unlikely. The remainder were divided between being somewhat likely (35 percent) or very likely (34 percent) to visit it. In comparison, respondents from the marketing area were significantly more likely to say they will visit the park in the future: 80 percent of respondents from this sample said they were either somewhat or very likely to visit Grand Canyon National Park in the future.

Table 5-3
Visitation of Grand Canyon National Park

	<u>Mail Survey</u>		<u>Telephone Survey</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>	<u>National Sample</u>	<u>Marketing Area Sample</u>
Visited Grand Canyon National Park ^{a,b,c,d}	34% (1,638)	66% (1,354)	18% (246)	41% (192)
Saw the Colorado River while in Grand Canyon National Park ^{b,c}	92% (553)	92% (884)	80% (45)	92% (78)
Went down to the Colorado River while in Grand Canyon National Park ^d	19% (510)	22% (819)	14% (36)	12% (72)
Expected likelihood of visiting Grand Canyon National Park in the future ^{a,b,c,d}				
Not at all likely	16%	9%	34%	29%
Somewhat unlikely	15	11	14	10
Somewhat likely	35	34	36	33
Very likely	34 (1,635)	46 (1,353)	16 (244)	28 (189)

^a Significant differences exist between the national sample and the marketing area sample in the mail survey.

^b Significant differences exist between the national sample and the marketing area sample in the telephone interview.

^c Significant differences exist between the mail survey and the telephone interviews in the national sample.

^d Significant differences exist between the mail survey and the telephone interview in the marketing area sample.

() Numbers in parentheses indicate the number of valid cases.

Results to the telephone survey show a similar pattern: A higher percentage of marketing area respondents report having visited the park than national sample respondents. However, the percentages for most of these questions were substantially lower than for the mail survey. Of the telephone survey respondents who had visited the park, 80 percent from the national sample and 92 percent from the marketing area sample said they saw the Colorado River while at the park. Less than 15 percent of either sample reported going down to the river.

The self-reported likelihood of visiting Grand Canyon National Park in the future followed a pattern similar to the mail survey. National telephone respondents are less likely to visit the park than those from the marketing area. National respondents were almost evenly split between being not likely to visit the park in the near future (34 percent "not at all likely" and 14 percent "somewhat unlikely") and likely to visit (36 percent "somewhat likely" and 16 percent "very likely"). A similar split existed in the marketing area sample: 39 percent said they are not at all or somewhat unlikely to visit the park in the future, and 61 percent said they were somewhat or very likely to visit it. Overall, these results suggest that respondents who reside nearer to Grand Canyon National Park are more likely to have visited it in the past and are more likely to visit it in the future.

Attitudinal and belief differences between the two types of surveys and the two types of samples were also examined. It was hypothesized that the attitudes that people hold affect their willingness-to pay.

The mail survey instruments included a total of 46 attitude and belief items. These items measured attitudes toward the environment, trade-offs between economic issues and the environment, national parks, Native Americans, and hydroelectric power. Respondents were asked whether they agreed or disagreed with each attitude statement using a scale of 1 to 5, where 1 meant strongly agree and 5 meant strongly disagree. The distribution of responses to these items is shown in the appendices. Time constraints in the telephone survey prevented the inclusion of all 46 attitudinal and belief items from the mail survey. However, 19 of the attitude items were included in the telephone survey. Factor analysis is used to identify a number of factors that represent relationships between groups of related variables, such as the attitude items included here. Factor analysis was used to aggregate these 19 items from both surveys into 5 factors. Factor loadings provide a measure of how heavily each attitude item contributes to the overall factor score (Table 5-4). Attitude items with factor loadings greater than 0.60 are considered to be the most influential items contributing to the factor score, and these attitude items are referred to for deriving explanatory labels for the factors. The five factors that were identified include: impacts of human intervention on nature, economic security, limits to growth, human ingenuity will ensure balance, and human dominance over nature.

Table 5-4
Factor loadings for attitude statements used in factor analysis

	Factor 1 Impacts of human intervention on nature	Factor 2 Economic security	Factor 3 Limits to growth	Factor 4 Human ingenuity will insure balance	Factor 5 Human dominance over nature
When humans interfere with nature, it often produces disastrous consequences	.70725	-.01213	.08691	-.17461	-.13564
The balance of nature is very delicate and easily upset.	.67526	-.13834	.16032	-.00832	-.08305
If things continue on their present course, we will soon experience a major ecological catastrophe.	.66676	-.12286	.18103	.01435	-.16856
Humans are severely abusing the environment.	.66303	-.11003	.15319	-.03096	-.07308
Plants and animals have just as much right as humans to exist.	.59958	-.20075	.03649	.13781	-.33425
Despite our special abilities, humans are still subject to the laws of nature.	.54960	-.17622	-.06756	-.28471	.43616

(Continued)

Table 5-4
Factor loadings for attitude statements used in factor analysis (Continued)

	Factor 1 Impacts of human intervention on nature	Factor 2 Economic security	Factor 3 Limits to growth	Factor 4 Human ingenuity will insure balance	Factor 5 Human dominance over nature
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market	-.18189	.70266	-.00587	.05908	.03529
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	-.25300	.68206	-.08831	.17278	.13007
Economic security and well-being should be considered first, then we can worry about environmental problems.	-.06704	.67120	-.09893	.13315	.06640
Some pollution is inevitable if we are going to continue to improve our standard of living.	.03025	.63347	-.02762	-.01126	.07527
The so-called ecological crises facing humankind has been greatly exaggerated.	-.37544	.45750	-.24539	.12213	.27374
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	-.26556	.42551	-.32269	.34084	.16267

(Continued)

Table 5-4
Factor loadings for attitude statements used in factor analysis (Continued)

	Factor 1 Impacts of human intervention on nature	Factor 2 Economic security	Factor 3 Limits to growth	Factor 4 Human ingenuity will insure balance	Factor 5 Human dominance over nature
The earth is like a spaceship with very limited room and resources.	.31727	-.07844	.80195	.01377	.02462
We are approaching the limit of the number of the people the earth can support.	.32131	-.01760	.77736	.04217	-.04968
The earth has plenty of natural resources, if we just learn how to develop them.	.17046	.25478	-.61498	.34287	.14653
Humans will eventually learn enough about how nature works to be able to control it.	-.01900	.05749	.03451	.81147	.03782
Human ingenuity will ensure that we do not make the earth unlivable.	-.06821	.19476	-.12949	.66908	.16488
Humans were meant to rule the rest of nature.	-.29391	.18148	-.10946	.16806	.68549
Humans have the right to modify the natural environment to suit their needs.	-.28098	.24396	.00557	.22323	.67654

The average responses to attitude and belief items that were most influential (items that loaded heavily) in the factor analysis are shown in Table 5-5. Responses to the mail survey show that the opinions of the respondents in the national sample differ significantly from those in the marketing area sample for many of the statements shown. However, these differences are not from completely opposite ends of the scale. For example, the results do not show that one sample "strongly agreed" with a statement while another "strongly disagreed." Instead, it appears that both samples have similar attitudes but of differing intensity. Likewise, the differences observed between samples for the telephone survey are not extreme. That is, the average scores do not reveal polar differences in opinions between the two samples.

Table 5-5
Mean Response to Attitude Questions Included in Factors*

	Mail Survey		Telephone Survey	
	National Sample	Marketing Area Sample	National Sample	Marketing Area Sample
Factor 1: Impacts of human intervention on nature				
When humans interfere with nature, it often produces disastrous consequences. ^a	2.08 (1,654)	2.21 (1,346)	2.13 (239)	2.24 (187)
The balance of nature is very delicate and easily upset. ^a	1.89 (1,648)	2.00 (1,352)	1.87 (237)	1.86 (189)
If things continue on their present course, we will soon experience a major ecological catastrophe. ^{a,c,d}	2.58 (1,649)	2.70 (1,350)	2.35 (235)	2.42 (186)
Plants and animals have as much right as humans to exist. ^{a,c}	1.07 (1,652)	2.19 (1,348)	1.78 (243)	2.00 (189)
Humans are severely abusing the environment. ^a	2.10 (1,656)	2.19 (1,349)	2.02 (242)	2.14 (188)
Factor 2: Economic security				
Economic security and well-being should be considered first; then we can worry about environmental problems. ^{a,c}	3.62 (1,656)	3.48 (1,372)	3.44 (241)	3.41 (187)
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market. ^{a,c}	3.46 (1,658)	3.30 (1,360)	3.11 (230)	3.18 (188)
Some pollution is inevitable if we are going to improve our standard of living. ^c	2.79 (1,657)	2.80 (1,367)	2.56 (237)	2.67 (186)
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds. ^{a,c,d}	3.79 (1,653)	3.64 (1,363)	3.55 (232)	3.44 (186)

(Continued)

Table 5-5
Mean Response to Attitude Questions Included in Factors* (Continued)

	<u>Mail Survey</u>		<u>Telephone Survey</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>	<u>National Sample</u>	<u>Marketing Area Sample</u>
Factor 3: Limits to growth				
We are approaching the limit of the number of people the earth can support.	2.73 (1,650)	2.78 (1,350)	2.66 (232)	2.61 (185)
The earth is like a spaceship with very limited room and resources. ^d	2.60 (1,646)	2.64 (1,345)	2.61 (237)	2.37 (185)
Factor 4: Human ingenuity will ensure balance				
Humans will eventually learn enough about how nature works to be able to control it. ^d	3.49 (1,655)	3.58 (1,352)	3.31 (244)	3.21 (188)
Human ingenuity will ensure that we do not make the earth unlivable. ^{b,d}	3.03 (1,649)	3.09 (1,338)	2.92 (235)	2.63 (186)
Factor 5: Human dominance over nature				
Humans have the right to modify the natural environment to suit their needs.	3.61 (1,652)	3.51 (1,352)	3.43 (237)	3.34 (188)
Humans were meant to rule the rest of nature.	3.91 (1,650)	3.77 (1,348)	3.78 (242)	3.76 (186)

* Ratings represent the average response based on a 5-point scale where 1 meant strongly agree and 5 meant strongly disagree.

^a Significant differences exist between the national sample and the marketing area sample in the mail survey.

^b Significant differences exist between the national sample and the marketing area sample in the telephone interview.

^c Significant differences exist between the mail survey and the telephone interviews in the national sample.

^d Significant differences exist between the mail survey and the telephone interview in the marketing area sample.

() Numbers in parentheses indicate the number of valid cases.

Factor scores were calculated for each respondent. Factor analysis uses a standardized regression-like procedure to predict factor scores for each observation. For this study, factor scores were created using an orthogonal rotation to eliminate multicollinearity between factor scores. Scores range from +1 to -1. Mean scores for orthogonally rotated factors are shown in Table 5-6. The predicted sign of the coefficient for each factor in subsequent discrete choice models on willingness to pay is also shown. Factors 2, 4, and 5 were expected to show a positive effect on willingness-to-pay, while Factors 1 and 3 were expected to show a negative effect. Another way to view these results is to consider that for Factors 1 and 3, lower factor scores indicate attitudes that favor the environment over economic development. For Factors 2, 4, and 5, higher values indicate attitudes that favor economic development over the environment. In many cases, the mean factor scores reported in Table 5-6 suggests that nonrespondents to the mail survey expressed attitudes that are less favorable toward the environment than did the respondents to the mail survey.

Table 5-6
Mean Factor Scores Calculated for Combined Mail and Telephone Survey Data

Factor (predicted sign)	Mail Survey		Telephone Survey	
	National Sample	Marketing Area Sample	National Sample	Marketing Area Sample
Factor 1 (-) ^{a,b}	-.0193 (1,545)	.0914 (1,257)	-.3106 (208)	-.1621 (173)
Factor 2 (+) ^{a,b}	.1111 (1,545)	.0155 (1,257)	-.5873 (208)	-.5306 (173)
Factor 3 (-)	-.0035 (1,545)	-.0013 (1,257)	.0630 (208)	-.0413 (173)
Factor 4 (+) ^{a,b}	-.0264 (1,545)	.0978 (1,257)	-.1712 (208)	-.3644 (173)
Factor 5 (+) ^a	.0482 (1,545)	-.0830 (1,257)	.1484 (208)	.0153 (173)

^a Significant differences exist between the national sample and the marketing area sample in the mail survey.

^b Significant differences exist between the mail survey and the telephone interviews in the national sample.

() Numbers in parentheses indicate the number of valid cases.

5.2 RESPONDENTS' UNDERSTANDING OF THE BACKGROUND INFORMATION

The complexity of the contingent valuation scenarios required a substantial amount of information be conveyed to the survey respondent. Prior to completing the survey booklet, respondents were asked to review a background information packet. The background information packet described the study area, the resources in the study, the current status of these resources, concerns about these resources and a discussion of how these concerns could be addressed by changing the operations of Glen Canyon Dam. Because of the amount of information contained in the background material there was some concern that survey respondents would not read or be able to comprehend these materials.

To address this issue, the survey booklet began with a series of true or false questions. The series included a total of 16 statements that referred to facts presented in the background materials. Respondents were asked to indicate whether the statements were correct (true) or not (false). The statements and the percentages of correct responses to them are shown in Table 5-7. Although the statements are grouped by topic in Table 5-7, in the surveys they appeared in a random order.

Results of the "quiz" lend confidence to the conclusion that, overall, respondents not only read the background materials, but understood them as well. With only one exception, 90 percent or more of all respondents correctly answered the quiz questions pertaining to beaches along the river. Responses to quiz questions about fish showed similar results: 85 percent or more of all respondents were able to correctly indicate whether these questions were true or false. Three of the statements addressed issues concerning the effects of fluctuating flows on Native American or cultural sites along the river. Like the other categories, almost all respondents were able to correctly answer these questions.

Finally, three additional statements were included in the quiz to address (1) present in-stream flow conditions, (2) the definition of the study area, and (3) the effects of reducing fluctuations on the production of hydroelectricity. The majority of respondents were again able to correctly indicate whether the statements addressing these issues were true or false. Nearly all respondents (93 percent in the national sample and 95 percent in the marketing area sample) correctly indicated that water levels are not constant throughout the day under current dam operations. Most respondents correctly said that the study area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead (88 percent in the national sample and 89 percent in the marketing area sample). Finally, the quiz question describing the effects of reducing fluctuations on production of hydro electricity was also answered correctly by a majority of respondents in both samples, although the

percentage of correct responses was somewhat lower than for the other questions (68 percent and 71 percent for the national and marketing area samples, respectively).

Overall, it is clear from the quiz results that most respondents read the background materials prior to beginning the survey and understood the issues described. Almost all respondents answered the quiz questions correctly: only one question was answered correctly by less than 85 percent of respondents.

To provide a more comprehensive picture of respondents' grasp of the issues, a quiz score was calculated for each respondent. Scores were calculated by summing the number of correct responses to the quiz questions, dividing by the total number of questions (statements), and multiplying by 100. Item nonresponse was considered to represent an incorrect response. There were 35 cases where respondents did not answer any of the quiz questions: these cases were not included in this analysis. Average quiz scores are shown in Table 5-8 for each sample and by survey version. Results show the average quiz scores are stable across both samples and survey versions. National sample respondents received an average score of 89, while those in the marketing area achieved an average score of 90. Looking at average scores by survey version shows similar results, with national sample respondents ranging from 89 to 90 compared to 90 for marketing area respondents regardless of survey version. This lack of fluctuation across survey versions was not unexpected, because the quiz questions only addressed current conditions of the resources and all survey versions contained identical descriptions of the current conditions.

Table 5-7
Percent of Correct Responses to True or False Questions

	<u>Percent of Respondents</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>
Beaches		
There are now many more beaches along the Colorado River than there were 20 years ago.	92% (1,673)	92% (1,362)
The decrease in the number and size of beaches is most severe along wide sections of the river.	86% (1,649)	86% (1,336)
None of the beaches along the river have vegetation.	96% ^b (1,660)	98% (1,357)
Nearly all visitors to the Grand Canyon National Park use the beaches along the river.	90% ^a (1,654)	92% (1,365)
The shoreline in the study area consists only of beaches.	96% (1,605)	96% (1,321)
Vegetation on beaches provides habitat for birds and other wildlife.	98% ^b (1,634)	99% (1,336)
Fish		
Native fish populations in the Colorado River have declined.	96% (1,670)	95% (1,364)
Trout are not native to the study area.	85% (1,662)	86% (1,356)
All native fish species have disappeared from the Grand Canyon.	96% (1,664)	97% (1,358)
Two of the native fish species are in danger of extinction.	89% (1,630)	91% (1,325)

(Continued)

Table 5-7
Percent of Correct Responses to True or False Questions (Continued)

	<u>Percent of Respondents</u>	
	National Sample	Marketing Area Sample
Native American Sites		
There are American Indian traditional-use areas and sacred sites located along the Colorado River below Glen Canyon Dam.	98% ^b (1,652)	99% (1,365)
Archeological sites are not being affected by erosion.	95% (1,662)	96% (1,359)
American Indian traditional-use areas are affected by erosion.	95% (1,634)	96% (1,324)
Other Issues		
Water levels are constant throughout the day.	93% ^b (1,631)	95% (1,327)
The Study Area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.	88% (1,612)	89% (1,317)
Reducing daily fluctuations in the amount of water released from the dam will reduce the total amount of hydroelectricity produced.	68% ^a (1,619)	71% (1,318)

^a Significant at $\alpha = 0.10$.

^b Significant at $\alpha = 0.05$.

() Numbers in parentheses is the number of valid cases.

Table 5-8
Quiz Scores

	National Sample	Marketing Area Sample
Overall average score	89% (1,679)	90% (1,374)
Average Score by Survey Version		
Moderate fluctuating flow (Versions 1, 5)	89% (416)	90% (455)
Low fluctuating flow (Versions 2, 6)	89% (416)	90% (441)
Seasonally adjusted steady flow (Versions 3, 7)	90% (423)	90% (478)
Seasonally adjusted steady flow with moderate fluctuating flow price impacts (Version 4)	90% (424)	NA

() Numbers in parentheses indicate the number of valid cases.
NA = Not applicable

5.3 SUPPORT OF DAM OPERATION ALTERNATIVES

After completing the quiz, survey respondents were presented with a proposal to change dam operations. The proposal described how dam operations would be changed and the consequences, or impacts, of these changes for downstream resources. Descriptions of the environmental impacts were designed to be consistent with the ones used in the GCDEIS. In the national sample, the consequences of the proposed change also included a description of expected impacts to users of power produced at Glen Canyon Dam.

Immediately following the description of the alternative, or proposal, respondents were asked (Question 2) how they would vote on a proposal to change the operations of Glen Canyon Dam if passage of the proposal cost them nothing (\$0).

The first column in Table 5-9 shows the distribution of responses to alternative proposals at no cost. In the national sample, the proportion of respondents who would support the no-cost proposal was lowest for the moderate fluctuating flow proposal (Version 1) and highest for the low fluctuating flow proposal (Version 2). Support for the seasonally adjusted steady flow proposal (Version 3) was lower than for the low fluctuating flow proposal (Version 2). Although Version 3 is more favorable than Version 2 for trout and native fish, it has much higher price impacts to consumers of power produced at Glen Canyon Dam. Focus groups conducted during the survey design process indicated that potential survey respondents would be concerned about price impacts to power users (indeed, this result was an important factor in the decision to include power impacts as part of the description of impacts). The lower level of support for the Version 3 proposal might reflect a judgment by survey respondents that the higher price impacts of Version 3 more than offset any additional environmental gains.

This interpretation is further strengthened by the level of support shown for Version 4. Version 4 contained a description of the environmental impacts of the seasonally adjusted steady flow alternative but with the lower price consequences of the moderate and low fluctuating flow alternatives. The proposal in Version 2 and the proposal in Version 4 differ only in environmental consequences. Support for Versions 2 and 4 are virtually identical, indicating that respondents found these two proposals equally acceptable.

Table 5-9
Support of Water Release Alternatives

Survey Version	Yes, Would Support the Proposal at No Cost	No, Would Not Support the Proposal at No Cost	Would Choose not to Vote	Number of Cases
National Sample				
Moderate Fluctuating Flow (Version 1)	71% ^a	17%	12%	402
Low Fluctuating Flow (Version 2)	83 ^b	9	8	408
Seasonally Adjusted Steady Flow (Version 3)	77 ^c	12	11	414
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	81 ^{b,c}	9	10	411
Marketing Area Sample				
Moderate Fluctuating Flow (Version 5)	76% ^a	17%	7%	434
Low Fluctuating Flow (Version 6)	85 ^b	8	7	437
Seasonally Adjusted Steady Flow (Version 7)	85 ^b	9	6	467

^{a,b,c} The percentages of "yes" responses were compared within the national and marketing area samples; they were not compared between the two samples. Within the sample, percentages that share the same superscript are not significantly different ($Z < 1.64$).

A similar support pattern can be observed in the marketing area sample. Support for the proposal at no cost was lowest for the moderate fluctuating flow (Version 5) and significantly higher for the low fluctuating and seasonally adjusted steady flows (Versions 6 and 7, respectively).

These results indicate that mail survey respondents were sensitive to the details contained in the proposals, and that these details determined whether they would support the proposal at no cost.

5.4 CONSIDERATION OF BUDGET CONSTRAINTS AND CHANGES IN VOTES

All respondents voting in favor of a proposal at zero cost were asked how they would vote if passage of the proposal increased their taxes (national sample) or utility bills (marketing area sample) by a specified amount (Question 3). Figure 5-1 presents the wording for Question 3 in the national sample versions of the survey.

Figure 5-1
Willingness-to-Pay Question Format (National Sample)

The higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal. Taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. Would you vote for this proposal if passage of the proposal would cost your household \$ _____ in increased taxes every year for the foreseeable future? (*CIRCLE ONE NUMBER*)
- | | | | |
|---|----------------|---|--|
| 1 | Definitely No | - | I would <u>definitely vote against</u> the proposal. |
| 2 | Probably No | - | I would <u>probably vote against</u> the proposal. |
| 3 | Not Sure | - | I am <u>not sure</u> if I would vote for the proposal. |
| 4 | Probably Yes | - | I would <u>probably vote for</u> the proposal. |
| 5 | Definitely Yes | - | I would <u>definitely vote for</u> the proposal. |

Responses to Question 3 by dollar amount are shown in Table 5-10 for both the national and the marketing area samples. As expected, across all proposals, responses to the cost of the proposal follow a general trend. The percentage of respondents voting "Definitely No" increased as the cost of the proposal increased. Likewise, the percentage of respondents voting "Definitely Yes" decreased as the cost of the proposal increased. For both the national and marketing area samples, the percentages of respondents choosing the "Not Sure" category fluctuated somewhat, tending to be highest in the middle dollar amounts (\$60 to \$150) for the national sample and highest in the higher dollar amounts (\$120 to \$200) for the marketing area sample.

Members of the marketing area sample appeared to have more definite opinions about whether they would support the proposal than the national sample. This was shown by the lower percentages of the marketing area sample choosing the "Not Sure" category and the correspondingly higher percentages choosing "Definitely Yes" or "Definitely No."

Table 5-10
Results of Initial Vote on Alternative Proposals by Dollar Values for
Respondents Who Supported a Change in Dam Operations^a

	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
National Sample									
Definitely no	5%	4%	7%	12%	11%	19%	19%	19%	12%
Probably no	2	10	13	18	22	25	24	21	17
Not sure	12	10	16	20	22	16	21	17	17
Probably yes	44	47	41	35	33	26	28	31	35
Definitely yes	<u>37</u>	<u>29</u>	<u>23</u>	<u>15</u>	<u>12</u>	<u>14</u>	<u>8</u>	<u>12</u>	<u>19</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(154)	(164)	(165)	(157)	(145)	(175)	(157)	(149)	(1,266)
Marketing Area Sample									
Definitely no	4%	7%	9%	13%	20%	18%	22%	23%	14%
Probably no	4	8	11	13	22	18	27	27	16
Not sure	4	9	13	10	14	17	18	23	13
Probably yes	40	42	43	43	28	35	29	18	35
Definitely yes	<u>48</u>	<u>34</u>	<u>24</u>	<u>21</u>	<u>16</u>	<u>12</u>	<u>4</u>	<u>9</u>	<u>22</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(145)	(142)	(127)	(133)	(129)	(133)	(133)	(142)	(1,084)

¹ Reported results represent cases where respondents supported a change in dam operations. Percentages are rounded to sum to 100 percent.

() Numbers in parentheses indicate the valid number of cases.

After voting on the proposal at a specific cost, respondents were asked to indicate the items they would give up to pay for the proposal if it passed. The items most commonly cited by members of both the national and marketing area samples included food and drink (for

example, take-out food, eating out, and "junk" food), entertainment (such as video rental, cable T.V., subscriptions, and movies), recreation and hobbies, and clothing (Table 5-11). Approximately 13 percent of the national sample and 12 percent of the marketing area sample indicated that passage of the proposal would have no perceptible effect on their expenditure patterns. No other categories were listed by more than 10 percent of either sample.

Table 5-11
Items That Would be Given Up to Pay for the Proposal if the Proposal Passed^{a,b}

	National Sample	Marketing Area Sample
Food and drink	30%	31%
Entertainment	28	26
The stated amount would have no effect	13	12
Recreation and hobbies	13	13
Clothing	12	12
Needless items	12	7
	(1,107)	(939)

^a Reported results represent cases where respondents supported a change in dam operations.

^b Percentages may sum to more than 100 percent because respondents could list more than one response.

() Numbers in parentheses indicate the valid number of cases.

After considering the impact to their budget if the proposal passed, respondents were asked if they would like to change their vote on the proposal. Very few respondents chose to change their vote (Table 5-12). Only six percent of the national sample respondents and five percent of marketing area respondents elected to change their votes.

Table 5-12
Percentage of Respondents Who Supported a Change in Dam Operations
but Elected to Change Their Initial Votes on Alternative Proposals^a

Sample	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
National	3% (153)	1% (161)	6% (164)	7% (157)	4% (142)	9% (172)	8% (156)	8% (147)	6% (1,252)
Marketing Area	2% (141)	4% (139)	7% (124)	4% (132)	5% (127)	8% (129)	6% (133)	6% (140)	5% (1,065)

^a Reported results represent cases where respondents supported a change in dam operations and responded to the initial vote question (Question 3).

() Numbers in parentheses indicate the valid number of cases on which the percentage is based.

Vote changes were observed in both directions. After considering the impacts to their budgets, some respondents were more likely to vote in favor of the proposal while others were less likely to vote in favor of the proposal (Tables 5-13, 5-14, and 5-15). However, in both samples, the majority of respondents electing to change their vote changed it to be more favorable to passage of the proposal (74 percent in the national sample and 69 percent in the marketing area). (Given the small number of valid cases available for analysis, we emphasize that these results should only be used for suggestive purposes.)

Table 5-13
Initial and Changed Votes for Respondents Electing to Change
Their Initial Votes on Alternative Proposals by Dollar Values
for the National and Marketing Area Samples^a

	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
National Sample									
INITIAL VOTE^b									
Definitely no	25%	0%	0%	27%	0%	20%	8%	33%	17%
Probably no	0	50	22	46	33	66	17	25	35
Not sure	50	0	45	18	50	7	50	42	33
Probably yes	25	50	22	9	17	7	25	0	14
Definitely yes	<u>0</u>	<u>0</u>	<u>11</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(4)	(2)	(9)	(11)	(6)	(15)	(12)	(12)	(71)
CHANGED VOTE^c									
Definitely no	0%	0%	14%	18%	0%	8%	9%	10%	9%
Probably no	25	50	29	18	0	15	8	0	14
Not sure	50	50	0	28	33	31	17	40	28
Probably yes	25	0	43	27	67	38	58	50	43
Definitely yes	<u>0</u>	<u>0</u>	<u>14</u>	<u>9</u>	<u>0</u>	<u>8</u>	<u>8</u>	<u>0</u>	<u>6</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(4)	(2)	(7)	(11)	(6)	(13)	(12)	(10)	(65)
Marketing Area Sample									
INITIAL VOTE^b									
Definitely no	0%	20%	22%	50%	16%	40%	0%	22%	23%
Probably no	0	0	22	33	17	40	12	45	25
Not sure	0	60	56	0	67	10	50	33	36
Probably yes	100	0	0	17	0	10	38	0	14
Definitely yes	<u>0</u>	<u>20</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(3)	(5)	(9)	(6)	(6)	(10)	(8)	(9)	(56)

(Continued)

Table 5-13
Initial and Changed Votes for Respondents Electing to Change
Their Initial Votes on Alternative Proposals by Dollar Values
for the National and Marketing Area Samples^a (Continued)

	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
CHANGED VOTE^c									
Definitely no	0%	0%	22%	40%	0%	11%	13%	12%	13%
Probably no	0	25	34	40	34	34	12	25	27
Not sure	0	0	11	0	33	33	12	25	20
Probably yes	0	75	33	0	33	22	38	38	31
Definitely yes	<u>100</u>	<u>0</u>	<u>0</u>	<u>20</u>	<u>0</u>	<u>0</u>	<u>25</u>	<u>0</u>	<u>12</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(3)	(4)	(9)	(5)	(6)	(9)	(8)	(9)	(52)

^a Percentages are rounded to sum to 100 percent.

^b Reported results represent cases where respondents supported a change in dam operations and responded to the initial vote question (Question 3), but elected to change their vote.

^c Reported results represent cases where respondents supported a change in dam operations, responded to the initial vote (Question 3), and indicated what their changed vote would be.

() Numbers in parentheses indicate the valid number of cases.

Table 5-14
Direction of Vote Changes for Respondents Electing to Change Their
Initial Votes on Alternative Proposals by Dollar Values for the National Sample^a

Initial Vote ---> Final Vote	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
Definitely no ---> Probably no	0%	0%	0%	0%	0%	15%	0%	0%	3%
Definitely no ---> Not sure	25	0	0	9	0	7	0	20	8
Definitely no ---> Probably yes	0	0	0	19	0	0	9	10	6
Probably no ---> Definitely no	0	0	0	18	0	8	8	0	6
Probably no ---> Not sure	0	50	0	18	16	23	0	20	14
Probably no ---> Probably yes	0	0	15	9	17	31	8	0	12
Not sure ---> Definitely no	0	0	14	0	0	0	0	10	3
Not sure ---> Probably no	25	0	14	18	0	0	8	0	8
Not sure ---> Probably yes	25	0	29	0	50	8	42	40	25
Probably yes ---> Probably no	0	50	14	0	0	0	0	0	3
Probably yes ---> Not sure	25	0	0	0	17	0	17	0	6
Probably yes ---> Definitely yes	<u>0</u> 100%	<u>0</u> 100%	<u>14</u> 100%	<u>9</u> 100%	<u>0</u> 100%	<u>8</u> 100%	<u>8</u> 100%	<u>0</u> 100%	<u>6</u> 100%
	(4)	(2)	(7)	(11)	(6)	(13)	(12)	(10)	(65)

^a Reported results represent cases where respondents supported a change in dam operations, responded to the initial vote (Question 3), and indicated what their changed vote would be. Percentages are rounded to sum to 100 percent.

() Numbers in parentheses indicate the valid number of cases.

Table 5-15
Direction of Vote Changes for Respondents Electing to Change Their Initial Votes
on Alternative Proposals by Dollar Values for the Marketing Area Sample^a

Initial Vote ---> Final Vote	Annual Dollar Amount								Total
	\$5	\$15	\$30	\$60	\$90	\$120	\$150	\$200	
Definitely no ---> Probably no	0%	0%	11%	40%	0%	23%	0%	13%	11%
Definitely no ---> Not sure	0	0	11	0	17	11	0	12	8
Definitely no ---> Probably yes	0	25	0	0	0	0	0	0	2
Probably no ---> Definitely no	0	0	22	40	0	11	0	12	12
Probably no ---> Not sure	0	0	0	0	17	11	13	13	8
Probably no ---> Probably yes	0	0	0	0	0	22	0	12	6
Not sure ---> Definitely no	0	0	0	0	0	0	12	0	2
Not sure ---> Probably no	0	25	22	0	33	11	0	13	13
Not sure ---> Probably yes	0	50	34	0	33	0	38	25	23
Probably yes ---> Probably no	0	0	0	0	0	0	12	0	2
Probably yes ---> Not sure	0	0	0	0	0	11	0	0	2
Probably yes ---> Definitely yes	<u>100</u>	<u>0</u>	<u>0</u>	<u>20</u>	<u>0</u>	<u>0</u>	<u>25</u>	<u>0</u>	<u>11</u>
	100%	100%	100%	100%	100%	100%	100%	100%	100%
	(3)	(4)	(9)	(5)	(6)	(9)	(8)	(8)	(52)

^a Reported results represent cases where respondents support a change in dam operations, responded to the initial vote (Question 3), and indicated what their changed vote would be. Percentages are rounded to sum to 100 percent.

() Numbers in parentheses indicate the valid number of cases.

Regardless of the sample, the majority of respondents choosing to change their votes had originally voted "Definitely No," "Probably No," or "Not Sure" (Table 5-14). No votes were changed from "Definitely No," "Probably No," or "Not Sure" to a "Definitely Yes." Only respondents who had already voted "Probably Yes" changed their vote to "Definitely Yes." For both samples, no respondent changed a "Definitely Yes" vote to another. (In each sample, only one respondent chose to change from a "Definitely Yes" vote to something else. However, neither of these answered the subsequent question asking how their vote would change.) Finally, a majority of respondents who originally voted "Not Sure" changed their votes to "Probably Yes."

In summary, very few respondents chose to change their votes after consideration of their budget constraints. Those changing their votes were slightly more likely to vote in favor of the proposal. However, since the number of vote changes was small, subsequent analysis in this report was based on the initial vote to the contingent valuation question.

5.5 RESPONDENT SELF-REPORTS ON DATA QUALITY

Some would argue that quality of responses to contingent valuation questions are improved to the extent that respondents understand the valuation scenario and take the valuation task seriously. Several questions in the survey were designed to collect data on the potential quality of the data collected in the survey.

Quality of contingent valuation responses might be higher if respondents find the payment vehicle to be credible. Payment vehicles differed between the national and marketing area samples. For the national sample, taxes were used as the payment vehicle. In the marketing area sample, utility bills were used as the payment vehicle. Following the contingent valuation question in the survey, respondents who voted to support the proposal at \$0 cost were asked whether they had believed their taxes (or utility bills) would increase if the proposal passed (Figure 5-2).

Figure 5-2
Payment Vehicle Questions

National Sample Survey:

7. Do you believe your taxes will increase if this proposal passes? (*CIRCLE ONE NUMBER*)
- 1 No
 - 2 Yes

Marketing Area Sample Survey:

7. Do your believe your utility bill will increase if this proposal passes? (*CIRCLE ONE NUMBER*)
- 1 No
 - 2 Yes
-

In both samples, the majority of respondents indicated they believed their taxes (or utility bills) would have increased if the proposal had passed (Table 5-16). Fully 72 percent of the national sample and 83 percent of the marketing area sample said they believed their bills (tax or utility) would have increased if the proposal had passed. In the national sample, across survey versions, the average percentage of respondents who believed their taxes would have increased ranged from 70 to 75 percent. Respondents from the marketing area apparently found the payment vehicle to be more believable than did respondents from the national sample: 81 to 85 percent believed their utility bills would have increased.

Table 5-16
Believability of the Payment Vehicle^a

	<u>Percent of Respondents</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>
All respondents	72% (1255)	83% (1076)
Survey Versions		
Moderate fluctuating flow (Versions 1,5)	75% (280)	81% (328)
Low fluctuating flow (Versions 2,6)	70% (229)	83% (299)
Seasonally adjusted fluctuating flow (Versions 3,7)	70% (221)	85% (331)
Seasonally adjusted fluctuating flow with moderate fluctuating flow price impacts (Version 4)	72% (240)	NA

^a This question was asked only of respondents who supported a change in dam operations at zero cost.

() Numbers in parentheses indicate the valid number of cases.

NA = not applicable

A second method of examining the validity of the payment vehicle is to determine whether the selected vehicle is binding on the respondents. There has been some concern that individuals might express a large willingness-to-pay when it is measured using a payment vehicle that is not binding on the respondent. For example, in the marketing area, a respondent might be willing to vote in favor of a change in dam operations regardless of the impact to utility bills if they are not responsible for paying the utility bills.

To determine whether the payment vehicles were binding, respondents in the national sample were asked whether they had taxes withheld from their 1993 earnings and whether they had filed a 1993 federal income tax form. Marketing area survey versions contained questions asking if respondents owned or rented their homes and whether they were responsible for paying the utility bills.

Eighty-three percent of all national sample respondents reported paying taxes in 1993, and 93 percent reported filing a Federal income tax form (Table 5-17). This result suggests that for the national sample, taxes represented a binding payment vehicle since nearly all these respondents either paid taxes or filed a federal income tax form. Looking only at those

national sample respondents who supported the proposal at zero cost shows slightly higher percentages: 87 percent reported they paid taxes and 95 percent reported they filed federal income tax forms in 1993. Responses from members of the marketing area sample shows similar patterns. Almost all respondents either owned or rented their homes and paid utility bills (85 percent and 98 percent, respectively). These results did not differ for marketing area respondents who voted to support the proposal only at \$0 cost.

Table 5-17
Binding Effects of the Payment Vehicle

	<u>Percent of Respondents</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>
All respondents		
Taxes were withheld from 1993 earnings	83% (1,619)	NA
Filed a 1993 federal income tax form	93% (1,620)	NA
Own or rent residence	NA	85% (1,354)
Responsible for paying utility bills	NA	98% (1,357)
Respondents who support a change in dam operations at zero cost		
Taxes were withheld from 1993 earnings	87% (1,236)	NA
Filed a 1993 federal income tax form	95% (1,238)	NA
Own or rent residence	NA	85% (1,073)
Responsible for paying utility bills	NA	98% (1,075)

() Numbers in parentheses indicate the number of valid cases.
NA = not applicable

All respondents were asked whether they felt public officials should consider study results in deciding how Glen Canyon Dam should be operated, and whether they felt public officials will consider the results in such decisions. Clearly, the majority of respondents feel study results should be considered when deciding how Glen Canyon Dam should be operated in the future (Table 5-18). In contrast, substantially fewer people feel the results actually will be used. These results hold even when examining only the responses of the individuals who supported a change in dam operations.

Table 5-18
Respondent Opinions on the Use of Study Results in
Future Decisions About the Operation of Glen Canyon Dam

	<u>Percent of Respondents</u>	
	<u>National Sample</u>	<u>Marketing Area Sample</u>
All respondents		
Public officials <u>should consider</u> study results in deciding how Glen Canyon Dam should be operated in the future.	95% (1,646)	95% (1,337)
Believe public officials <u>will consider</u> study results in deciding how Glen Canyon Dam will be operated in the future.	61% (1,633)	58% (1,331)
Respondents who support a change in dam operations		
Public officials <u>should consider</u> study results in deciding how Glen Canyon Dam should be operated in the future.	97% (1,262)	96% (1,071)
Believe public officials <u>will consider</u> study results in deciding how Glen Canyon Dam will be operated in the future.	63% (1,250)	59% (1,065)

() Numbers in parentheses indicate the number of valid cases.

In summary, respondents generally believed they would have to pay if the proposal was passed. The payment vehicle appeared to be binding on nearly all respondents. Respondents felt that the results of the survey should be considered by public officials when making decisions about the operation of Glen Canyon Dam. Taken together, these results suggest that respondents took the valuation exercise seriously and felt their responses provided valuable information that should be considered in the decision-making process, even though they were not confident that results would be used.

5.6 DISCRETE CHOICE MODELS OF WILLINGNESS-TO-PAY

Responses to Question 3 (Figure 5-1) were evaluated using two different approaches. In the first approach, respondents choosing the "Definitely Yes" category in Question 3 were considered to have voted "YES." Respondents choosing the "Definitely No," "Probably No," "Unsure," and "Probably Yes" categories were classified as having voted against the proposal ("NO"). Under the second approach, respondents choosing either the "Definitely Yes" or the "Probably Yes" category were considered to have voted in favor of the proposal and those choosing "Unsure," "Probably No," and "Definitely No" were considered to have voted against the proposal.

Question 3 data were analyzed using a discrete choice model based on a logistic cumulative density function:

$$\text{Eq. (1)} \quad \text{prob (vote in favor)} = (1 + \exp - \beta X)^{-1}$$

In Equation 1, X represents a vector of explanatory variables and β represents the parameters to be estimated.

For this study, the logistic regression model estimated the probability that a respondent would vote in favor of a proposal as a function of several variables. These variables reflect the perceived reality and validity of the valuation process, and respondents' understanding of the critical features of the proposal. Also included was a dummy variable reflecting which proposal was being evaluated, a series of environmental attitude items, respondent education and income, and the cost to the respondent if the proposal were to pass. Cases with missing data for any variable included in the model were excluded from this analysis. Results are presented in Table 5-19 for the models used with the national sample, and in Table 5-20 for the marketing area. Variable definitions are found in Table 5-21.

Positive coefficients in Tables 5-19 and 5-20 indicate that respondents are more likely to vote in favor of a proposal when the value of the associated variable is increased. The variable "score" for example, reflects the score respondents received on a set of true or false questions asked about the components of the survey materials. The coefficient on "score" is positive and significant for all the econometric models shown in Tables 5-19 and 5-20, indicating that respondents who achieved higher scores were more likely to vote "Yes" for the proposed dam operation alternative. The probability of voting in favor of a proposal was typically increased by:

- ▶ Higher expectations of visiting the Grand Canyon in the future;
- ▶ Better understanding of the survey materials;
- ▶ A belief that the study results would be used to determine future dam operations;
- ▶ Attitudes favoring the environment;
- ▶ Higher levels of income; and
- ▶ Higher levels of education.

The probability of voting **against** the proposal was typically increased by:

- ▶ A belief that the respondent would actually pay money if the proposal passed; and
- ▶ The cost to respondent if the proposal passed.

Table 5-19
Estimated Logistic Regression Model Parameters for the National Sample^a

Variable	Definitely Yes Models	Definitely / Probably Yes Models
constant	-3.8933 (0.9670) P=0.000	-2.4317 (0.7142) P=0.001
score	1.4920 (0.9489) P=0.116	2.4681 (0.6729) P=0.000
taxincrease	-0.3774 (0.1761) P=0.032	-0.3698 (0.1557) P=0.018
useresults		0.2239 (0.1458) P=0.125
futuregc	0.1801 (0.0948) P=0.058	0.1521 (0.0763) P=0.046
factor1	-0.2954 (0.1095) P=0.007	-0.3585 (0.0823) P=0.000
factor2	0.6938 (0.1124) P=0.000	0.5070 (0.0861) P=0.000
factor3	-0.1530 (0.0903) P=0.090	-0.1169 (0.0747) P=0.118
factor4	0.1892 (0.0964) P=0.050	
school	0.1946 (0.0814) P=0.017	
income		0.000008 (0.000003) P=0.004
D2	0.2355 (0.2493) P=0.345	0.3266 (0.2024) P=0.107
D3	0.3360 (0.2477) P=0.175	0.2316 (0.2031) P=0.254
D4	0.4552 (0.2432) P=0.062	0.3855 (0.2006) P=0.055
annbid1	-0.0101 (0.0015) P=0.000	-0.0111 (0.0011) P=0.000
-2 * Log Likelihood	919.6081	1203.4691
Chi-squared	158.9979 P=0.000	223.6875 P=0.000
Correctly predicted responses	82.45%	70.16%
Number of observations	1,094	1,039

^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Table 5-20
Estimated Logistic Regression Model Parameters for the Marketing Area Sample^a

Variable	Definitely Yes Models	Definitely / Probably Yes Models
constant	-4.0312 (0.9989) P=0.000	2.5619 (0.8281) P=0.002
score	1.3772 (0.9191) P=0.134	1.7688 (0.7490) P=0.018
utilityincrease		-0.5393 (0.2194) P=0.014
userresults	0.6777 (0.1919) P=0.000	0.6125 (0.1642) P=0.000
futuregc	0.2556 (0.1210) P=0.035	0.5445 (0.0940) P=0.000
factor1	-0.5568 (0.1143) P=0.000	-0.3542 (0.0878) P=0.000
factor2	0.5250 (0.1081) P=0.000	0.5919 (0.0904) P=0.000
factor3	-0.2864 (0.0888) P=0.001	-0.3008 (0.0793) P=0.000
factor4	0.3942 (0.1037) P=0.000	0.1722 (0.0899) P=0.056
income	0.000009 (0.000004) P=0.029	
D6	-0.1796 (0.2297) P=0.434	0.4786 (0.2017) P=0.018
D7	0.1936 (0.2194) P=0.378	0.3045 (0.1919) P=0.113
annbid1	-0.0163 (0.0018) P=0.000	-0.0161 (0.0013) P=0.000
-2 * Log Likelihood	765.8547	962.2454
Chi-squared	213.8576 P=0.000	328.1274 P=0.000
Correctly predicted responses	80.18%	74.47%
Number of observations	908	948

^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Table 5-21
Model Variable Definitions

Variable	Definition
constant	constant = 1
score	Quiz score computed from mail survey true/false questions. Maximum score = 1.
taxincrease	Question 7 in the national version of the mail survey. (Do you believe your taxes will increase if this proposal passes?) 0 = no, 1 = yes
utilityincrease	Question 7 in the marketing area version of the mail survey. (Do you believe your utility bills will increase if this proposal passes?) 0 = no, 1 = yes
userresults	Question 8 in the mail survey. (Do you think public officials will consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future?) 1 = no, 2 = yes
futuregc	Question 23 in the mail survey and question 13 in the phone survey. (How likely do you think it is that you will visit the Grand Canyon National Park in the future?) 1 = not at all likely, 4 = very likely
factor1	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 12 (nep scale), items 1,3,5,8, and 10. Labeled "Impacts of human intervention on nature." Expected sign: -
factor2	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 13 (economic/environmental issues), items 1,3,4, and 6. Labeled "Economic security." Expected sign: +
factor3	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 12 (nep scale), items 12 and 13. Labeled "Limits to growth." Expected sign: -
factor4	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 12 (nep scale), items 2 and 9. Labeled "Human ingenuity will ensure balance." Expected sign: +
school	Question 26 in the mail survey and question 17 in the telephone survey. Respondent education, coded in categories where 1 = eight years or less and 6 = post graduate work.
income	Question 30 in the mail survey and question 19 in the telephone survey. House hold income. Recoded from categories to midpoint values.

(Continued)

Table 5-21
Model Variable Definitions

Variable	Definition
D2	Dummy variable for national survey version. 1 = low fluctuating flow (Version 2), 0 = other
D3	Dummy variable for national survey version 1 = seasonally adjusted steady flow (Version 3), 0 = other
D4	Dummy variable for national survey version. 1 = seasonally adjusted steady flow with moderate flow price impacts (Version 4), 0 = other
D6	Dummy variable for marketing survey version. 1 = low fluctuating flow (Version 6), 0 = other
D7	Dummy variable for marketing survey version. 1 = seasonally adjusted steady flow (Version 7), 0 = other
annbid1	Annual cost of proposal.

5.7 ESTIMATED WILLINGNESS-TO-PAY

The estimated logistic regression parameters reported in Tables 5-19 and 5-20 specify the cumulative density function for willingness-to-pay. Estimates of average, or mean, willingness-to-pay can be calculated using the following formula:

$$\text{Eq. (2)} \quad \overline{\text{WTP}} = \frac{\ln \left(1 + \exp \sum_{i=1}^{n-1} B_i * X_i \right)}{-B_n}$$

In Equation 2, B_1 represents the constant; B_2 through B_{n-1} represent coefficients on all the variables except the cost of the proposal; and B_n is the coefficient on the cost of the proposal. In calculating the mean willingness-to-pay, all of the non-cost variables must be set at appropriate levels. In carrying out this calculation, the relevant national-sample averages and marketing-area sample averages from the mail survey data were used. The one exception was the variable that measured whether respondents really believed they would have to pay if the proposal passed. This variable was set at a level that indicated respondents believed they would have to pay if the proposal passed. This step served to correct for the upward bias that would otherwise have been present because some respondents indicated they did not really believe they would have to pay the stated amount if the referendum passed. Dummy variables representing the various proposals were set at appropriate levels in order to

determine mean willingness-to-pay for the different proposals. Mean willingness-to-pay values are reported in Table 5-22 for the national sample, and in Table 5-23 for the marketing area sample.

Table 5-22
Annual Estimated Mean Willingness-to-Pay for a Change in Dam Operations
for the National Sample^a

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Moderate Fluctuating Flow (Version 1)	\$23.96	\$107.31
Low Fluctuating Flow (Version 2)	\$29.45	\$128.75
Seasonally Adjusted Steady Flow (Version 3)	\$32.11	\$122.32
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	\$35.52	\$132.82

^a Reported values were calculated for all cases where respondents supported a change in dam operations at zero cost and believed their tax bills would increase with the passage of the referendum.

Table 5-23
Annual Estimated Mean Willingness-to-Pay for a Change in Dam Operations
for the Marketing Area Sample^a

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Moderate Fluctuating Flow (Version 5)	\$32.43	\$100.11
Low Fluctuating Flow (Version 6)	\$28.14	\$124.93
Seasonally Adjusted Steady Flow (Version 7)	\$37.59	\$115.68

^a Reported values were calculated for all cases where respondents supported a change in dam operations at zero cost and believed their utility bills would increase with the passage of the referendum.

5.8 THE ROLE OF POWER PRICE INCREASES IN THE SCENARIOS

The qualitative research indicated that some members of the national sample were likely to feel empathy toward individuals who would experience increases in their electric rates as a result of changes in the operation of Glen Canyon Dam. As a result, these increases were included as a part of the contingent valuation scenarios in surveys sent to members of the national sample. Furthermore, inclusion of these price impacts posed a potential problem. Specifically, protection for the environment increases as dam operations move from moderate fluctuating flows to seasonally adjusted steady flows. Furthermore, as environmental protection increases, so do the price impacts to power consumers. Table 5-24 summarizes these relationships. While many of the environmental improvements were described in qualitative terms (for example, "a major improvement in conditions for native fish," or "a substantial reduction in the risk of erosion"), the power price impacts were described in quantitative terms (dollars per month). Some concern was expressed during the OMB approval process that the higher degree of specificity for power price impacts might serve as a cue that would affect responses to the contingent valuation question in an undesirable manner. It was argued that respondents might reason along the following lines, "If the power price impacts are high, then the problem must be serious, and I should be willing to pay a lot to solve a serious problem." Reasoning along these lines would produce a pattern of higher willingness-to-pay for the seasonally adjusted steady flow alternative and lower willingness-to-pay for the moderate and low fluctuating flow alternatives.

This issue of power price anchoring can be partially addressed by examining the average willingness-to-pay expressed for the moderate and low fluctuating flow scenarios. Recall that the power price impacts were identical for these two proposals, but the environmental improvements were greater for the low fluctuating flow proposal (Table 5-24). If respondents are paying attention to the environmental benefits, we would expect a higher willingness-to-pay for the low fluctuating flow proposal. Table 5-22 shows that in the national sample, willingness-to-pay for the low fluctuating flow proposal exceeds willingness-to-pay for the moderate fluctuating flow proposal. This result indicates that, given constant power price impacts, respondents in the national sample tended to place higher value on the proposal that had larger environmental improvements.

Survey Version 4 was designed to provide a further examination of the role of power price impacts. The proposal in Version 4 combined the environmental improvements of the seasonally adjusted steady flow alternative with the power price impacts of the low and moderate fluctuating flow alternative. If respondents used the power price impacts as a cue for answering the contingent valuation question, we would expect to see a lower willingness-to-pay for the proposal in Version 4 than for the seasonally adjusted steady flow proposal (Version 3). On the other hand, if respondents felt empathy for power consumers, a higher willingness-to-pay would be expected for the proposal in Version 4 than for Version 3. Table 5-22 shows that in the national sample, willingness-to-pay for the seasonally adjusted steady flow proposal is less than the willingness-to-pay for the proposal in Version 4. This result supports the hypothesis that responses to the contingent valuation question were partially

motivated by feelings of empathy toward power consumers and did not seem to suffer from the power price anchoring issue raised during the OMB approval process.

Table 5-24
Overview of Environmental Improvements and
Power Price Impacts in the National Sample Surveys

Survey Version	Environmental Improvements ^a	Cost to Power Consumers	
		Average	Maximum
Moderate Fluctuating Flow (Version 1)	Smallest	\$3/month	\$9/month
Low Fluctuating Flow (Version 2)	Moderate	\$3/month	\$9/month
Seasonally Adjusted Steady Flow (Version 3)	Largest	\$9/month	\$21/month
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	Largest	\$3/month	\$9/month

^a For complete descriptions used in the survey instruments, see Appendix E.

5.9 CALCULATION OF POPULATION AVERAGE WILLINGNESS-TO-PAY

The means reported in Table 5-22 represent the average willingness-to-pay only for those respondents in the national sample to the mail survey who voted in favor of the proposal at no cost. Equivalent values for marketing area sample respondents are reported in Table 5-23. Determining an average value that can be aggregated across relevant populations requires taking account of the values held by three additional groups: (1) respondents to the mail survey who indicated they would vote against the proposal at zero cost; (2) respondents to the mail survey who would choose to not vote on the proposal, and; (3) non-respondents to the mail survey.

Mail survey respondents who voted against a proposal even at zero cost provided a clear indication that they did not place a positive value on the proposal. In the analysis that follows, these individuals are assigned a willingness-to-pay amount of zero. Mail survey respondents who chose not to vote either for or against the proposal may have been expressing a protest against the valuation process. It could be argued that these

individuals should be excluded from the analysis, since they chose not to participate in the valuation process. On the other hand, if these respondents had been forced to vote on the proposal, it is very likely that some would have voted in favor of the proposal and expressed a positive value. However, in the absence of any information about the potential values the individuals might have, a willingness-to-pay of zero is assumed in the analysis that follows.

Accounting for nonrespondents to the mail survey raises more complex issues. Recall that telephone interviews were carried out with these nonrespondents. The results of this telephone survey indicated that nonrespondents tended to have lower incomes, lower educational attainment, lower probabilities of future visits to the Grand Canyon, and slightly less environmentally oriented attitudes than respondents to the mail survey. While it might be reasonable to assume that some nonrespondents would have expressed a positive willingness-to-pay if they had completed the mail survey, it is also reasonable to assume that the average willingness-to-pay for nonrespondents would have been less than the average willingness-to-pay for the mail survey respondents.

Assigning willingness-to-pay values to nonrespondents was carried out in two ways. The first approach used the mail survey data to estimate a model predicting whether a respondent would vote in favor of the proposal at zero cost. This model was then applied to data collected during the telephone interview with mail survey nonrespondents to estimate the probability that they would have voted in favor of the proposal at zero cost.² Next, an average willingness-to-pay for nonrespondents was estimated using the models reported in Tables 5-19 and 5-20 but evaluated at relevant average values from the telephone survey of nonrespondents. The second approach simply assumed that all nonrespondents to the mail survey had a zero willingness-to-pay.

The population average willingness-to-pay was calculated as a weighted average of the estimated or assumed willingness-to-pay values for four groups:

- ▶ Mail survey respondents who would vote for the proposal at zero cost;
- ▶ Mail survey respondents who would either not vote for the proposal at zero cost or who would choose not to vote;
- ▶ Nonrespondents to the mail survey estimated, or assumed, to support the proposal at zero cost; and
- ▶ Nonrespondents to the mail survey estimated, or assumed, to either not support the proposal at zero cost or not vote.

The weight for each component of population average willingness-to-pay is the proportion of each of these groups in the sample. Details of the calculation of population average

² The model used to predict the percentage of nonrespondents who would support the proposal at zero cost is discussed in Appendix G.

willingness-to-pay are presented in Tables 5-25 and 5-26 for the national and marketing area “Definitely Yes” models, and in Tables 5-27 and 5-28 for the national and marketing area “Definitely/ Probably Yes” models. A summary of population average willingness-to-pay is presented in Tables 5-29 and 5-30 for the national and marketing area tables, respectively.

Table 5-25

Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations
National Sample Definitely Yes Models

	Response Rate Weights	Support Weight	Total Weight	Estimated Mean Willingness to Pay	Contribution to Weighted Mean	Population Weighted Average Willingness to Pay
Moderate Fluctuating Flow Alternative (Version 1)						
Mail Respondents	0.6435					
<i>Support at \$0 cost</i>		0.71	0.456885	\$23.96	\$10.95	
<i>Not support / not vote</i>		0.29	0.186615	\$0.00	\$0.00	
Nonrespondents	0.3565					
<i>Support at \$0 cost</i>		0.65	0.230377	\$11.75	\$2.71	
<i>Not support / not vote</i>		0.35	0.126123	\$0.00	\$0.00	
			<u>1.000000</u>			\$13.65
Low Fluctuating Flow Alternative (Version 2)						
Mail Respondents	0.6651					
<i>Support at \$0 cost</i>		0.83	0.552033	\$29.45	\$16.26	
<i>Not support / not vote</i>		0.17	0.113067	\$0.00	\$0.00	
Nonrespondents	0.3349					
<i>Support at \$0 cost</i>		0.79	0.265388	\$14.65	\$3.89	
<i>Not support / not vote</i>		0.21	0.069512	\$0.00	\$0.00	
			<u>1.000000</u>			\$20.15
Seasonally Adjusted Steady Flow Alternative (Version 3)						
Mail Respondents	0.6713					
<i>Support at \$0 cost</i>		0.77	0.516901	\$32.11	\$16.60	
<i>Not support / not vote</i>		0.23	0.154399	\$0.00	\$0.00	
Nonrespondents	0.3287					
<i>Support at \$0 cost</i>		0.75	0.245912	\$16.08	\$3.95	
<i>Not support / not vote</i>		0.25	0.082788	\$0.00	\$0.00	
			<u>1.000000</u>			\$20.55
Seasonally Adjusted Steady Flow Alternative With Moderate Flow Price Impacts (Version 4)						
Mail Respondents	0.6545					
<i>Support at \$0 cost</i>		0.81	0.530145	\$35.52	\$18.83	
<i>Not support / not vote</i>		0.19	0.124355	\$0.00	\$0.00	
Nonrespondents	0.3455					
<i>Support at \$0 cost</i>		0.80	0.276606	\$17.94	\$4.96	
<i>Not support / not vote</i>		0.20	0.068894	\$0.00	\$0.00	
			<u>1.000000</u>			\$23.79

Table 5-26

**Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations
Marketing Area Sample Definitely Yes Models**

	Response Rate Weights	Support Weight	Total Weight	Estimated Mean Willingness to Pay	Contribution to Weighted Mean	Population Weighted Average Willingness to Pay
Moderate Fluctuating Flow Alternative (Version 5)						
Mail Respondents	0.7401					
<i>Support at \$0 cost</i>		0.76	0.562476	\$32.43	\$18.24	
<i>Not support / not vote</i>		0.24	0.177624	\$0.00	\$0.00	
Nonrespondents	0.2599					
<i>Support at \$0 cost</i>		0.75	0.195211	\$19.54	\$3.81	
<i>Not support / not vote</i>		0.25	0.064689	\$0.00	\$0.00	
			1.000000			\$22.06
Low Fluctuating Flow Alternative (Version 6)						
Mail Respondents	0.7484					
<i>Support at \$0 cost</i>		0.85	0.636140	\$28.14	\$17.90	
<i>Not support / not vote</i>		0.15	0.112260	\$0.00	\$0.00	
Nonrespondents	0.2516					
<i>Support at \$0 cost</i>		0.84	0.212124	\$16.73	\$3.55	
<i>Not support / not vote</i>		0.16	0.039476	\$0.00	\$0.00	
			1.000000			\$21.45
Seasonally Adjusted Steady Flow Alternative (Version 7)						
Mail Respondents	0.7523					
<i>Support at \$0 cost</i>		0.85	0.639455	\$37.59	\$24.04	
<i>Not support / not vote</i>		0.15	0.112845	\$0.00	\$0.00	
Nonrespondents	0.2477					
<i>Support at \$0 cost</i>		0.85	0.209951	\$23.01	\$4.83	
<i>Not support / not vote</i>		0.15	0.037749	\$0.00	\$0.00	
			1.000000			\$28.87

Table 5-27
Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations
National Sample Definitely/Probably Yes Models

	Response Rate Weights	Support Weight	Total Weight	Estimated Mean Willingness to Pay	Contribution to Weighted Mean	Population Weighted Average Willingness to Pay
Moderate Fluctuating Flow Alternative (Version 1)						
Mail Respondents	0.6435					
<i>Support at \$0 cost</i>		0.71	0.456885	\$107.31	\$49.03	
<i>Not support / not vote</i>		0.29	0.186615	\$0.00	\$0.00	
Nonrespondents	0.3565					
<i>Support at \$0 cost</i>		0.65	0.230377	\$80.45	\$18.53	
<i>Not support / not vote</i>		0.35	0.126123	\$0.00	\$0.00	
			<u>1.000000</u>			\$67.56
Low Fluctuating Flow Alternative (Version 2)						
Mail Respondents	0.6651					
<i>Support at \$0 cost</i>		0.83	0.552033	\$128.75	\$71.07	
<i>Not support / not vote</i>		0.17	0.113067	\$0.00	\$0.00	
Nonrespondents	0.3349					
<i>Support at \$0 cost</i>		0.79	0.265388	\$98.95	\$26.26	
<i>Not support / not vote</i>		0.21	0.069512	\$0.00	\$0.00	
			<u>1.000000</u>			\$97.33
Seasonally Adjusted Steady Flow Alternative (Version 3)						
Mail Respondents	0.6713					
<i>Support at \$0 cost</i>		0.77	0.516901	\$122.32	\$63.23	
<i>Not support / not vote</i>		0.23	0.154399	\$0.00	\$0.00	
Nonrespondents	0.3287					
<i>Support at \$0 cost</i>		0.75	0.245912	\$93.34	\$22.95	
<i>Not support / not vote</i>		0.25	0.082788	\$0.00	\$0.00	
			<u>1.000000</u>			\$86.18
Seasonally Adjusted Steady Flow Alternative With Moderate Flow Price Impacts (Version 4)						
Mail Respondents	0.6545					
<i>Support at \$0 cost</i>		0.81	0.530145	\$132.82	\$70.41	
<i>Not support / not vote</i>		0.19	0.124355	\$0.00	\$0.00	
Nonrespondents	0.3455					
<i>Support at \$0 cost</i>		0.80	0.276606	\$102.52	\$28.36	
<i>Not support / not vote</i>		0.20	0.068894	\$0.00	\$0.00	
			<u>1.000000</u>			\$98.77

Table 5-28
Weighted Mean Values for Willingness-to-Pay for a Change in Dam Operations
Marketing Area Sample Definitely / Probably Yes Models

	Response Rate Weights	Support Weight	Total Weight	Estimated Mean Willingness to Pay	Contribution to Weighted Mean	Population Weighted Average Willingness to Pay
Moderate Fluctuating Flow Alternative (Version 5)						
Mail Respondents	0.7401					
<i>Support at \$0 cost</i>		0.76	0.562476	\$100.11	\$56.31	
<i>Not support / not vote</i>		0.24	0.177624	\$0.00	\$0.00	
Nonrespondents	0.2599					
<i>Support at \$0 cost</i>		0.75	0.195211	\$67.53	\$13.18	
<i>Not support / not vote</i>		0.25	0.064689	\$0.00	\$0.00	
			1.000000			\$69.49
Low Fluctuating Flow Alternative (Version 6)						
Mail Respondents	0.7484					
<i>Support at \$0 cost</i>		0.85	0.636140	\$124.93	\$79.47	
<i>Not support / not vote</i>		0.15	0.112260	\$0.00	\$0.00	
Nonrespondents	0.2516					
<i>Support at \$0 cost</i>		0.84	0.212124	\$88.73	\$18.82	
<i>Not support / not vote</i>		0.16	0.039476	\$0.00	\$0.00	
			1.000000			\$98.29
Seasonally Adjusted Steady Flow Alternative (Version 7)						
Mail Respondents	0.7523					
<i>Support at \$0 cost</i>		0.85	0.639455	\$115.68	\$73.97	
<i>Not support / not vote</i>		0.15	0.112845	\$0.00	\$0.00	
Nonrespondents	0.2477					
<i>Support at \$0 cost</i>		0.85	0.209951	\$80.69	\$16.94	
<i>Not support / not vote</i>		0.15	0.037749	\$0.00	\$0.00	
			1.000000			\$90.91

Table 5-29
Summary of National Sample Population Average Willingness-to-Pay

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Values Imputed for Nonrespondents^a		
Moderate Fluctuating Flow (Version 1)	\$13.65	\$67.56
Low Fluctuating Flow (Version 2)	\$20.15	\$97.33
Seasonally Adjusted Steady Flow (Version 3)	\$20.55	\$86.18
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	\$23.79	\$98.77
Zero Values Assumed for Nonrespondents^b		
Moderate Fluctuating Flow (Version 1)	\$10.95	\$49.03
Low Fluctuating Flow (Version 2)	\$16.26	\$71.07
Seasonally Adjusted Steady Flow (Version 3)	\$16.60	\$63.23
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	\$18.83	\$70.41

^a Adjusted to reflect values of nonrespondents and to reflect a belief that respondents would actually pay if the proposal passed.

^b Adjusted to reflect a zero dollar value for nonrespondents and to reflect a belief that respondents would actually pay if the proposal passed.

Table 5-30
Summary of Marketing Area Sample Population Average Willingness-to-Pay

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Values Imputed for Nonrespondents^a		
Moderate Fluctuating Flow (Version 5)	\$22.06	\$69.49
Low Fluctuating Flow (Version 6)	\$21.45	\$98.29
Seasonally Adjusted Steady Flow (Version 7)	\$28.87	\$90.91
Zero Values Assumed for Nonrespondents^b		
Moderate Fluctuating Flow (Version 5)	\$18.24	\$56.31
Low Fluctuating Flow (Version 6)	\$17.90	\$79.47
Seasonally Adjusted Steady Flow (Version 7)	\$24.04	\$73.97

^a Adjusted to reflect values of nonrespondents and to reflect a belief that respondents would actually pay if the proposal passed.

^b Adjusted to reflect a zero dollar value for nonrespondents and to reflect a belief that respondents would actually pay if the proposal passed.

5.10 STATISTICAL VARIABILITY IN WILLINGNESS-TO-PAY ESTIMATES

The values reported in Tables 5-29 and 5-30 represent point estimates of per household population average willingness-to-pay for the national and marketing area samples, respectively. These point estimates are a function of the parameters of the models presented in Tables 5-19 and 5-20 and assumptions made about the values held by non-respondents to the mail survey. Both the assumptions made, and the statistical uncertainties about the estimated parameters introduce some uncertainty about the point estimates. The variability introduced by making different assumptions is explored in more detail in Appendix I. This section explores the statistical uncertainty associated with the point estimates of population average willingness-to-pay derived from the "Definitely Yes" models.

Since the parameters reported in Tables 5-19 and 5-20 are subject to statistical uncertainty, the point estimates reported in Tables 5-29 and 5-30 are also subject to statistical uncertainty. However, given the process used to calculate the population average willingness-to-pay, it would be difficult to analytically derive variance estimators. As an alternative, a monte-carlo technique was used to construct empirical distributions for the estimated (as opposed to assumed) components of the population average willingness-to-pay point estimates. This was accomplished by repeated sampling from the estimated distribution of parameters reported in Tables 5-19 and 5-20 (Krinsky and Robb, 1986). A total of three thousand random draws was made, and estimates of mean willingness-to-pay for one alternative were constructed for each of the three thousand sets of parameters. This resulted in 3000 estimates of mean willingness-to-pay for each alternative which were then arranged in order from lowest to highest. Empirical 95 percent confidence intervals were then constructed by dropping the lowest 25 and the highest 25 willingness-to-pay estimates. This process was repeated for each alternative and was carried out for both respondents and non-respondents. Lower 95 percent confidence limits for population average willingness-to-pay were estimated by recalculating the estimate using lower 95 percent confidence limits for respondents and non-respondent willingness-to-pay estimates (Table 5-31). Likewise, upper 95 percent confidence limits were estimated by using the upper 95 percent confidence limits for willingness-to-pay estimates (Table 5-32).

Table 5-31
Percent Change in Mean Willingness-to-Pay between Definitely Yes Models with Values Imputed for Nonrespondents and the Lower 95 Percent Confidence Interval for the Same Model

	Values Imputed for Nonrespondents	Lower 95% CI	Percent Change from Base
National Sample			
Moderate Fluctuating Flow	\$13.65	\$9.27	-32.09%
Low Fluctuating Flow	\$20.15	\$14.22	-29.43%
Seasonally Adjusted Steady Flow	\$20.55	\$14.57	-20.10%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	\$23.79	\$17.17	-27.83%
Market Area Sample			
Moderate Fluctuating Flow	\$22.06	\$16.68	-24.39%
Low Fluctuating Flow	\$21.45	\$15.84	-26.15%
Seasonally Adjusted Steady Flow	\$28.87	\$22.50	-22.06%

Table 5-32
Percent Change in Mean Willingness-to-Pay between Definitely Yes Models with Values Imputed for Nonrespondents and the Upper 95 Percent Confidence Interval for the Same Model

	Values Imputed for Nonrespondents	Upper 95% CI	Percent Change from Base
National Sample			
Moderate Fluctuating Flow	\$13.65	\$20.39	49.38%
Low Fluctuating Flow	\$20.15	\$29.29	45.36%
Seasonally Adjusted Steady Flow	\$20.55	\$29.84	45.21%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	\$23.79	\$33.39	40.35%
Market Area Sample			
Moderate Fluctuating Flow	\$22.06	\$29.39	33.23%
Low Fluctuating Flow	\$21.45	\$29.28	36.50%
Seasonally Adjusted Steady Flow	\$28.87	\$37.24	28.99%

5.11 AGGREGATION

The household average willingness-to-pay values were aggregated across relevant populations. At the time the sample was purchased, Survey Sampling, Inc. estimated there were 94,836,300 households in the United States.³ A total of 1,500,000 households were estimated to reside in the marketing area (Energy Information Administration, 1991).

The procedures used to aggregate the population average household willingness-to-pay are consistent with the aggregation procedures used to develop the estimates of recreational values and power values reported in the GCDEIS. Aggregation was carried out using a fifty-year time period from 1991 to 2040. The gross national product (GNP) price deflator series reported by the GCES Power Resources Committee was used to construct estimates of average household willingness-to-pay for each year from 1991 to 2040. Since projections of the future number of U.S. households were not readily available, increases in the number of households were based on the rate of increase in the population. For the national sample, the rate of increase in the number of households was calculated using U.S. Census estimates of the total U.S. population. In the marketing area, the rate of increase in the number of households was estimated using U.S. Census estimates of total population for the states of Wyoming, Utah, Colorado, New Mexico, Arizona, and Nevada.

Household series were constructed so that the 1994 estimated number of households was 94,836,300 for the nation, and 1,500,000 from the marketing area. Consistent with the work of the GCES Power Resources Committee, population growth was assumed to occur only during the first 20 years of the 50-year aggregation period.⁴

For each proposal analyzed, the estimated annual value per household was multiplied by the corresponding estimated number of households to arrive at an estimate of the annual total value associated with the alternative. Present value and levelized annual value estimates were calculated using a discount rate of 8.50 percent. The interest rate used by the federal water agencies in economic analyses is specified by the Water Resources Council in accordance with Section 80(a) Public Law 93-251. That rate reflects the average yield during the preceding fiscal year on United States interest-bearing securities which have terms of 15 years or more remaining to maturity rounded to the nearest one-eighth percent. Changes in the rate are limited to no more than one-fourth percent per year. This is intended to eliminate the effects of short-term changes, and thus more appropriately reflects the relatively long-term

³ The estimate of the total number of U.S. households from SSI is slightly lower than estimates provided by U.S. Census Bureau. For example, in 1993 the Census Bureau estimated a total of 96,391,000 households in the United States.

⁴ This assumption was made to reflect the fact that while the GCES Power Resources Committee escalated costs throughout the 50-year period, electrical loads were held constant after the twentieth year.

period of economic analysis for water resource projects. The rate is provided annually by the Treasury Department for each fiscal year based on the average yield for the preceding fiscal year. For fiscal year 1992 (beginning with October of 1991) the rate is 8.50 percent. This rate is used for all economic analyses in the Glen Canyon Dam EIS. Levelized annual values are presented in Tables 5-33 and 5-34 for the national and marketing area samples.

Table 5-33
Aggregate Levelized Annual Willingness-to-Pay for Changes in Dam Operations
for the National Sample (Millions of Dollars)

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Values Imputed for Nonrespondents^a		
Moderate Fluctuating Flow (Version 1)	\$2,286.4	\$11,316.4
Low Fluctuating Flow (Version 2)	\$3,375.2	\$16,302.9
Seasonally Adjusted Steady Flow (Version 3)	\$3,442.2	\$14,435.2
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	\$3,984.8	\$16,544.1
Zero Values Assumed for Nonrespondents^b		
Moderate Fluctuating Flow (Version 1)	\$1,834.1	\$ 8,212.6
Low Fluctuating Flow (Version 2)	\$2,723.6	\$11,904.3
Seasonally Adjusted Steady Flow (Version 3)	\$2,780.5	\$10,591.1
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts (Version 4)	\$3,154.0	\$11,793.8

^a Adjusted to reflect values of nonrespondents and to reflect respondents' stated belief that they would actually pay if the proposal passed.

^b Adjusted to reflect a zero dollar value for nonrespondents and to reflect respondents' stated belief that they would actually pay if the proposal passed.

Table 5-34
 Aggregate Levelized Annual Willingness-to-Pay for Changes in Dam Operations
 for the Marketing Area Sample (Millions of Dollars)

Water Release Alternative	Definitely Yes Models	Definitely / Probably Yes Models
Values Imputed for Nonrespondents^a		
Moderate Fluctuating Flow (Version 5)	\$62.2	\$196.1
Low Fluctuating Flow (Version 6)	\$60.5	\$277.3
Seasonally Adjusted Steady Flow (Version 7)	\$81.4	\$256.5
Zero Values Assumed for Nonrespondents^b		
Moderate Fluctuating Flow (Version 5)	\$51.5	\$ 158.9
Low Fluctuating Flow (Version 6)	\$50.5	\$224.2
Seasonally Adjusted Steady Flow (Version 7)	\$67.8	\$208.7

^a Adjusted to reflect values of nonrespondents and to reflect respondents' stated belief that they would actually pay if the proposal passed.

^b Adjusted to reflect a zero dollar value for nonrespondents and to reflect respondents' stated belief that they would actually pay if the proposal passed.

5.12 DISCUSSION OF ASSUMPTIONS USED

The values reported in Tables 5-33 and 5-34 span a relatively large range. A substantial portion of this range is a direct result of various assumptions that could be made during the process of calculating population average willingness-to-pay. We believe that the best estimates of willingness-to-pay are those that are based on the "Definitely Yes" models and for which values were imputed for nonrespondents. These best estimates for the national sample are presented in Table 5-35. Best estimates for the marketing area sample follow in Table 5-36. A large number of decisions were made during survey design, implementation, and data analysis. In this section we discuss these decisions, the justification for them, and their implications.

Table 5-35
Best Estimates of Willingness-to-Pay for Changes in the Operation
of Glen Canyon Dam -- National Sample

	Population Weighted Willingness-to-Pay Per Household	Levelized Annual Value ^a
Moderate Fluctuating Flow	\$13.65	\$2,286.4
Low Fluctuating Flow	\$20.15	\$3,375.2
Seasonally Adjusted Steady Flow	\$20.55	\$3,442.2

^a Millions of dollars

Table 5-36
Best Estimates of Willingness-to-Pay for Changes in the Operation of
Glen Canyon Dam -- Marketing Area Sample

	Population Weighted Willingness-to-Pay Per Household	Levelized Annual Value ^a
Moderate Fluctuating Flow	\$22.06	\$62.2
Low Fluctuating Flow	\$21.45	\$60.5
Seasonally Adjusted Steady Flow	\$28.87	\$81.4

^a Millions of dollars

Proposed federal regulations governing contingent valuation studies of non-use values strongly support the use of a single-bounded dichotomous choice framework. The GCES Non-Use Values Study used a modified version of the single-bounded dichotomous choice question format. Instead of asking respondents to simply vote "Yes" or "No" to a proposal, they were asked to indicate how they would vote on a five-point scale. The five-point scale ranged from "Definitely No" to "Definitely Yes." This decision was based partially on early results from a criterion validity study (Champ, 1994) showing that individuals who are more sure of their preferences seem to provide "better" contingent valuation responses.

Respondents were also given a chance to "opt out" of the contingent valuation question. Respondents were first asked if they would vote in favor of the proposal if passage of the proposal cost them nothing. They were provided with three response categories: "No," "Yes," and "I would choose not to vote on this proposal." All individuals choosing the first category ("No") were assigned a willingness-to-pay of zero. Some might argue that respondents voting against the proposal at zero cost were actually indicating they held a negative value for the proposal. There is no easy way to investigate this issue in a quantitative manner short of contacting these individuals and asking about their willingness-to-pay to avoid implementation of the proposal. We suspect that such an effort would reveal very small, if not zero, willingness-to-pay to maintain current dam operations. During the qualitative research, we saw no indication that respondents felt that they would experience a decrease in utility as a result of a change in the operations of Glen Canyon Dam. Results clearly indicated that, with the possible exception of impacts to power consumers, respondents in the national sample were either indifferent to or in favor of changes in the operations of Glen Canyon Dam. This finding did not support assigning negative values to individuals who voted against the proposal at zero cost and we feel justified in assigning zero willingness-to-pay to these respondents.

Making assumptions about willingness to pay for respondents choosing the third category ("Choose not to vote") was more problematic. Based on the qualitative research, we suspect that at least a portion of these respondents elected not to vote because they did not want to vote in favor a proposal that increased electricity prices for residents of the marketing area, not because they felt the proposal had no value. In fact, the results of the qualitative research led us to believe that it's probable that some respondents who objected to the payment vehicle may have a positive value for changes in dam operations. However, in the absence of information about these values, these respondents were assigned a willingness-to-pay of zero.

The logistic regression equations reported in Tables 5-19 and 5-20 were used to estimate willingness-to-pay values for survey nonrespondents. Some might argue that all nonrespondents to the mail survey should be assigned a zero value, thereby decreasing the estimated average willingness-to-pay by approximately 20 to 30 percent. However, a substantial effort was made to contact nonrespondents to the mail survey via telephone and

collect data that would address issues of potential nonresponse bias. These data were combined with the models estimated from the mail survey data to provide our best estimate of the willingness-to-pay of nonrespondents. Thus, in the presence of a model and sufficient data from nonrespondents to the mail survey, it would be inappropriate to simply assume that all nonrespondents to the mail survey had a willingness-to-pay of zero.

Finally, the portion of the sample identified as out-of-scope was excluded from the analysis for this report. The calculation of aggregate willingness-to-pay implicitly assumed that the distribution of willingness-to-pay among out-of-scope individuals is identical to the estimated distribution of willingness-to-pay for respondents to the mail and telephone surveys. The only other feasible assumption would be that all out-of-scope sample points have a willingness-to-pay of zero. We are not aware of any precedent for assigning a zero willingness-to-pay to out-of-scope members of the original sample. In fact, a strong argument could be made that some of these individuals would express a positive willingness-to-pay if they could have been contacted. Consequently, it seemed more appropriate to exclude the out-of-scope cases as was done in the analysis contained in this report.

CHAPTER 6

VALIDITY OF RESULTS

This chapter discusses the accuracy, or validity, of the study's results. We start by admitting that validity is not a simple issue. Willingness-to-pay (WTP) is defined as the amount of money that the idealized consumer in economic theory could give up before he or she would be indifferent about changes in dam operations. As such, WTP is unobservable in the real world. We cannot measure it directly to assess the accuracy of valuation techniques, including contingent valuation (CV). Less direct forms of evidence must be used to evaluate the validity of economic values. This measurement problem is confronted in the first section of this chapter. Fortunately, the problem is not unique to economics. Drawing on the efforts of psychologists and other social scientists to address similar measurement problems, economists are developing a theory of measurement that is described in the second section. Based on the validity criteria described and applied in early parts of this chapter, we will argue later in this chapter that values estimated in this study have sufficient validity to warrant their use in economic analysis of Glen Canyon Dam operating alternatives for purposes of public decision making.

6.1 THE MEASUREMENT PROBLEM

The goal of economic valuation studies is to measure WTP for some change in people's economic circumstances.¹ Such changes are brought about by "interventions." These interventions can take the form of public projects, changes in governmental policies or regulations, and intentional or unintentional releases of pollutants into the environment.² In theory, consumers are willing to pay to obtain "interventions" that increase their utility and to avoid interventions that reduce their utility. WTP for an intervention represents just the right amount of money paid to make consumers indifferent about it.

In applied studies, we can estimate WTP using revealed preference methods or stated preference methods. Revealed preference methods typically involve estimating a demand function. The theory of consumer behavior leads economists to expect that the area below the estimated demand function and above the price line (the so-called welfare triangle) will,

¹ Alternatively, willingness to accept compensation might be the ideal measure for some studies. Most of what is said in this chapter also applies to measurement of willingness-to-accept, but is not discussed directly because this study deals exclusively with WTP.

² Indeed, the operational alternatives for Glen Canyon Dam are examples of such interventions.

after adjusting for the income effect, equal aggregate WTP for consumption of that good. WTP represents a payment that, if collected, would lead real-world consumers to be indifferent about consuming the good at its current price as opposed to not consuming it at all. If an intervention causes the welfare triangle to change, thus changing aggregate WTP for the good, then the change in the welfare triangle (again after proper allowance for the income effect) is taken to represent aggregate WTP for the intervention.

Stated preference methods, of which CV is the most widely applied example, are more direct. Rather than estimating welfare triangles, people are asked to reveal their WTP values for the intervention during a survey.

Regardless of whether revealed preference or stated preference methods are used, judging the accuracy of WTP estimates is difficult. The problem stems from the fact that WTP cannot be observed directly. It is an abstraction. It exists only in the idealized theory of the consumer. If it is unobservable, then it cannot be measured and used as a standard to evaluate the accuracy of estimated values from either revealed preference or stated preference studies. Less direct methods to assess the accuracy or "validity" of value measures are required.

Historically, revealed preference methods dominated in valuation studies. The market transactions used in these studies were (rightly or wrongly) considered highly credible indicators of WTP. It is not apparent why market transactions should be considered credible indicators. How do economists know that changes in welfare triangles are indicative of the amount of money required to make consumers indifferent about interventions? Unfortunately, this question did not attract much attention from researchers applying revealed preference methods.

On the other hand, responses to stated preference questions have lacked the presumed credibility of market transactions and have been widely questioned. Throughout CV's history, numerous doubts have been raised about whether people are willing and able to reveal their WTP values in this way. Respondents might be unwilling to reveal their values if they see strategic advantages to giving misleading answers. For example, if the intervention is favorable to them and they realize that they will not really have to pay, then they may answer CV questions in ways that imply larger WTP values than they would really pay. On the other hand, even if they were willing to reveal their values, respondents may be unable to judge how much they really would pay simply because they have no past experience with buying or selling the environmental resources being valued.

Alternative views on the overall validity of the CV method will be examined more closely later in this chapter. The point to be made here is that the validity of alternative methods of measuring values is now on the economic agenda.

If such questions are raised about CV and other stated preference methods, they must be raised about revealed preference methods as well. Ultimately, consistent standards of validity will need to be applied across the full range of methods.

Fortunately, this sort of measurement problem is not unique to economic valuation. Throughout the social sciences, observable potential indicators of unobservable constructs must be evaluated for accuracy. In psychology, for example, tests have been devised to try to measure such concepts as intelligence and self-esteem. Intelligence and self-esteem are ultimately abstract theoretical constructs not unlike WTP, at least up to a point. To the extent that they exist at all in reality, intelligence, self-esteem, and payments sufficient to produce indifference about interventions exist only inside the minds of people and cannot be observed directly. Instead, evidence must be acquired using IQ tests, personality tests, and either market data or stated preference surveys to attempt to estimate their magnitudes. Economics can draw on psychology in developing its own theory of measurement.

6.2 TOWARD A THEORY OF ECONOMIC MEASUREMENT

Psychologists (e.g., Bohrnstedt, 1983) have applied three strategies to assess the accuracy of their methods. These are content validity, construct validity, and criterion validity -- the "Three Cs." Environmental economists have already begun to adapt the Three Cs to contingent valuation (Mitchell and Carson, 1989; Champ, 1994; Bishop et al., 1994; Bishop and McCollum, 1995). Although CV is the focus of this discussion, all three strategies for validity assessment should be of interest for a full range of measurement issues within economics.

Content validity has to do with whether the design and execution of a study were conducive to revealing theoretical WTP. Assessing content validity involves examining the "content" of the study procedures.

Construct validity -- the second of the Three Cs -- looks at the degree to which the measure under scrutiny (in this case CV estimates of WTP) relates to other measures as predicted by theory and intuition. Mitchell and Carson (1989) discuss two forms of construct validity -- convergent and theoretical. Tests of convergent validity consider the relationship between the CV-measure and alternative measures of the value of the same intervention. For example, convergent validity could be assessed by comparing values estimated from a CV study to values estimated using revealed preference methods such as a travel cost model or an hedonic pricing model.

Because non-use values are not fully reflected in revealed preference measures, convergent validity will not play a direct role in evaluating the validity of the results of the current study.³ Nevertheless, convergent validity studies will prove interesting in discussing the overall validity of CV.

Theoretical validity--the other form of construct validity--is assessed by testing theory-based hypotheses about relationships between WTP and other variables. In CV, it is often assessed by considering the relationship between the CV measure and independent variables that are thought to be potential determinants of WTP. A common example is a test to see if income and WTP are positively related. Assessing the theoretical validity of a measure may involve simple contingency table analyses. Or, more sophisticated multivariate regression procedures may be applied and coefficients on potentially important independent variables scrutinized for statistical significance, appropriate signs, and relative magnitudes.

Diamond et al. (1993), among others, have recently advocated a different form of the theoretical validity test. They advocate testing theory-based hypotheses about relationships between two or more CV values from the same study. For example, one would expect WTP to be greater when a larger environmental amenity is provided or when a larger environmental insult is avoided. CV estimates of values should, if they are measuring theoretical WTP, exhibit relative magnitudes consistent with this hypothesis. Tests of hypotheses about expected variations in estimated values associated with changes in the scope of environmental improvements or insults have come to be known as "scope tests." Within the taxonomy being followed here, scope tests are theoretical validity tests. Many other such tests are conceivable.

The third of the Three Cs is *criterion validity*. To assess criterion validity, Mitchell and Carson (1989) point out that "It is necessary to have in hand a criterion which is unequivocally closer to the theoretical construct than the measure whose validity is being assessed." The closer the contingent value is to the criterion, the more valid it is judged to be.

Given the credibility of market choices as indicators of true values, actual market prices would be a criterion to use in evaluating contingent values; however, because such market prices are rare for environmental amenities (especially when non-use values come into play),

³ Revealed preference approaches to valuation by definition infer consumer preferences from the actual behavior of people, usually as a result of buying and selling things in markets. Non-use values may not fully manifest themselves in easily observable behavior. People who value oil spill prevention in coastal environments they never visit or endangered fishes even though they have no hope of benefiting personally from preservation, cannot express those preferences directly by buying oil spill prevention or endangered fish preservation in markets. Joining an environmental organization or writing to one's congressional representatives are forms of behavior that are more subtle and difficult to interpret in a valuation study.

so-called "simulated market" values are perhaps a more promising alternative for judging the criterion validity of contingent values. Simulated markets involve creating situations in the field or laboratory where subjects have the opportunity to actually pay for the good or service or receive compensation for it. The same good or service is also valued using CV, and the simulated market value is used as a criterion for assessing criterion validity.

An example will illustrate both the potential usefulness of criterion validity studies and their limitations in evaluating the validity of individual CV studies like the one under review here. Champ et al. (1995) conducted a criterion validity study involving removal of some old dirt roads from the North Rim of the Grand Canyon. These old roads allow unauthorized public access using motor vehicles into some remote areas there. Removal of the roads would reduce disturbance to wildlife and those attempting to enjoy wilderness recreation in these areas. Removal would also fulfill one of the requirements for designating the area as an official Wilderness Area. For these reasons, removal of the roads is a National Park Service goal. However, the Park Service lacks money to provide support for volunteers to carry out the work. Champ et al. asked a random sample of Wisconsin residents if they would actually donate money for road removal. Members of a second sample drawn from the same population were asked CV questions about their willingness to donate money. The actual donations then served as simulated market-like criteria for evaluating the validity of the CV donations. This study found a large potential upward bias in the CV responses. That is, people expressed willingness to donate more money for this purpose in the CV exercise than they would actually have donated.

Now, on the surface, Champ et al. appears to raise serious questions about the current study. Both studies dealt with environmental resources of Grand Canyon National Park. Both employed CV methods. Both involved values that were heavily weighted toward non-use values. If they found a substantial bias in an upward direction, would it not follow that our results as presented in Chapter 5 are also likely to be biased?

The answer to this question is not so clear as it might seem at first glance, however. The Champ et al. study differed from this one in that they used a donation framework while we used a referendum framework with taxes (or utility bills) as the payment vehicle. The donation vehicle invites underestimation of the economic value of the resource, especially when actual donations will be collected. Donations encourage people to engage in "free rider" behavior. That is, respondents in simulated markets using donation vehicles may have positive values for the resource and yet hold back from actually paying in the hope that other will donate enough to assure the intervention. In theoretical terms, donation vehicles are "incentive incompatible" with revelation of theoretical WTP.⁴ In fact, one might argue that values based on donation vehicles ought not be considered satisfactory criteria for purposes

⁴ Recall that theoretical WTP is taken to be an amount of money paid by a respondent sufficient to make that respondent indifferent about the intervention.

of validity testing. On the other hand, referenda with tax vehicles are "incentive compatible." They provide respondents with incentives to vote according to their preferences. The conclusions regarding bias of Champ et al. may only apply to CV studies employing donation payment vehicles. Based on theory, we would expect incentive compatible formats to work better than donation vehicles. How much better is impossible to judge from the Champ et al. study.

We nevertheless did draw on the Champ et al. study in choosing to offer respondents an opportunity to express various degrees of uncertainty about how they would vote in a real referendum, from definitely yes to definitely no. Champ et al. found that allowing respondents to express their uncertainty in such ways could be used to predict who would really donate money and who would not. If "Definitely Yes" models predict well for incentive incompatible donations, then there was reason to hope that they would also predict at least as well who would really vote yes in an incentive compatible referendum. Given that such models predict well for donations, they ought, if anything, to err on the low side, all else equal, in predicting the positive votes in a real referendum.

In the broader context, criterion validity studies will nearly always have limited direct applicability in evaluating the validity of individual CV studies. As the comparison of the road removal study and the current effort illustrates well, the "match" between one study that was able to develop a criterion and another that was not will rarely be perfect. If a method of valuation superior to CV (i.e., valuation methods capable of yielding values for criterion validity tests of CV) could be applied in most situations where CV is applied, there would be much less need for CV.

Still, criterion validity tests, in those instances where they are feasible, are capable of yielding useful insights. Support for the definitely yes models in the current study is one example. In general, criterion validity tests should help to improve content validity criteria.

In applying the Three Cs, an important, although often overlooked, distinction must be made between the validity of individual studies and the overall validity of the CV method. Content validity assessment is exclusively applicable at the level of the individual study. It would be nonsense to ask whether the CV method as a whole has content validity. Some studies will be more content-valid than others. Construct validity testing also occurs at the level of the individual study. However, as such testing is done in more and more studies, the results can have implications for the overall validity of the method. If, for example, CV studies consistently fail construct validity tests, this would raise questions about whether the method as a whole is capable of producing valid value estimates. As we just saw, criterion validity tests are likely to have limited applicability in evaluating the validity of individual studies. Criterion validity studies are mainly relevant to the overall assessment of CV's validity.

Before we turn to a detailed assessment of the content and construct validity of this study, we will first briefly consider the available evidence about the overall validity of the CV method.

6.3 OVERALL VALIDITY OF THE CV METHOD

The question of whether CV is capable of yielding valid economic values is among the most hotly contested issues in economics today, with distinguished economists lining up on both sides. This controversy is all the more confusing to outsiders because some of the most vehement opponents of CV are econometricians from among America's best universities. Much of the body of this criticism is found in various chapters of the book edited by Hausman (1993). Further discussion of the critique may be found in a paper by McFadden (1994). We will attempt only a sketch of the dimensions of the debate here.

Those most critical of CV begin from the standard presupposition that only revealed preference data hold reliable information about economic values. Many economists are dubious about the credibility of verbal reports about economic preferences. That verbal reports are untrustworthy goes back at least Samuelson's (1954) classic theoretical article on public goods. Critics of CV nevertheless agree that ultimately empirical evidence should be consulted to determine whether CV data might also provide valid information about values. However, they believe that there is a major impediment to empirical research on the problem. They reason that revealed preference methods, and most notably market valuation methods, are subject to external validation by comparing market behavior to predictions from econometric models. The problem with CV, as they see it, is that it is not subject to external validation. If people hold non-use values, they will not leave such market or other behavior-based evidence to use for external validation of CV. Hence the critics reason that CV will, even at best, remain inferior to revealed preference measures. They do recognize the possibility of internal validation, though they consider it less potent than external validation. That is, critics of CV do recognize that CV might gain some economic credibility if it could produce results consistent with prior expectations based on economic theory. In the terminology of this report, critics have proposed that CV results be subjected to strict theoretical validity testing. To this end, they carried out a few CV studies, found that the results failed scope tests and other tests based on theory, and concluded that CV cannot even stand up to internal validity tests.

Proponents of CV have been less than convinced by these arguments. In-print support for the method can be found in many places including Mitchell and Carson (1989) and Hanemann (1994). At least lukewarm support has also come from the NOAA Panel on Contingent Valuation, a panel of distinguished scholars co-chaired by Nobel Laureates in Economics Kenneth Arrow and Robert Solow (U.S. Department of Commerce, 1993). We will not attempt to do justice to all the counter arguments, but will attempt to summarize, from our own point of view, the current state of knowledge about the overall validity of CV.

On the conceptual side, we would argue that CV and revealed preference methods have more in common than the critics are admitting. The alleged external testability of revealed preference methods seems to us to be largely an illusion. Theoretically speaking, the welfare triangles from revealed preference valuation studies do not constitute the true values of the commodity being valued. As we have already stressed, the true value of any intervention is the amount of money paid or received that would leave the people affected by the intervention indifferent about it. As we have also stressed already, indifference is an internal mental state that cannot be observed directly. Relationships between estimated welfare triangles and states of indifference must be inferred through theory. Based on theory, we are led to expect that demand functions (in particular, Hicksian compensated demand functions) are determined by consumers in such a way as to make the area under them and above the price line indifference-producing amounts of money, but there is no way to externally validate this theoretical result. Instead, the validity of revealed preference measures of value, like the validity of stated preference measures, can only be addressed using strategies that we have attempted to capture in the Three Cs.

Now, from the standpoint of the Three Cs, one might observe that, for economists, revealed preference data have a high level of content validity *a priori*. Stated preference data do not. We accept this as a starting point for the debate over CV.⁵ Nevertheless, this does not obviate the need to test for validity at the level of the individual study.

It is interesting to consider the theoretical validity of modern market demand studies. Despite the fact that theory clearly points to systems of demand equations where the quantity demanded of each good is a function of all prices and income, it is still not unusual, even today, to find applied studies that estimate a single demand equation. Those studies that do estimate systems of equations generally estimate only a limited subset of the full demand system. Estimation of the subset is justified using separability assumptions that are rarely tested. Furthermore, researchers sometimes impose the fundamental structural requirements of demand theory econometrically, by assuming that functional forms meeting theoretical requirements hold and imposing them on the data. Attempts to estimate flexible functional forms have met with mixed success at best.

Though it has not been referred to explicitly as theoretical validity testing, such testing does normally occur in market demand studies. Demand studies routinely examine regression coefficients for expected signs and statistical significance. More sophisticated studies may test for more complex theoretical prior expectations, such as additivity or whether the Slutsky matrix is negative semi-definite. As might be expected, theoretical validity tests in market demand studies frequently reveal violations of prior expectations.

⁵ One caveat might be inserted at this point. In our view, economists would do well to worry a bit more about the content validity of market data. However, this point is not central here and will not be pursued.

The manner in which failures of validity tests are dealt with in market valuation studies is rather interesting in light of the criticisms being leveled at CV. In market studies, a wrong sign or insignificant coefficient here or there is not taken as a serious problem. The real world has its imperfections, after all. Furthermore, many studies do not do very much validity testing beyond an examination of signs and significance once the functional form that "fits best" is determined. Where systems of demand equations are estimated and the structural requirements of demand theory have not simply been imposed on the data *a priori*, the inability of demand studies to meet theoretical prior expectations is certainly viewed with concern. However, such failures are not necessarily considered to be grounds for rejecting a study outright. Certainly, outright failures of some studies to successfully meet a minimum set of theoretical priors would not be considered grounds for throwing out market demand studies in general.

How economists view validity in market studies has important implications for CV validity assessment. First, given that CV lacks *a priori* content validity, it is especially incumbent on the investigators in CV studies to give careful attention to the content validity of their procedures. At a minimum, in other words, it is incumbent on researchers to measure values well. Otherwise, progress in determining whether resulting values ought to have economic credibility will be hampered. Secondly, estimation of valuation equations and theory-driven hypothesis testing to establish or reject the theoretical validity of CV results seems very much in keeping with normal practice in market demand studies. Basically, this requirement boils down to asking whether there is evidence to indicate that market behavior and responses to CV questions appear to be rooted in mental processes like those modeled in economic theory. The more such evidence one sees, the stronger the foundation for interpreting market values and contingent values as economic values. However, following the same sort of approach as is normal in market studies, one should not be surprised or overly upset to find that not all theoretical expectations are fulfilled all the time. Empirical work is a messy business whether one is dealing with market data or CV data. Finally, and now we return to the question of the overall validity of CV, attempts to draw sweeping conclusions about the validity of CV from a few studies, as the more vociferous critics of CV have done, cannot be justified scientifically. They may have shown that *their* CV studies are invalid, but judgments about the overall validity of the method must be based on the preponderance of evidence across a full range of studies.

Given the credibility of revealed preference data in economics, comparisons of values from applications of revealed preference methods with CV values for the same interventions are particularly potent evidence. In a recent paper, Carson et al. (forthcoming) considered 83 separate studies that supported 616 comparisons of contingent values to revealed preference values for the same interventions. Some of the revealed preference results came from criterion validity studies in which simulated market or actual market comparisons were feasible. Other studies involved comparisons of CV values with hedonic price, travel-cost,

and averting expenditure studies and would probably be more properly considered convergent validity comparisons.

All 83 studies involved WTP. Summary statistics of the ratios of contingent values to revealed preference values were constructed for the full set of studies, for a 5 percent trimmed set of studies, and for a data set that gave equal weight to each study rather than to each CV-revealed preference comparison. For the full set of comparisons, the ratios of contingent values to revealed-preference values averaged 0.89 with a 95% confidence interval of [0.81-0.96] and a median of 0.75. Comparable statistics for the trimmed and weighted comparisons were 0.77 [0.74-0.81] and 0.75 and 0.92 [0.81-1.03] and 0.94, respectively. The Spearman rank correlation coefficients for contingent values and associated revealed-preference values were 0.78, 0.88, and 0.92, respectively.

These results would support the conclusion that CV studies are capable of producing value estimates that are rather close to those that would be obtained from revealed-preference studies in cases where both approaches are possible. If anything, the work by Carson et al. suggests that CV tends to err on the low side compared to revealed-preference valuation procedures. These are rather encouraging results, although more evidence regarding non-use values, where revealed-preference methods are more difficult to apply, would be helpful.

Although the debate over CV continues, many economists have concluded that CV studies, if carried out well, are capable of producing estimates of WTP that are sufficiently accurate to be useful in estimating WTP for environmental interventions like the ones in this study. This was the overall conclusion of the NOAA Panel on Contingent Valuation (U.S. Department of Commerce, 1993), for example. In summary, well-done CV studies have considerable credibility and poorly-done studies may have none at all. This leads us to a more detailed examination of the content and construct validity of the current study.

6.4 CONTENT VALIDITY ASSESSMENT OF THE GCES NON-USE VALUE STUDY

Assessing content validity involves four dimensions. First, the study design must be reviewed for consistency with the underlying economic theory of value. If CV values are to be interpreted as economic values, they must be estimated in ways that are compatible with theory. Among the issues that have to be considered here are those associated with budget constraints, the availability of substitutes and complements, and the incentive compatibility of the valuation mechanism. Second, the extent to which the study communicates effectively to potential respondents must be evaluated. These first two dimensions might be summarized by saying that a valid CV study must deal with both *Homo economicus* and *Homo sapiens* in ways that are conducive to value revelation. Third, whether various facets of study execution were adequate must be considered. Such matters as sampling and response rates are examined here. Fourth, procedures followed as the study results were analyzed and reported must be considered. Here, attention is focused on econometrics and quality of reporting.

In an attempt to flesh out these principles, Bishop and McCollum (1995) have proposed the rating form presented as Figure 6-1. The form is composed of 12 detailed questions about study procedures plus additional related questions. Certain parts of the form are specifically designed for use by outside reviewers of CV studies. For example, the rating form suggests that points be assigned for each of the 12 detailed questions depending on how well the study did in addressing the issues raised in each question. It also asks for a total score (Question 13) and for a qualitative rating of the study (Question 15) on a scale ranging from Excellent to Unacceptable. While it would make little sense for us as the researchers to assign points or qualitative ratings to our own study, we can use the 12 detailed questions to organize our reasons for believing that our study was designed and executed in ways that give it high content validity.

Figure 6.1
Content Validity Rating Form for Contingent Valuation Studies

1. Was the theoretical true value clearly and correctly defined? (5 points)
2. Were the environmental attributes relevant to potential subjects fully identified? (10 points)
3. Were the potential effects of the intervention on environmental attributes and other economic parameters adequately documented and communicated? (10 points)
4. Were respondents aware of their budget constraints and of the existence and status of environmental and other substitutes? (5 points)
5. Was the context for valuation fully specified and incentive compatible? (10 points).....
6. Did survey participants accept the scenario? Did they believe the scenario? (10 points)
7. How adequate and complete were survey questions other than those designed to elicit values? (10 points)
8. Was the survey mode appropriate? (10 points)
9. Were qualitative research procedures, pretests, and pilots sufficient to find and remedy identifiable flaws in the instrument and associated materials? (5 points)
10. Given study objectives, how adequate were procedures employed to choose study subjects, assign them to treatments (if applicable), and encourage high response rates? (10 points)
11. Was the econometric analysis adequate? (10 points)
12. How adequate are the written materials from the study? (5 points)
13. Total points

(continued)

Figure 6.1 (continued)
Content Validity Rating Form for Contingent Valuation Studies

14. Are there other concerns relating to the design and execution of the study that have not already been addressed?

15. Considering the issues raised in Question 1 through 12, your total score as calculated for Question 13, and any additional issues raised under Question 14, how would you rate this study overall?

- _____ Excellent
- _____ Good
- _____ Fair
- _____ Poor
- _____ Unacceptable (Study Fatally Flawed)

(1) Was the theoretical true value clearly and correctly defined? Soon after the GCES Non-Use Value Study was conceived in general terms, the values to be estimated were defined in theoretical terms and presented in a report along with a discussion of various theoretical issues and a review of the literature on total value (Bishop et al., 1991). This work was subjected to a peer review by four experts in the field of environmental economics who provided numerous comments and suggestions.

(2) Were the environmental attributes relevant to potential subjects fully identified? Eight focus groups were conducted early in the process of designing the study. To probe in a preliminary way for relevant regional differences among potential future survey respondents, these groups were held in New York State, Tennessee, Nebraska, Arizona, and Utah. The groups were evenly split between urban and rural participants. An additional seven focus groups were later held at various locations and six observed personal interviews using the draft survey instrument were conducted in Madison, WI. Results from the focus groups and interviews are presented in Appendix B of this report. Throughout this process, a great deal of attention was devoted to investigating which of the potential effects of changing dam operations were relevant to people and why. We incorporated what we learned into the survey instruments.

(3) Were the potential effects of the intervention on environmental attributes and other economic parameters adequately documented and communicated? Potential effects of changing dam operations on environmental and cultural resources were tailored to correspond to the effects identified in the GCDEIS (U.S. Bureau of Reclamation, 1995). Effects of changes in dam operations on power costs were studied by the Power Resources Committee

under the auspices of the Glen Canyon Environmental Studies and associated agencies. Their estimates of power cost impacts were translated into potential effects on retail power rates with the help of the Western Area Power Administration. Drafts of the survey instruments were repeatedly revised for effective communication through the process of focus groups, observed interviews, pretests, and the pilot study. Throughout this process the researchers worked with the Non-Use Value Committee. This committee, as described above, was composed of representatives from relevant federal and state agencies, Indian tribes, and interest groups. Much attention was devoted during committee meetings to the accuracy of the information presented to respondents as well as effectiveness and neutrality of communication.

Respondents' understanding of the information provided about potentially affected resources and the effects of dam operations were investigated within the survey through a set of true-false questions. In the final survey, respondents in the national sample averaged 89 percent correct in answering these questions, and respondents in the marketing area sample averaged 90 percent correct.

(4) Were respondents aware of their budget constraints and of the existence and status of environmental and other substitutes? We addressed this issue by including the following statement just prior to the valuation question in the national survey (emphasis in original):

The higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal. Taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

The comparable statement in the marketing area survey was (emphasis in original):

How would you vote on this proposal if passage meant your utility bill would increase? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

The budget constraint was further emphasized by asking respondents to list the items on which they would spend less money if the proposal passed. After explicitly considering their expenditure alternatives, respondents were offered the opportunity to change their vote on the proposal.

(5) Was the context for valuation fully specified and incentive compatible? Context refers to all dimensions of the possible transactions posed in the CV question: how decisions about implementing the intervention will be made and how money referred to in the CV question will be paid. Examples may include the timing of payments, who else will be paying (the "extent of the market," see Smith, 1993), and the payment vehicle (e.g., taxes, prices of goods and services, user fees). A context is "complete" when respondents have enough such details to feel that they understand the terms of the transaction proposed in the valuation exercise (Fischhoff and Furby, 1988). For example, if respondents feel that they do not have adequate information about the timing of the payment or the decision process that determines whether the intervention will be implemented, then the context would be incomplete.

Throughout the focus groups and other steps in instrument design reported in Appendix B, we probed for possible incompleteness of the context and corrected the instruments accordingly. Respondents were told that government officials who would be deciding how to operate the dam in the future needed to know, among other things, whether the proposal presented in the survey would be worthwhile to people like them. Specific payment mechanisms in the form of federal taxes for the national sample and electric utility bills for the marketing area sample were specified. The extent of the market was taxpayers for the national sample and electric power consumers for the marketing area. If proposals were passed, payments were to last for the indefinite future. A referendum format with single-bounded discrete choice responses was adopted. Such a format is widely considered to be incentive-compatible (Hoehn and Randall, 1987; Mitchell and Carson, 1989).

(6) Did survey participants accept the scenario? Did they believe the scenario? A study subject accepts the scenario when he or she at least implicitly agrees to proceed with the valuation exercise based on the information and context provided. Scenario rejection can lead either to poor quality valuation data or item non-response for CV questions. Thus, a valid CV study will strive to develop an acceptable scenario. Study subjects believe the scenario to the extent that they are convinced that their responses to the CV question will actually affect the availability and/or quality of the environmental amenity being evaluated and how much they will actually pay or receive in compensation. Although not a requirement for a content-valid study, belief in the scenario is highly desirable.

One purpose of the focus groups and observed personal interviews was to develop respondent-acceptable survey materials. For example, the use of utility bills as a payment vehicle for the national sample was ruled out because focus group participants outside the West found this vehicle implausible.

Further evidence on acceptance and belief is provided by the survey respondents themselves. Nearly all survey respondents felt that the results of the study should be considered when making decisions about future operations of Glen Canyon Dam (97 percent in the national sample and 96 percent in the marketing area sample). Furthermore, a large proportion of these respondents believed they would actually have to pay if the proposal passed. In the national sample, 72 percent of individuals answering the CV question believed their taxes would increase if the proposal passed. In the marketing area sample, 83 percent of respondents believed their utility bills would increase if the proposal passed. In summary, respondents tended to believe they would have to pay if the proposal passed and that their vote on the proposal ought to be a factor in determining future dam operations. We believe this indicates a high degree of belief in and acceptance of the contingent valuation scenario.

However, one source of some concern about the believability of the scenario did arise from our analysis. For the national sample, those who did not believe that their taxes would rise if the proposal passed were more likely to vote definitely yes than those who thought their taxes would rise (see Table 5-19). One possible interpretation of this result is that these people might have answered the CV question with strategic intentions. That is to say, desiring to see the proposal in question instituted, those who figured they would not have to actually pay, may have answered definitely yes to amounts larger than they would really be willing to pay. If accepted, this interpretation would reduce the validity of the study results. In response to this concern, the values for the national sample were adjusted as explained in Chapter 5. Furthermore, other interpretations of this result are possible. For one, rather than responding to the CV question strategically, it is conceivable that those who tended to answer definitely yes may have also been sufficiently sophisticated in their understanding of government to have realized that their taxes would not really rise. Comparisons of the socioeconomic characteristics of those who did and did not believe that their taxes would rise did not identify any significant differences. Thus, further support for these and other alternative interpretations of the result in question are not forthcoming. Beyond the adjustment for beliefs about taxes just mentioned, more drastic steps to somehow correct for possible strategic influences did not seem warranted.

(7) How adequate and complete were survey questions other than those designed to elicit values? Questions other than the valuation questions provide data to support construct validity testing and may also provide decision makers with useful information of a non-economic nature. Our survey contained standard environmental attitude questions, as well as questions on attitudes toward cultural resources, American Indians, and national parks.

Demographic data were also gathered. Pilot study results were used to select questions that were most promising in predicting WTP.

The questions discussed in the preceding paragraph regarding whether survey respondents felt the results ought to be used and would be used, as well as those asking whether respondents believed their taxes or utility bills would increase were adopted for the final survey to help assess the validity of the exercise.

(8) Was the survey mode appropriate? Except for telephone interviews with nonrespondents to the mail survey, this study was conducted entirely by mail. This survey method is a potential source of trouble in a study of this type. It is probable that in a sample of U.S. residents or even in the marketing area sample, many people would not be familiar with the environmental and cultural resources at the bottom of the Grand Canyon or how those resources would be affected under alternative dam operations. Thus, a great deal of information had to be communicated to survey recipients at the beginning of the survey. Informing potential respondents of all the relevant issues through written information and related material required a substantial effort to ensure that the materials conveyed the correct information. The NOAA Panel and the proposed rules for damage assessment (U.S. Department of Commerce, 1993; U.S. Department of the Interior, 1994; U.S. Department of Commerce, 1994) recognize the potential for such problems by recommending that CV studies be conducted using personal interviews.

Although we do not want to minimize the potential problems of mail surveys for non-use value studies, we have some evidence that indicates our mail survey performed well. First, there were the relatively high scores on the true-false questions, as previously reported. The scores indicated that most respondents had an excellent grasp of the information we provided. Second, our pilot results showed that responses were not sensitive to minor changes in how the information was worded (Appendix C). Third, nearly all respondents felt that the results of the study should be used in future decision making, which can be interpreted as a vote of confidence that respondents felt they had participated in a sound survey. Fourth, a further vote of confidence from respondents came in the high response rates both nationally and especially in the market area. Low response rates can be indicative of poor communication in the survey and other design problems. Finally, as we shall see below, the results of the construct validity testing were quite positive. Poor data due to an overly complex survey that failed to communicate would not have fared so well.

(9) Were qualitative research procedures, pretests, and pilots sufficient to find and remedy identifiable flaws in the instrument and associated materials? As already discussed, this study involved extensive efforts to refine the survey instruments. Focus groups, observed one-on-one interviews, and a large pilot study all contributed to the evolution of the surveys. The study was scrutinized at each step in its design and execution by the Non-Use Value Committee. The design process and the survey instruments at various

stages of development were also reviewed by our panel of peer reviewers. Pilot and final instruments were approved by the Office of Management and Budget.

(10) Given the study objectives, how adequate were the procedures for choosing study subjects, assigning them to treatments (if applicable), and encouraging high response rates? Our samples were purchased from a firm that is widely recognized for the quality of its mail survey samples. Potential respondents were carefully assigned at random to the various cells for both the pilot and final surveys. The marketing area sample was selected from households with ZIP codes in areas served by utilities holding long-term firm-power contracts with the Salt Lake City office of the Western Area Power Administration (WAPA). The contracts held by these utilities represented approximately one-half of the firm power marketed from the Salt Lake City Area integrated projects, of which Glen Canyon represents approximately 80 percent of all the power generated. Although power from Glen Canyon Dam is marketed from several other WAPA offices, representatives from WAPA felt that the areas served by the Salt Lake City office would be typical of other areas served by power produced at Glen Canyon Dam. The ZIP codes list provided by WAPA included ZIP codes in Utah, New Mexico, Arizona, Nevada, Colorado, and Wyoming.

Samples provided by the sampling firm typically identify a head of household (usually a male). To avoid a potential bias associated with surveying only heads of households, the survey was addressed to the entire household in care of the identified sample point. For example, if John Smith was the sampled individual, the survey was sent to the John Smith household in care of John Smith. Instructions in the cover letter and on a post-it note attached to the survey materials requested that the survey be completed by the adult member of the household with the latest birthday in the calendar year. This method allowed us to more randomly select adult members of the household to complete the survey and thus resulted in a nearly even gender split among the respondents.

Two sources of concern arise with respect to mail surveys. First, mail surveys samples are assembled using telephone directory listings. Such samples are subject to potential non-coverage errors, to the extent that households either have no telephone or have an unlisted telephone number. For this particular study, the potential for non-coverage errors was reduced by augmenting telephone directory listings with drivers license records in the three states where Department of Motor Vehicles license records were available. The second concern with the mail survey methodology is that non-response to the survey may mean that respondents are not representative of the initial sample. High response rates minimize the potential bias resulting from survey non-response. As described in Chapter 4 and Appendix C, several steps, including the use of a prepaid monetary incentive and extensive follow up contacts of nonrespondents, were used to increase the survey response rate.

While we believe this study achieved as high a rate of coverage and as high a response rate as was possible given the resources available, coverage and response rate are a matter of degree. Unless one achieves a 100 percent coverage and response rate, there remains a possibility of bias. To help assess the adequacy of the sample coverage and the response rate, we compare basic background characteristics of the U.S. population with estimates of these same characteristics for the sampling frame and the respondents to the mail and telephone surveys (Table 6.1).⁶

⁶ Additional information regarding sampling and sources of data for Table 6-1 are found in Appendix D.

Table 6-1
Characteristics of the Population, Sample Frame, and Survey Respondents

	Population Characteristics ^a	National Sample Frame Characteristics ^b	National Sample Respondent Characteristics ^c
Age:			
18 - 24 Years	13.4%	14.4%	4.1%
25 - 34 Years	22.0	22.0	17.5
35 - 44 Years	21.4	20.7	22.7
45 - 54 Years	15.0	14.5	19.8
55 - 64 Years	11.0	11.3	12.5
65 Years or older	17.2	17.1	23.4
	(190,674,000)	(190,282,531)	(1,913)
Percent Male:			
	47.9%	NA	52.8%
	(190,674,000)		(1,878)
Education:^d			
High school graduate or higher	80.2%	NA	91.6%
	(165,012,000)		(1,789)
Bachelors degree or higher ^e	21.9%	NA	43.8%
	(165,012,000)		(1,789)
Average Household Size:			
	2.6 people	NA	2.7 people
	(96,391,000)		(1,765)
Household Income:			
\$0 - \$9,999	NA	14.2%	7.1%
\$10 - \$14,999		8.4	7.2
\$15 - \$24,999		16.5	15.1
\$25 - \$34,999		15.3	18.0
\$35 - \$49,999		17.9	19.4
\$50 - \$99,999		21.9	26.9
\$100,000 or more		5.7	6.3
		(94,705,985)	(1,741)

(continued)

Table 6-1
Characteristics of the Population, Sample Frame, and Survey Respondents
(Continued)

Income:^f			
Average household	NA	\$41,911 (94,705,985)	\$42,856 (1,741)
Median household	\$30,786 (96,391,000)	NA	\$37,250 (1,741)
Median family	\$36,950 (68,100,000)	NA	NA

^a U.S. Census projected estimates for 1993.

^b Information provided by SSI, projected forward from the 1990 U.S. Census.

^c To more fully represent the portion of the national sample contacted, results are reported for the combined mail and telephone survey data. For cases where respondents might be represented in both data sets, the mail survey data is excluded.

^d Education is reported for individuals 25 years old or older.

^e Information reported for national sample respondent characteristics represents respondents who reported being a college or technical school graduate or having completed post graduate work.

^f Median household income reported for the population is projected for 1992, in 1992 dollars, and the median family income is projected for 1993, in 1993 dollars.

() Numbers in parentheses indicate the number of valid cases.

NA Information is not available.

Respondents to the survey appear to be slightly older and have a higher level of educational attainment than the population at large. The average household income of respondents is close to the estimated average household income for the sampling frame. Furthermore, the median household income of respondents is very close to the median family income as estimated by the U.S. Census Bureau. In summary, while the characteristics of survey respondents do not exactly replicate those of the population, the differences are not substantial. In combination with the procedures used to extrapolate the survey data to the population to calculate an average willingness-to-pay for the relevant population, we believe the procedures used in this study have been successful in minimizing the potential biases associated with non-coverage and non-response.

(11) **Was the econometric analysis adequate?** We endeavored to be thorough and statistically sound in the econometric procedures applied. Econometric suggestions from our peer review panel and the Non-Use Value Committee were implemented to the extent practical.

(12) How adequate are the written materials from the study? We fully agree with and have attempted to meet, the reporting requirements set by the NOAA Panel (U.S. Department of Commerce, 1993):

Every report of a CV study should make clear the definition of the population sampled, the sampling frame used, the sample size, the overall sample non-response rate and its components (e.g., refusals), and item non-response on all important questions. The report should also reproduce the exact wording and sequence of the questionnaire and of other communications to respondents (e.g., advance letters). All data from the study should be archived and made available to interested parties . . .

In addition, we have described the qualitative research done as part of instrument development and the results of those efforts; the pilot study results; how the survey instrument was modified after the pilot study; and the final study results. Procedures for estimating aggregate values were explained. Finally, and here we believe our study is unusual, we have attempted to explicitly and systematically assess the validity of the study's procedures and results.

6.5 CONSTRUCT VALIDITY ASSESSMENT

Construct validity assessment offers another strategy for judging the accuracy of contingent values. Given the potential role of non-use values in this study, convergent validity comparisons were not relevant. However, theoretical validity testing was a high priority from the beginning. To re-emphasize a basic point of this chapter, the stronger the linkages are between a study's results and economic theory, the firmer the foundation is for interpreting CV values as economic values. Weaknesses identified during theoretical validity testing could indicate flaws in study design that were not detected when content validity was assessed or they could be symptomatic of unknown factors outside the theory that are influencing results. In either case, the link between observed CV values and the theoretical ideal is weakened.

Bishop et al. (1994) proposed that a distinction be made between "rudimentary" and "advanced" theoretical validity tests. Rudimentary tests use regression analyses, contingency tables, and other such procedures to explore whether prior expectations about the relationships between responses to CV questions and other types of data were met by the study's results. For rudimentary tests, it is worth explicitly recognizing that an important role exists for common knowledge and intuition as well. An example from market demand estimation would be the commonly made assumption that meats like beef and pork are substitutes for each other. There is no reason in theory for this hypothesis, but it would certainly be supported by introspection and casual observation. Likewise, one might

hypothesize that members of environmental organizations would have higher values for environmental improvements than non-members. Thus, relationships between CV question responses and income, socioeconomic characteristics, self-reported past behavior (e.g., having visited the area where the environmental resource is located), and attitudinal measures are often evaluated in rudimentary tests. To the extent that such relationships are significant and accompanied by expected signs, the study is judged to have higher construct validity.

In contrast to the rudimentary tests, advanced theoretical validity tests involve prior expectations about the relationships between contingent values, most often from the same study. Scope tests, one example of advanced tests, have been much discussed lately. The credibility of the advanced tests is enhanced if the survey instrument (or instruments) has high content validity and the values to be compared come from independent samples. Passing advanced tests is potent evidence that CV survey responses are rooted to a significant degree in decision processes consistent with economic theory.

Bishop et al. (1994, pp. 22-23) suggest that results from rudimentary and advanced tests should be interpreted in the following way:

We propose that studies be categorized into a three-level hierarchy expressing increasing degrees of construct validity. At the lowest level would be studies that either have not included any construct validity tests or have failed to pass rudimentary tests . . . Such studies may still be useful for scientific purposes or as exercises involving the training of students, but should be used in policy analysis and litigation only with the heaviest caveats. The second level of the hierarchy would involve studies that have achieved a fair amount of success in the rudimentary tests, but that either do not have the budget to support advanced testing or have not succeeded in passing advanced tests. Second-level studies may be usable in cost-benefit analyses, since normally such analyses are simply interested in determining whether the benefits of an intervention exceed the costs. Of course, suitable caveats would need to be introduced into such studies. Unless benefits exceed costs by a fairly wide margin or vice versa, potential imprecision in second level studies may mean that the issue of whether benefits exceed costs remains open. Second level studies may be less useful for litigation, where relatively precise estimates of value are needed to assess damages, but they may still be useful in preliminary damage assessments . . . Third level studies are studies that have conducted and achieved substantial success in sophisticated rudimentary tests and/or have conducted and passed advanced tests. Provided that such studies are judged to have a high degree of content validity as well, they would have the highest level of credibility for benefit-cost analysis and litigation.

To consider the level of the current study in this hierarchy, consider first how well the study performed in rudimentary tests. Logistic equations presented in Tables 5-19 and 5-20 indicate that willingness to pay is strongly related to factors like income, education, environmental attitudes, and expectations of future visits to the Grand Canyon in ways that are quite consistent with prior expectations.

Several advanced tests were passed as well. First, theory would lead one to expect that responses to CV questions should not be sensitive to seemingly innocuous wording changes. Pilot test results confirmed (Appendix C) that values did not change in statistically significant ways when minor wording changes and changes in the order of the information were introduced.

A second advanced test relates to prior expectations about how electricity price impacts would affect WTP estimates. Recall that for the national sample in the final study, each version contained descriptions of the environmental benefits and electricity price impacts for a specific alternative dam operation. Furthermore, for increasingly severe restrictions on power generation--from the moderate fluctuating flow alternative to the low fluctuating flow alternative and then the seasonally adjusted steady flow alternative--increasing levels of environmental improvements were associated with increasing power price impacts. Based on the focus groups results, we were confident that environmental improvements were viewed by many potential respondents as positive attributes of the alternatives, whereas increasing price impacts were often viewed as negative impacts. In the pilot study, values increased as more stringent constraints on dam operations were introduced. We tended to interpret this as evidence that environmental concerns were outweighing empathy for power consumers. However, an alternative interpretation arose in reviewing the pilot results. It was suggested that higher contingent values expressed for the seasonally adjusted steady flow alternative may have resulted because respondents used the power price impacts as a cue to the value they should express for that proposal. This concern was addressed by including Version 4 in the final study. Version 4 contained the environmental impacts of Version 3 (the seasonally adjusted steady flow alternative) but the power impacts of Version 2 (the low fluctuating flow alternative). That is, the environmental effects in Version 3 and Version 4 were identical, while the power price impacts in Version 4 were lower than in Version 3. If respondents were weighing environmental positives against power price impact negatives in a theoretically consistent way then Version 4 ought to generate higher values than Version 3. If the price impacts were providing a cue for respondents then, contrary to what would be expected based on theory and the focus groups, Version 4 ought to have had a lower value. As we saw in the preceding chapter, Version 4's value was larger, supporting the theoretical validity of the study.

Finally, several scope tests were applied using the pilot and final survey results. In both the pilot test and the final survey, the portion of respondents who would support proposals if the cost to them were zero varied significantly across proposals in ways that were consistent with

prior expectations. In the pilot survey for the national sample, among those who would vote for the proposals at zero cost to them, mean WTP for the seasonally adjusted steady flow alternative was rather consistently more than the mean WTP for the moderate fluctuating flow alternative based on the various statistical tests performed. Furthermore, in the national-sample pilot test, Version 8, which was identical to Version 3 except that impacts to Native Americans, trout, and native fish were deleted, produced a lower value than Version 3. This lower value was marginally significant in the definitely-yes models and quite significant in the combined definitely-yes and probably-yes models. This outcome confirmed prior expectations.

Interpretation of the scope tests was somewhat more complicated in the final survey. Some changes made to the scenarios between the pilot survey and the final survey reduced the likelihood of finding significantly different values for the seasonally adjusted steady flow alternative compared to the modified fluctuating flow alternative. For example, the description of the seasonally adjusted steady flow alternative was modified to make it less environmentally beneficial. In particular, the pilot version indicated that endangered native fish populations would increase. To conform to more recent conclusions in the GCDEIS, the final version said that "Native fish . . . would most likely increase in numbers. However, competition from non-native species may still limit the growth of native fish populations." (See Appendix C for additional changes in the scenario between the pilot and final surveys.) Also, the statistical tests performed during the pilot study had the benefit of the greater statistical precision associated with the multiple-bounded CV questions; the final study did not. Because the multiple-bounded approach is still relatively new and unproven, a decision was made to implement the final survey using the traditional single-bounded approach. This reduced the statistical precision of the final estimates, making scope more difficult to demonstrate.

Tables 5-19 and 5-20 list the dummy variables for the different survey versions (variables D2-D7). Tests of significance of these dummy variables can be interpreted as scope tests. D3 has the expected sign but is not significant. In other words, for the national sample, the estimated distribution of values for the seasonally adjusted steady flow alternative was not significantly different from the distribution for the moderate fluctuating flow alternative. However, the difference is close to significant with $P=0.175$ and $P=0.254$ for the definitely yes and the definitely/probably yes models, respectively.

It is also worth noting that these two alternatives are less than perfect as scope tests because the environmental improvements are counterbalanced by heavier power price impacts. Not only does the dummy variable D4 stand counter to the hypothesis that respondents were basing their values on cues provided by the power impacts (as we learned above), it also serves as a clearer scope test because it combines the environmental improvements of the seasonally adjusted steady flow alternative with the power impacts of the low fluctuating flow alternative. And D4 is statistically significant ($P=0.062$ for the definitely yes model and

P=0.055 for the definitely/probably yes model). Thus, based on both the pilot study results and the significance of D4, we conclude that our study passes scope tests for the national survey.

For the marketing area, results of the final study also show some signs of passing scope tests, but the evidence is somewhat less compelling. The positive result is for D6 which is significant at P=0.018 for the definitely/probably yes model. For that model, the estimated WTP for the low fluctuating flow alternative is significantly larger than for the moderate fluctuating flow alternative. However, that result does not carry over to the definitely yes model. There, D6 is not only insignificant, but has the wrong sign. D7, the dummy variable for the seasonally adjusted steady flow alternative, is not significant in either model, but comes close in the definitely/probably yes model (P=0.113). Combined with the lack of demonstrated sensitivity to scope for the marketing area in the pilot survey, the case for stating that the marketing area study has passed advanced tests is somewhat weaker than for the national survey.

Of course, as with many empirical data sets, anomalies can be present. In this data set, for example, one would expect, all else equal, that the percentage of "Yes" votes would decrease as the dollar value of the bid amount increases. In actuality, the percentage of "Yes" votes (when aggregated across all survey versions) appears to be too low for the \$150 bid amount when judged against the percentage of "Yes" votes at the \$120 and \$200 bid amounts. Furthermore, this anomaly appears to be present for female respondents, but absent for male respondents.⁷ We have been unable to find an explanation for this anomaly and have simply accepted it for the present analysis as a quirk of this particular data set. However, as reported in Tables 5-19 and 5-20, even in the presence of this anomaly the coefficient for the bid amount still has the expected (negative) sign.

We conclude that the national survey should be categorized as a Level 3 study in the framework proposed above. That is, the national sample results are of sufficient validity to be used in decision making with minimal reservations. Though the scope test results are mixed for the marketing area sample, its strong showing in the rudimentary tests and the one positive scope test is encouraging. In terms of construct validity, it should probably be placed toward the bottom of Level 3 or at the very top of Level 2.

⁷ Appendix H provides a discussion of this issue.

6.6 CONCLUSION

A content-valid CV study is rooted throughout in a clear theoretical definition of the true value of the intervention. Using well-documented evidence of the respondent-relevant effects of the intervention, a sound study will effectively communicate the potential effects of the intervention to respondents. It includes whatever information respondents might need regarding substitutes for the environmental resources in question and reminds them of their budget constraints if necessary. It also includes a fully specified and incentive-compatible context for valuation. The sound study does all this in ways that potential respondents will accept and, if possible, believe. Looking beyond the scenario, a content-valid survey instrument includes well-designed questions to support construct validity testing and achieve other goals. The mode chosen for administering the survey must be appropriate for the complexity of the scenario and the ultimate goals of the study. Prior to administration, the instrument must be subjected to sufficient qualitative investigation, pretesting, and, if needed, pilot testing to eliminate as many problems as possible. Econometric analysis of the results must be adequately performed and the final results effectively reported. We believe that the GCES Non-Use Value Study meets these standards well.

A construct-valid CV study has passed both rudimentary and advanced theoretical validity tests. The valuation equations estimated in this study showed a high degree of consistency between study results and prior expectations. Furthermore, with the caveats expressed at the end of the last section about the marketing area surveys, we were able to achieve considerable success in passing scope tests.

Our conclusion, then, is that the GCES Non-Use Value Study has demonstrated sufficiently high levels of content and construct validity to be used in choosing the criteria for operating Glen Canyon Dam in the future. Integrating the results of this study with results of the power and recreation valuation studies should help to judge the economic implications of alternative criteria for operation of Glen Canyon Dam.

APPENDIX A
GCES NON-USE VALUE STUDY TIMELINE

GCES Non-Use Value Study Timeline

December, 1990	GCES authorizes study on conceptual framework and prospects for a successful Non-Use Value Study
April, 1991	Conceptual framework proposed and submitted for peer review
July, 1991	Submit final report on conceptual framework and prospects for a successful study
January, 1992	Begin qualitative research on instrument design
September, 1992	Submit preliminary report on findings from qualitative research
January, 1993	Conduct additional qualitative research on instrument design. Submit description of water release alternatives to EIS members for review
July, 1993	Receive approval to proceed with study plan for a pilot test
January, 1994	Finalize pilot test survey and experimental design Receive OMB approval of proposed pilot test and study plan Pilot test implementation and analysis
May, 1994	Submit results of pilot test for peer review, and discuss prospects for a successful final study
June, 1994	Review of pilot test results by Non-Use Value Committee
May-June, 1994	OMB review of pilot test study and approval of final study plan

July, 1994	Submit results of pilot test to cooperating agencies for review and recommendation for final study
August, 1994	Finalize experimental design and survey materials in coordination with non-use value committee and OMB
October, 1994	Field mail survey
January, 1995	Field telephone survey
March, 1995	Present preliminary results to Non-Use Value Committee. Receive recommendations for additional analyses
May, 1995	Present a draft summary report for review
July, 1995	Submit a draft report of the final study results for review
August, 1995	Final study results subjected to peer review and recommendations
September, 1995	Submit Final Report of Non-Use Value Study Results to GCES Non-Use Values Committee

APPENDIX B
GCES NON-USE VALUE QUALITATIVE RESEARCH

B.1 INTRODUCTION AND INTERPRETATION OF QUALITATIVE RESEARCH

Many features of the final GCES (Glen Canyon Environmental Studies) non-use value survey were the result of a substantial qualitative research program that began in early 1992 and continued for two years. The GCES Non-Use Value qualitative research program included focus groups and in-depth personal interviews. This appendix provides an overview of this research. Before discussing the research program, however, it is important to reiterate several general points about the appropriate use and reporting of qualitative data. In this study, qualitative research provided valuable insights into the ways that people thought about the Grand Canyon and clarified how to best present the technical information about dam operations and the consequences of changes in dam operations. These insights were then used to help design better questionnaires for the quantitative general population surveys.

It is important to remember that the results from qualitative research are not generally used to make quantitative estimates of the proportion of people who hold a certain attitude or belief. One reason is because participants in focus groups and in-depth personal interviews may not represent the population from which they are selected. Furthermore, the sample sizes for qualitative research are generally small. These two characteristics of qualitative research usually make it inappropriate to report quantitative type results, such as "65 percent of the participants said this." Rather, the results of qualitative research are usually reported by using qualitative terms, such as "some people said this," or "most people said this."

Although the results from qualitative research are not generally used to estimate the percentage of individuals who hold a certain attitude or belief, they are frequently used to determine the range of attitudes and beliefs that different people hold about a topic, as well as the degree to which potential survey respondents comprehend the potential survey materials.

B.2 RECRUITING PARTICIPANTS FOR THE QUALITATIVE RESEARCH

Even if participants are selected from a random sample of residents near the focus group site, many factors can result in a set of participants that is not representative sample of the population. For instance, it can often be difficult to get a sufficient number of people to attend a focus group meeting. Even though participants were offered \$25 to \$35 to participate in this study, it was difficult to get individuals to agree to come to a discussion (or an interview) at a specific time and place. A second important factor is the salience of the topic to be discussed. If the topic is specifically identified during recruitment and if is of special interest to a subgroup of the population, there is a risk that only those individuals most interested will agree to attend. If this happens, participants will be more representative

of people who are interested in the topic than of the population from which they were selected. To avoid this second type of problem, potential participants were told during recruitment only that the discussion would involve issues related to national parks or to trade-offs between economics and the environment. They were also told that even if they felt they had very little information about the topic, they would still be able to participate. Recruiting scripts were designed to sound interesting to a wide range of potential participants without telling them the specific topic that was to be addressed.

B.3 DECISION RULES FOR EVALUATING QUALITATIVE RESEARCH RESULTS

Because qualitative research provides data on the range of attitudes and beliefs (and the degrees of comprehension) rather than on the proportion of people holding these attitudes and beliefs, the criteria used to evaluate the results of the non-use value focus group discussions did not take the form of quantitative decision rules. As the name suggests, qualitative research results in data that are qualitative in nature and that require the application of qualitative decision criteria. For example, in this study a target percentage of participants who felt that the alternative dam operations had value did not have to be specified in order to proceed with general population surveys. Rather, the observation that alternative dam operations had value to some of the participants was sufficient evidence for proceeding to the quantitative research phase of the study. Only the general population surveys in the quantitative phase can indicate the percentage of people for whom the alternative dam operations have value, or estimate the aggregate values across respondents. Similarly, as long as the qualitative research program indicated that the technical information on dam impacts was understandable to at least some of the participants, the decision could be made to proceed with the quantitative research phase to determine the actual percentage of people who could understand this technical information.

Practically speaking, these rather gross decision criteria suggest that the chances of proceeding to a quantitative research phase were quite high. Only if the qualitative research had indicated that virtually no one understood the impacts of various alternative dam operations or saw value in the environmental changes that might occur if dam operations were changed, would we have recommended not proceeding with the design and pretesting of a contingent valuation survey. Because of this, the qualitative research program was primarily viewed by the research team as an aid to survey design.

The qualitative research program for the GCES Non-Use Value study was carried out in two steps. The first step consisted of a series of eight focus groups held in various locations around the country. The purpose of these focus groups was to explore the feasibility of designing and implementing a study of the non-use values associated with resources affected by the operation of Glen Canyon Dam. The first step of the program was carried out in

different parts of the country to help ensure that we would hear most (or all) of the different attitudes and beliefs about the impacts of dam operations on the Colorado River environment in the Grand Canyon. Upon successful completion of the first step, the second step was carried out. The purpose of the second step was to evaluate and refine various drafts of potential survey instruments.

B. 4 INITIAL FOCUS GROUP DISCUSSIONS

The first step in the program was initiated with a series of eight focus group discussions held at various locations around the country. The locations were chosen to represent a broad geographic spectrum of U.S. citizens and to include residents in both urban and suburban/rural areas. Four geographic areas were chosen: New York, Tennessee, Nebraska, and Arizona/Utah. Two focus groups discussions were held in each location, one in an urban area and one in a suburban or rural location nearby. In New York, participants in the urban discussion groups were chosen at random from the metropolitan area of Buffalo, New York. Participants in the suburban/rural discussion group were chosen from the city of Batavia. In Tennessee, the urban group was recruited from the metropolitan Nashville area, and participants in the suburban/rural group were chosen from the area around Murfreesboro. In Nebraska, the urban group was recruited from the city of Omaha, while the participants in the suburban/rural group were chosen from the Columbus area. The urban group in the Arizona/Utah area was held in Phoenix and the suburban/rural group was held in St. George, Utah. In addition to being a smaller town, St. George was also chosen because electric utilities serving the city have firm power contracts for power generated at Glen Canyon Dam. Table B-1 summarizes the dates and locations of the initial round of focus group discussions.

Table B-1
Dates and Locations of the Focus Group Discussions

Location	Date	Number of Participants	Presentation of Information	Contingent Valuation Vehicle
Buffalo, NY	February 5, 1992	10	Oral/Visual	Monthly Utility Bill
Batavia, NY	February 6, 1992	6	Oral/Visual	Monthly Utility Bill
Nashville, TN	March 18, 1992	10	Oral/Visual	Monthly Utility Bill
Murfreesboro, TN	March 19, 1992	10	Oral/Visual	Monthly Utility Bill
Omaha, NE	August 20, 1992	10	Written	Monthly Utility Bill
Columbus, NE	August 31, 1992	12	Written	Lump Sum Tax Increase
Phoenix, AZ	September 9, 1992	10	Written	Monthly Utility Bill
St. George, UT	September 10, 1992	10	Written	Monthly Utility Bill

B.4.1 Focus Group Discussion Topics

Focus group discussions are typically controlled by an agenda summarizing the major topics to be covered during the discussion. In these eight initial focus groups, the agenda centered around four major topics:

1. A general discussion of information, knowledge, attitudes, and beliefs about the Grand Canyon that participants brought with them to the focus group discussion.
2. Presentation and evaluation of information describing how Glen Canyon Dam has altered the flows of the Colorado River in the Grand Canyon. Participants were also asked to predict how these changes in flow patterns might have affected the ecosystem associated with the Colorado River in the Grand Canyon.
3. Presentation and evaluation of information describing how the construction and operation of Glen Canyon Dam has affected the ecosystem associated with the Colorado River in the Grand Canyon.
4. A contingent valuation exercise to determine whether participants could express, in monetary terms, values for various dam operation alternatives.

B.4.2 Participants' Knowledge, Attitudes, and Beliefs About the Grand Canyon

To introduce the first topic listed above, participants were asked, "What do you think of when you think of the Grand Canyon?" Participants mentioned a wide variety of items, including scenic qualities, wilderness values, threats from pollution and overuse, a desire to see the Grand Canyon, and mule rides to the bottom of the Grand Canyon. In all of the focus groups in which this question was asked, at least one participant mentioned either the Colorado River or rafting in the Grand Canyon. Although the above question was not asked at the two locations closest to the Grand Canyon (Phoenix and St. George), it was obvious that awareness of the Colorado River as part of the Grand Canyon ecosystem was higher at these locations, which are closer to the Grand Canyon. Thus, the data from the initial focus groups indicated that at least some of the general population in all locations were aware that the Colorado River is at the bottom of the Grand Canyon.

Participants in all of the initial focus groups were also asked if they were aware of any recent controversies surrounding the Grand Canyon. The most frequently mentioned included problems with pollution, problems with aircraft overflights, and problems stemming from releases of water from Glen Canyon Dam. Identification of problems associated with the operations of Glen Canyon dam occurred in Batavia, New York; Phoenix, Arizona; and St. George, Utah.

B.4.3 Information on Operations of Glen Canyon Dam

Participants were provided with information about how the construction and operation of Glen Canyon Dam had changed the pattern of flows of the Colorado River in the Grand Canyon. This information was presented in slightly different ways in different groups. Participants in the first three focus groups (Buffalo, New York; Batavia, New York; and Nashville, Tennessee) were provided with a short visual and oral presentation describing the human and natural environment along the Colorado River in the Grand Canyon. This presentation identified trout, trout fishing, archeological sites, native fish, rafting, wildlife, and birds as parts of the natural and human environment along the Colorado River in the Grand Canyon. Following this presentation, participants were provided with a short visual and oral discussion of how Glen Canyon Dam had changed the flow patterns of the Colorado River in the Grand Canyon. Participants in the Murfreesboro discussion group were not provided with the information about the resources at the bottom of the Canyon, but were provided with information about how the dam had altered the flow patterns of the Colorado River. Participants in the Nebraska, Arizona, and Utah groups were provided with only written information. Furthermore, this written information related only to how the Glen Canyon Dam had altered the flow patterns of the Colorado River.

In each of the eight initial focus group discussions, participants were first presented with the "background" information and then asked if they thought the changes in flow patterns might

have caused any changes along the Colorado River in the Grand Canyon. If so, participants were asked what they thought these changes might have been. At each of the focus groups, participants identified changes in the rate of erosion, changes in vegetation, and impacts to fish and wildlife as possible consequences of the construction and operation of Glen Canyon Dam. Some participants identified the affected resources and the type of change that has resulted from dam operations. Others correctly identified those resources that have been affected, but incorrectly identified the direction of the change. For instance, while erosion was frequently mentioned as a result of the construction and operation of Glen Canyon Dam, several participants thought that rates of erosion would be lower after completion of the dam than before. These participants reasoned that the pre-dam spring floods were much higher than typical daily peaks resulting from power operations. As a result, these participants felt that erosion should be less with the dam than without it.

In spite of the slightly flawed logic of some participants, the initial focus groups indicated that some members of the general public were able to identify many of the environmental impacts of Glen Canyon Dam operations. This was an important result. Because some participants were able to predict the types of changes that have actually been observed, it was reasoned that at least a portion of the general population would be familiar with, or be able to identify, the types of changes that would have to be conveyed as part of a contingent valuation survey of the non-use values of the Colorado River-related resources in the Grand Canyon.

Participants were generally able to understand how the Glen Canyon Dam has changed flow patterns on the Colorado River. They required very little clarification of the information that was presented. Some felt the description of how the dam had changed flow patterns may have been biased "in favor of the dam." They cited the elimination of spring floods, improvements in water clarity, and reductions in water temperature as being good, but perhaps not the whole story of what had occurred as a result of the construction and operation of Glen Canyon Dam.

B.4.4 Understanding and Evaluating the Impacts of Dam Operations

Although it was encouraging that some participants were already familiar with the process through which the operation of Glen Canyon Dam affects downstream resources, this was not a necessary condition for the successful completion of a contingent valuation study of non-use values. What was required was for survey respondents to feel they could understand the impacts that are occurring and could evaluate them in a contingent valuation question.

To assess whether participants could understand and evaluate the impacts, respondents were provided with information on the actual impacts of the operations of Glen Canyon Dam. Impacts to native fish, archeological sites, sites of cultural importance to Native Americans, erosion of beaches, vegetation and associated birds and wildlife, and impacts on the

recreational use of the Colorado River in the Grand Canyon were presented. For example, participants were told that rates of erosion had increased so that some beaches, archeological sites, and Native American cultural sites were being affected. Participants were also told that large daily fluctuations had a negative impact on the quality of white water rafting trips in the Grand Canyon and that the long-term reduction in the number of beaches could adversely affect the quality of rafting trips. In addition, participants were told that native fish populations, including some federally endangered species had been reduced as a result of the dam. While these impacts were not described as negative impacts (they were described in a factual and neutral manner), we expected that these impacts would be evaluated as negative by participants in the focus groups. Participants were also provided information about other impacts that we expected would be evaluated as positive or good changes. For example, participants were told that elimination of the large spring floods had allowed increases in vegetation, which in turn had resulted in increases in the number of birds and wildlife. Participants were also told that construction and operation of the dam had allowed for the establishment of a high-quality sport fishery for rainbow trout.

After presenting this information, participants were asked if they had questions about the impacts that had been described and if the impacts seemed believable. Participants did not report difficulty in either understanding or believing the description of the changes that had resulted from the construction and operation of Glen Canyon Dam. This result indicated that the impacts of the operation of Glen Canyon Dam could be described within the context of a general population survey.

After discussing the impacts that have resulted from the construction and operation of Glen Canyon Dam, participants were asked for a personal evaluation of the impacts that had just been described. As expected, most participants typically evaluated the increase in erosion and associated impacts to beaches, archeological sites, and Native American cultural sites, and reductions in native fish populations as being negative changes. The changes most often cited as being positive included increases in bird populations and the establishment of a trout fishery. Many of the participants indicated that impacts to white water rafters were not a large concern. In addition, several participants indicated that they did not rate the increase in bird populations or the establishment of a trout fishery as positive changes. The reason most often offered for this point of view was that these species were not native to the Grand Canyon. Consequently, establishment of these populations was not viewed in a favorable light if it occurred at the expense of native species.

B.4.5 Contingent Valuation Questions

In the final portion of the focus group discussion, participants were asked to complete a contingent valuation exercise for various changes in operations at Glen Canyon Dam. They were first told that changes in operations at Glen Canyon Dam could reduce some of the negative downstream effects. They were then asked to imagine that these changes would

result in some economic impacts such as higher electric bills, either because a reduction in peak power would have to be met by using more expensive sources of power, or because the value of power would be reduced, requiring the federal government to find other sources of revenue to repay the expense of building the dam.

The contingent valuation exercise asked participants to imagine that they could vote on whether to change operations at Glen Canyon Dam. They were told that if a majority voted to change operations, either their taxes or their monthly utility bill would go up (depending upon the specific focus group), but that dam operations would be changed so that downstream impacts would be reduced. If a majority voted no, participants were told their taxes or utility bills would remain the same, but that operations would also remain the same.

One of the focus groups (Columbus, Nebraska) was carried out using increases in taxes as the contingent valuation vehicle. Although most participants in this group were able to deal with this payment vehicle, at least some indicated they would not be willing to pay any additional amount in taxes to change operations at Glen Canyon Dam. These participants indicated that concerns about the general level of taxes was more important to their response than their evaluation of the benefits of changing operations at Glen Canyon Dam. For the remainder of the focus groups, an increase in the monthly utility bill was used as the payment vehicle. Some participants in the New York and Tennessee focus groups had minor difficulties with the utility bill vehicle. Some of these indicated that although they tried to reflect in their vote their own personal evaluation of the changes in operations, they also thought about how much money would be raised if all utility bills in the United States were increased by a small amount.

At some groups, after discussing the motivations for their responses to the contingent valuation questions, participants were asked why they thought these questions had been asked. In several of the focus groups, participants said they thought the contingent valuation questions had been asked to find out how important they felt it was to change operations at Glen Canyon Dam. Some participants reported that we were asking them "to put our money where our mouth is."

B.4.6 Initial Focus Group Results

These general results from the initial focus groups were evaluated in terms of four specific criteria. These criteria included:

1. Could most participants' attention be directed to the Colorado River environment, rather than to the Grand Canyon as a whole?
2. Can at least some people understand the impacts that they were asked to evaluate?

3. Do at least some of the participants have enough information on the potential impacts of current and alternative dam operations to determine the value for them?
4. Do at least some people express non-zero values for alternative dam operations, and are they unwilling to lower these values under direct questioning by the focus group moderator?

For the first criterion, the initial focus group discussions indicated that participants were able to direct their attention to the Colorado River environment and away from the Grand Canyon as a whole. Prior to receiving information about the effects of operations at Glen Canyon Dam, participants typically mentioned scenic vistas and unspoiled wilderness as thoughts that came to mind when they thought of the Grand Canyon. Near the end of the focus groups, they were asked to discuss the motivations for their responses to the contingent valuation questions. Participants typically cited how the proposed alternatives would affect rates of erosion, loss of beaches and archaeological sites, and impacts to native fish and trout. Because participants cited this different set of factors as reasons for their contingent valuation responses, we believe they were able to focus on the described impacts to river-related resources and not on their general feelings about the Grand Canyon as a whole.

In Criterion 2, the focus group discussions also demonstrated that a significant portion of the participants were able to understand the impacts they were asked to evaluate. This conclusion was based on two factors. First, at least some of the participants possessed a basic knowledge of the mechanisms by which dams can affect downstream river-related resources prior to the presentation of information on the impacts of dam operations. Second, most participants did not appear to have difficulty understanding or believing the oral, visual, and written descriptions of how the construction and operation of Glen Canyon Dam affects downstream resources.

For the third criterion, participants generally felt they had sufficient information to evaluate the downstream impacts of dam operations. This conclusion was based on the ability of participants to evaluate whether they felt the impacts to various resources were either positive or negative. Some issues were discovered that may require additional research. For example, some participants expressed frustration with the use of phrases such as "are likely to cause" or "may result" in the descriptions of the impacts of changes in dam operations. For at least some participants, the uncertainty associated with the impacts of changes in dam operations may have reduced the amount they said they would be willing to pay for various alternatives. A few participants also expressed a desire for more details in the description of the impacts of changes in dam operations. Notably absent from their requests for additional information were requests for information about impacts to individuals using power produced at Glen Canyon Dam or requests for additional details on how dam operations

would be changed under the various alternatives. Taken together, the above results indicated that survey respondents would be able to respond to a well-designed contingent valuation scenario that focussed on impacts to river-related resources.

In Criterion 4, majority of participants expressed non-zero dollar values for their alternative operations. Among those individuals expressing a zero willingness-to-pay for specific alternatives, one of two reasons was typically offered. Some participants in the focus groups that used taxes as the contingent valuation vehicle indicated they would not agree to a tax increase for any reason. The others typically indicated that the described impacts of the alternative dam operations were simply not worth anything to them. This ability to successfully deal with the contingent valuation questions as part of the focus group discussion indicated that participants in a general population survey that was designed to measure the non-use values of various dam alternatives would also be able to respond to well-designed contingent valuation questions.

The initial focus group discussions indicated that certain areas, such as the choice of a contingent valuation vehicle and the descriptions of the impacts of various alternative dam operations, would require additional work. However, the bulk of the evidence from the initial focus groups provided support for continuing research into the non-use values associated with dam operation alternatives. Participants in focus groups held at locations far from the Grand Canyon, near the Grand Canyon, and even in locations that obtain power from the Glen Canyon Dam all indicated that they would like to see something done to reduce the impacts of the operations of Glen Canyon Dam on downstream resources. Participants in all of these groups seemed to be able to understand and believe descriptions of how various alternative operations would affect downstream resources. Finally, a majority of participants seemed to be able to provide valid responses to the contingent valuation questions that were designed to measure the non-use values of alternative operations.

Subsequent to the initial focus groups, a decision was made to proceed with the design of a contingent valuation instrument using a mail survey format and to subject this survey to an additional round of qualitative research.

B.5 SECOND PHASE OF QUALITATIVE RESEARCH

Several members of the GCES Non-Use Value Committee expressed concern that the survey materials used in that the initial focus groups did not solicit values for the loss of hydropower capacity that would occur as a result of changes in the operation of Glen Canyon Dam. Consequently, the first additional focus group dealt with potential non-use values for hydro-power and was held in Albuquerque on June 17, 1993. A total of 10 individuals attended this discussion. At the beginning of the discussion, participants were handed an

information sheet describing the traditional operation of Glen Canyon Dam for generating on-peak electricity. Hypothetical changes in the ability to produce on-peak power were attributed to the age of the power plant. The information sheet indicated that, as the dam and power plant had aged, conditions had developed that would soon reduce the ability of the power plant to produce on-peak electricity. If these conditions were not remedied, three consequences would occur: (1) some power consumers would experience increases in their power bills; (2) patterns of electricity production would change; and (3) a small number of farmers in areas heavily dependent on power from Glen Canyon Dam would see their incomes decrease. No mention was made of the downstream environmental effects of dam operations.

After reading this information, participants were asked to discuss how they felt about the above-described impacts. While participants expressed concern about all three impacts, they tended to be confused about the changes in patterns of electrical generation. Furthermore, they expressed a great deal of interest in knowing more about the conditions that would cause a loss of on-peak capacity at the Glen Canyon Dam power plant. The absence of this information made them feel that perhaps there had been an engineering or design problem during the construction of the dam, and that the responsible party should be identified and required to fix the problem.

Three conclusions were reached after this group. First, that it would be difficult to make survey respondents understand and then value a loss in hydro-power capacity. Second, that participants expressed empathy for residential and agricultural users of power from Glen Canyon Dam. Third, it would be difficult (if not impossible) to design a survey that focussed solely on changes in power production.

After the Albuquerque focus group, a preliminary survey instrument was developed. This instrument contained many of the features eventually included in the pilot test and final study surveys. The background information consisted of two sheets. One sheet identified how the construction and operation of Glen Canyon Dam had affected the characteristics of in-stream flow in the Colorado River below Glen Canyon Dam. The second sheet identified the impacts of the construction and operation of the dam. Information on this second sheet identified both negative impacts (loss of beaches and reductions in native fish, for example) and positive impacts (establishment of a trout fishery and increases in bird populations along the river corridor).

This preliminary survey draft was tested in a focus group held in Milwaukee, Wisconsin, on July 14, 1993. Eight individuals participated in the discussion. After reading the background materials, participants were asked to complete a draft mail survey instrument. This instrument included a true-false quiz covering the important points presented in the background material, as well as four contingent valuation questions, one for each of four alternative dam operations. These four scenarios were developed in cooperation with the

physical and biological scientists who were preparing the draft GCDEIS (Glen Canyon Dam Environmental Impact Statement). The scenarios did not include descriptions of price impacts to consumers of electric power.

Several issues were explored during the July 14 focus group. First, the question was asked whether potential survey respondents would be able to deal with multiple scenarios and perceive differences between them? Second, would potential survey respondents be "put off" by the quiz? Finally, how would potential survey respondents react in general to the draft mail survey instrument?

Results from this group indicated that potential respondents were able to deal with four scenarios in one survey and that they were able to perceive differences between the scenarios. Second, this group indicated that potential survey respondents would not react negatively to the quiz as long as it was introduced as a way to determine whether the designers of the survey had effectively communicated important facts to the respondents. Finally, the group did not identify any major obstacles that would prohibit the implementation of this study using a mail survey format.

Up to this point in the qualitative research, the background materials had been developed in order to highlight the changes that had occurred as a result of the construction and operation of Glen Canyon Dam. This was done on the assumption that many respondents would want to evaluate the consequences of a change in dam operations relative to the conditions that existed prior to construction of the dam. Some members of the GCES Non-Use Value Committee were concerned that a discussion of the impacts of the construction of and operation of Glen Canyon Dam would predispose potential survey respondents to vote in favor of changes in dam operations. Furthermore, these members of the committee pointed out that the Glen Canyon Environmental Impact Statement explored the operations, not the existence of the dam.

To address these concerns, a new version of the survey instrument was developed. In this new version, the background information was modified to remove references to pre-dam conditions, as well as to remove any indication that either the operation or the construction of the dam had resulted in any downstream impacts. Instead, the background material defined the study area (including a map), identified trends in downstream resources, and indicated that the operations of the dam could be modified to benefit these resources. Several modifications were also made to the survey. An informational box was added to the survey pointing out that changes in the operation of the dam would change the pattern of electricity production, increase electric bills for some individuals, and decrease the income of a few farmers.

Performance of the new background information sheets and the new survey was evaluated in a focus group held in Milwaukee, Wisconsin, on August 5, 1993, and in-depth personal

interviews on the evenings of August 9 and 11, 1993, in Madison, Wisconsin. Ten individuals participated in the Milwaukee focus group, and six individuals were interviewed in Madison. In the draft of the survey used for this round of qualitative research, each respondent was asked to evaluate only one contingent valuation scenario. The contingent valuation question following the scenario was modified to first ask respondents how they would vote on the proposal if passage would not cost them anything. Respondents voting in favor of the proposal were asked how they would vote if passage cost them various amounts.

Although several participants expressed a desire for more information about pre-dam conditions and the relationship between dam operations and downstream resources, these concerns did not seem to have a significant effect on their responses. Many participants reported that the impacts on power consumers and farmers were factors they considered when deciding how to vote on the proposal. Probing on the descriptions of impacts to Native American sites revealed that use of the phrase "sacred sites" conveyed an image of burial grounds to many of the respondents.

Based on the results of this round of qualitative research, it was concluded that future survey versions would include references to price impacts to consumers of power produced at Glen Canyon Dam. Furthermore, the background information would focus only on the current status of the affected resources and mention only that changes in the operations of the dam could benefit some of these resources.

Two more focus groups were conducted in Orem, Utah, on the evening of August 25, 1993. These groups had two purposes. First, it was important to test the survey in the marketing area. This was accomplished by recruiting participants for the focus group from two communities in which the local utility received a large percentage of its power from Glen Canyon Dam.

A second purpose was to explore how respondents with differing levels of education and income would react to the survey instrument. This topic was explored because of a concern that in a typical focus group, individuals with lower educational attainment might be embarrassed to admit they were having trouble understanding the survey. This issue was addressed by restricting participation in one of the focus groups to non-students without college degrees and a lower level of income. Five individuals participated in the lower-educational attainment and lower-income group. None of the five participants had college degrees, and four of the five had household incomes of less than \$15,000. Nine individuals participated in the higher educational attainment/income group.

The survey instrument used in Orem was identical to those used in Milwaukee and Madison with one exception. The Orem survey reminded participants that they lived in areas served by power produced at Glen Canyon Dam and that if dam operations were changed, they would have to pay higher utility bills. The contingent valuation questions were framed as a

referendum on changes in dam operations, and increased utility bills were used as the payment vehicle.

Participants in the lower educational attainment group generally comprehended most aspects of the background information and were able to complete the survey. Participants in both groups expressed a positive willingness-to-pay for the changes in the operation of Glen Canyon Dam.

Up to, and including the Orem focus groups, the program of qualitative research consisted of a total of 13 focus groups and two evenings of in-depth personal interviews involving a total of 126 participants. The result of this qualitative research was a survey instrument that was submitted to OMB (Office of Management and Budget) for approval. OMB approval was granted with the condition that a final round of focus groups be carried out to document that respondents correctly understood the key portions of the contingent valuation scenarios. To satisfy this requirement, two additional focus groups were conducted in Phoenix, Arizona, on February 22 and February 23, 1994. Phoenix was chosen in order to make it possible for GCES physical and biological researchers to observe the focus group discussion. After observing the groups, these GCES researchers were satisfied that participants' interpretation of the contingent valuation scenarios was consistent with their own.

In addition to performing a final check on participants' understanding of the survey materials, the Phoenix focus groups were used to make a final attempt to explain the concept of lost hydroelectric capacity. This issue was raised because some members of the GCES Non-Use Value committee felt that hydroelectric capacity lost as a result of changes in dam operations might have a non-use value. The results of previous focus groups had indicated that the concept of hydroelectric capacity was extremely difficult to explain in a survey context. Most survey respondents erroneously assumed that if hydroelectric capacity was lost, hydroelectric energy would also be lost. A significant effort was made to explain how hydroelectric energy could remain the same while capacity decreased. Some participants were simply unable to understand the concepts as presented. Those who did understand indicated that the loss of hydroelectric capacity was not a major concern.

APPENDIX C
OVERVIEW OF PILOT TEST

This appendix presents a discussion of the pilot test conducted for this study prior to the implementation of the final study. This is not intended to provide the reader with complete documentation of the pilot test, but rather to provide an overview of it, its purpose, and results. Study objectives and experimental design for the pilot test are discussed, followed by an explanation of the distribution of the dollar amounts used in the contingent valuation question. Sampling and survey implementation procedures are reviewed, and results of the pilot test are presented. The final two sections include the results of hypotheses tests that address study objectives and a summary of the pilot test results overall. The appendix concludes with an overview of changes made to experimental design and survey materials subsequent to the pilot test but prior to the final study.

C.1 STUDY OBJECTIVES AND EXPERIMENTAL DESIGN

Upon completion of the qualitative research program, a draft research plan and survey instruments were developed for a pilot by the GCES Non-Use Value Committee and submitted to the Office of Management and Budget (OMB) for approval. After further review by the committee and OMB, the final study plan and survey instruments were prepared for the pilot test.

Two sets of objectives were explored during the pilot test. The first set related to methodological issues relevant to assessing the eventual performance of the survey instrument in a final study. A second set of objectives was to further evaluate the survey design and to test survey implementation procedures.

Methodological issues explored during the pilot tests included a determination of whether the survey instrument was sensitive to what we shall term the "scale" and "scope" of the resource impacts of alternative operating regimes for Glen Canyon Dam.¹ The term "scale" is used to refer to the degree or extent of resource impacts relative to the baseline or "No action" alternative. Changing dam operations will affect beaches, American Indian cultural and religious sites, conditions for both native and non-native fish, and other characteristics of the environment in the Grand Canyon. Some alternatives will have small effects on these resources compared to the "No Action" alternative and other alternatives will have larger impacts. The term "scope," on the other hand, refers to the array of resources considered. An

¹ The definitions of scope and scale used in this appendix evolved during evaluation of the proposed pilot study by the Office of Management and Budget. More specifically, we wish to acknowledge Richard Belzer and Richard Theroux for suggesting the concepts. Scope has been used by the National Oceanic and Atmospheric Administration (NOAA) Panel on Contingent Valuation and appears in the proposed NOAA damage assessment regulations, but to our knowledge, the concept of scale and the useful distinction between scope and scale which we applied here have not been previously discussed in the literature.

instrument that is narrow in scope might cover only beaches and vegetation while a instrument with broader scope would include American Indian sites, native fish, and other resources as well. In addition, one would expect a valid survey instrument to produce statistically indistinguishable values when the order in which information is presented to respondents is changed, provided that the nature of the information is invariant. Likewise, the survey instrument should produce values that are stable with respect to minor changes in wording. Thus, the technical testing of the instrument was designed to achieve three objectives:

- Objective 1: To determine whether non-use value estimates for Glen Canyon Dam Environmental Impact Statement (GCDEIS) alternatives are sensitive to the scale of resource impacts under those alternatives.
- Objective 2: To determine whether non-use values for GCDEIS alternatives would be sensitive to the scope of the resources impacted by those alternatives.
- Objective 3: To determine whether estimates of non-use values based on the draft instruments would be affected by seemingly innocuous changes in the wording and order of presentation of background information.

These objectives are central to evaluating the scientific credibility of results from a final survey using those instruments. Lack of value differences relating to scale and scope would raise doubts about whether the researchers had correctly identified resource impact relevant to respondents and communicated those impacts to respondents effectively to support meaningful economic valuations. If values are sensitive to the order in which information is presented, or to minor changes in wording, then doubts would arise about whether resulting non-use value estimates are sufficiently stable and otherwise meaningful to be used in policy analysis.

In addition to the methodological objectives, the pilot tests had three additional objectives. These objectives related to information needed for planning a possible final survey. The additional objectives included:

- Objective 4: To determine whether non-use values for GCDEIS alternatives differ between the marketing area and the nation as a whole.

Values expressed by residents of the market area may have special significance for this study. These individuals will actually have to pay higher prices if dam operations are changed. Documentation of significant values for marketing area residents would lend validity to the ultimate study results. If values in the marketing area are indistinguishable from zero, the expense of a separate survey in the marketing area could be avoided in a final study.

Objective 5: To determine whether non-use values measured using a multiple-bounded format for contingent valuation questions would be significantly different than non-use values measured using a single-bounded contingent valuation question.

The multiple-bounded contingent valuation questioning format was the primary question format used in the pilot test. The multiple-bounded technique was chosen to increase the precision of the results given the relatively small sample sizes available. However, the multiple-bounded technique had not previously been tested against the more widely applied, and more widely accepted single-bounded framework. Both formats involve a referendum where respondents vote to say whether they are willing to pay specified amounts to support a water flow alternative. The multiple-bounded format allows respondents to give a range of responses from "Definitely Yes" to "Definitely No" for a wide range of dollar amounts. The single-bounded format allows respondents to give only a "Yes" or "No" response to one dollar amount. Concerns about the performance of the multiple-bounded technique prompted a decision to include a traditional single-bounded, dichotomous choice contingent survey version as part of the pilot test. Concerns about the multiple-bounded technique included a concern that the range and/or the increment of values presented in a multiple-bounded question may have an undesired influence on the survey responses. Information regarding the performance of the multiple-bounded technique relative to the dichotomous choice single-bounded technique could be used to assist in the choice of a valuation questioning technique in the final study.

Objective 6: To determine whether empathy for the effects of the alternatives on the amounts paid by consumers of power from Glen Canyon Dam has significant effects on overall non-use values for the alternatives.

The qualitative research phase had determined that survey respondents were likely to feel empathy towards individuals who would experience increases in utility bills as a result of changes in dam operations. Theoretical issues arise regarding the appropriateness of including interpersonal empathy as a motivation for non-use values. If empathy does not affect values then these issues would become less relevant for this particular application.

Accomplishing these study objectives required an experimental design consisting of nine survey versions. Table C-1 identifies the differences between each questionnaire version.

Table C-1
Identification of Glen Canyon Studies Non-Use Questionnaire Versions

Questionnaire Version	Water Release Alternative^a	CV Question Format	Background Information/ Scenario
National Sample			
Version 1	MFF	Multiple Bounded	Base Background
Version 2	L FF	Multiple Bounded	Base Background
Version 3	SASF	Multiple Bounded	Base Background
Version 6	SASF	Multiple Bounded	Changed Background
Version 7	SASF	Single Bounded	Base Background
Version 8	SASF	Multiple Bounded	Scope Test
Version 9	SASF	Multiple Bounded	Empathy Impact Test
Marketing Area Sample			
Version 4	MFF	Multiple Bounded	Base Background
Version 5	SASF	Multiple Bounded	Base Background

^a MFF = Moderate fluctuating flow alternative.
LFF = Low fluctuating flow alternative.
SASF = Seasonally adjust steady flow alternative.

C.2 DISTRIBUTION OF DOLLAR AMOUNTS

Survey versions with the multiple-bounded format (all versions except 7) contained the following dollar amounts, which respondents were asked to consider in the contingent valuation question: 10¢, 50¢, \$1, \$5, \$10, \$20, \$30, \$40, \$50, \$75, \$100, \$150, and \$200. For each amount, respondents were requested to indicate if they would definitely pay, probably pay, were unsure, probably not pay, or definitely not pay the stated amount. In Version 7, respondents were asked to consider only one dollar amount in the contingent valuation question. In this version, a dichotomous choice, yes/no response, was required. A uniform distribution of the following amounts was used: \$5, \$10, \$20, \$30, \$40, \$50, \$75, \$100, and \$150 (Table C-2). One randomly selected amount was assigned to each respondent.

Table C-2
Distribution of Dollar Amounts Used in Questionnaire Version 7

Dollar Value (\$)	Frequency	Percent of Sample
5	28	11.2%
10	28	11.2
20	29	11.6
30	28	11.2
40	28	11.2
50	28	11.2
75	28	11.2
100	26	10.4
150	<u>27</u>	<u>10.8</u>
Total Sample	250	100.0%

C.3 SAMPLING

Two separate random samples were constructed for the pilot test. A national sample was drawn from a sampling frame consisting of residential telephone directory listings. A marketing area sample was drawn from a sampling frame consisting of residential telephone directory listings for ZIP codes of areas served by utilities holding Salt Lake City Area Integrated Projects (SLCA/IP) firm power contracts with the Salt Lake City Office of Western Area Power Administration.² A total sample of 2,250 individuals was selected: 1,750 for the national sample and 500 for the marketing area sample. Individuals residing in the marketing area were eligible for inclusion in either the national sample or the marketing area sample, but not both. The sample was split into nine subsamples of 250 respondents each. Each subsample was administered one version of the questionnaire that contained a specific combination of background information and a scenario description of a proposed flow alternative as described in Table C-1.

² Glen Canyon Dam represents nearly 80% of the total power marketed as the SLCA/IP.

C.4 IMPLEMENTATION

The pilot test was carried out in January through March of 1994. Survey procedures included an advance letter, an initial survey copy with a \$2 incentive, a reminder postcard, and up to two additional survey copies sent to non-respondents. The final survey copy was sent via certified mail. Response rates to the pilot test are summarized in Table C-3. Response rates for completed surveys and refusals are calculated as a percent of deliverable questionnaires.

**Table C-3
Glen Canyon Studies Non-Use Survey Response Rates -- Pilot Test^a**

	Sample Size	Out of Scope ^b	Completed Questionnaire	Response Rate ^c
National Sample				
Version 1	250	24	138	61%
Version 2	250	39	131	62
Version 3	250	30	127	58
Version 6	250	35	126	59
Version 7	250	42	118	57
Version 8	250	28	133	60
Version 9	<u>250</u>	<u>34</u>	<u>126</u>	<u>58</u>
TOTAL	1,750	232	899	59%
Marketing Area Sample				
Version 4	250	46	149	73%
Version 5	<u>250</u>	<u>35</u>	<u>168</u>	<u>78</u>
TOTAL	500	81	317	76%

^a Response rates shown are calculated from the final day that completed questionnaires were included in the data set, April 12, 1994.

^b Includes cases where the addressee was deceased or the survey mailing was returned as undeliverable.

^c Calculated as a percentage of deliverable questionnaires (sample size minus out of scope).

C.5 PILOT TEST RESULTS

Statistical analyses performed to test the study hypotheses are presented below. First, for each survey version, mean willingness-to-pay is estimated using multiple-bounded logistic regression analysis. These results are then compared with results from models estimating multiple-bounded data as though it were single-bounded. Additional mean willingness-to-pay estimates were derived by treating the multiple-bounded data as though it were a payment card. Following these results is the analysis of mean willingness-to-pay for survey Version 7, which received the single-bounded question format. Results from Version 7 are compared with the multiple-bounded analysis of Version 3. (Both Versions 3 and 7 addressed the seasonally adjusted steady flow alternative.) Hypothesis tests were performed for each type of analyses and are discussed at the conclusion of this section.

Mean willingness-to-pay values, reported in Table C-4, were derived from a multiple-bounded logistic regression analysis of the pilot test data. Results are reported for simple models in which the dependent variable is the response to the contingent valuation question, and the independent variable is the amount of money asked about. A separate logistic regression model was estimated for each survey version. The results reported in Table C-4 are not based on the set of all completed questionnaires. Just prior to the willingness-to-pay question, respondents were asked how they would vote on the proposal if passage of the proposal would cost them nothing. Respondents could answer that they would (1) vote "No," (2) vote "Yes," or (3) choose not to vote. The means are based only on those respondents who indicated they would vote for the proposal. In addition, a small percentage of respondents indicating they would support the proposal at zero cost did not go on to complete the valuation question. Individuals not completing not completing the valuation question are not included in the analysis logistic regression analysis. As a consequence, the mean willingness-to-pay values reported in Table C-4 cannot be directly extrapolated to national or marketing area populations.

Discrete choice analysis requires assigning a yes or no response to each dollar amount asked about in the multiple-bounded question. The mean values reported in Table C-4 are calculated in two ways. First, analysis was carried out by coding "Definitely Yes" as a "Yes" and "Probably Yes," "Unsure," "Probably No," and "Definitely No" as a "No." A second analysis was performed by coding "Definitely Yes" and "Probably Yes" as a "Yes" and "Unsure," "Probably No," and "Definitely No" as a "No." The values reported in the three left-hand columns are based on a multiple-bounded logistic regression analysis. A second set of logistic regression models were estimated using data from the multiple-bounded question format, but analyzed as though the data had been generated by a single-bounded question format. The results of this analysis is shown in the three right-hand columns of Table C-4. In the single-bounded analysis of the multiple-bounded data, each row (dollar amount) in the multiple-bounded question format is treated as an independent single-bounded response to a willingness-to-pay question. Admittedly, this approach ignores the potential interdependence of the responses given to various dollar

amounts in multiple-bounded contingent valuation questions. The usefulness of the single-bounded analysis approach was that it allows estimation of discrete choice models in which the implied sample size is much larger, making it possible to tentatively explore the implications of larger sample sizes combined with single-bounded question formats which are planned for the final study. This increased effective sample size also increases the precision of the estimated parameters. Our confidence that this practice was justified was bolstered by finding that mean willingness to pay changes by only a small amount between the two approaches, with the single-bounded approach providing slightly higher estimates of willingness-to-pay.

As expected, mean willingness-to-pay increases as we move from moderate fluctuating flows (Versions 1 and 4) to seasonally adjusted steady flows (Versions 3 and 5) in both the national and the marketing area samples. Mean values for the marketing area are lower than mean values for the national sample for identical scenarios. Small changes in the wording of the background information and changes in the order of presentation of the impacts within the seasonally adjusted steady flow alternative (Version 3 versus Version 6) induced a small decrease in willingness-to-pay. Dropping impacts to Native American cultural sites, trout, and native fish from the seasonally adjusted steady flow alternative (Version 3 versus Version 8) resulted in a substantial decrease in mean willingness-to-pay. Finally, contrary to prior expectations, dropping electricity price impacts from the seasonally adjusted steady flow alternative (Version 3 versus Version 9) decreased mean willingness-to-pay.

Table C-4
Mean Willingness-To-Pay for Stated Proposal -- Discrete Choice Analysis of Data Collected Using Multiple Bounded Questioning Format^a

	Multiple-Bounded			Single-Bounded^b		
	Mean Willingness-To-Pay			Mean Willingness-To-Pay		
	Definitely Yes^c	Definitely/ Probably Yes^d	n^e	Definitely Yes^c	Definitely/ Probably Yes^d	n^e
National Sample						
Version 1	\$42.3	\$69.2	85	\$45.6	\$72.4	1,105
Version 2	\$45.9	\$73.6	83	\$49.0	\$77.2	1,079
Version 3	\$58.2	\$95.5	73	\$62.7	\$97.0	949
Version 6	\$53.4	\$91.9	67	\$56.5	\$92.3	871
Version 8	\$42.0	\$66.1	66	\$45.2	\$69.1	858
Version 9	\$33.3	\$57.0	80	\$37.2	\$62.0	1,040
Marketing Area Sample						
Version 4	\$26.2	\$47.5	94	\$28.5	\$51.5	1,222
Version 5	\$30.2	\$54.6	112	\$33.8	\$59.4	1,456

- ^a Analysis was carried out using cases where respondents supported the proposal and responded to all dollar amounts given. Not applicable for survey Version 7.
- ^b Data were analyzed as if the response to each dollar amount in the multiple-bounded question represented an independent response to traditional single-bounded questions.
- ^c Definitely yes responses to dollar amounts coded as a "yes"; all other responses coded as a "no".
- ^d Definitely yes and probably yes responses to dollar amounts coded as a "yes"; all other responses coded as a "no".
- ^e n equals the number of valid cases.

In addition to the logistic regression analysis, another estimate of mean willingness-to-pay was derived by treating the multiple-bounded willingness-to-pay question as if it were a payment card. Again, two separate analyses were performed. For one analysis, the highest amount a respondent would "definitely pay" was recorded as a point estimate of willingness-to-pay. In a second analysis, the point estimate of willingness-to-pay was recorded as the highest amount the respondent would "probably pay." The analysis was carried out only for those respondents indicating previously they would vote for the proposal and who completed the multiple-bounded willingness-to-pay question. The results of this analysis (Table C-5) are very similar to the results based on the discrete choice analysis of the multiple-bounded data.

Table C-5
Mean Willingness-To-Pay for Stated Proposal -- Payment Card Analysis ^a

	<u>Definitely Yes^b</u>		<u>Definitely/ Probably Yes^c</u>		n ^e
	Mean Willingness- To-Pay	s ^d	Mean Willingness- To-Pay	s ^d	
National Sample					
Version 1	\$37.9	\$49.0	\$60.9	\$54.0	85
Version 2	\$41.2	\$54.7	\$65.2	\$63.6	83
Version 3	\$53.2	\$63.0	\$80.5	\$71.5	73
Version 6	\$47.5	\$55.7	\$77.1	\$68.6	67
Version 8	\$37.6	\$51.2	\$58.1	\$59.0	66
Version 9	\$30.9	\$50.5	\$52.1	\$65.3	80
Marketing Area Sample					
Version 4	\$23.5	\$38.5	\$43.6	\$54.3	94
Version 5	\$28.0	\$43.9	\$50.2	\$59.8	112

- ^a Computed using the highest dollar amount that respondents who supported the proposal said they would be willing to pay.
- ^b Definitely yes responses to dollar amounts coded as a "yes"; all other responses coded as a "no."
- ^c Definitely yes and probably yes responses to dollar amounts coded as a "yes"; all other responses coded as a "no."
- ^d s equals the sample standard deviation.
- ^e n equals the number of valid cases.

To this point the discussion has focussed primarily on the comparisons of mean willingness-to-pay derived from survey versions using the multiple-bounded question format. Version 7 of the survey asked respondents to evaluate the seasonally adjusted steady flow alternative in the context of a single-bounded dichotomous choice contingent valuation question. The estimated average willingness-to-pay derived from the data collected using a single-bounded dichotomous choice contingent valuation question was \$121.80

C.6 TESTS OF HYPOTHESES

Tables C-6 and C-7 report the test statistics for pair-wise tests of hypotheses concerning estimated mean willingness-to-pay. These tests were carried out in three ways. First, Monte Carlo methods were used to create empirical distributions of willingness-to-pay using the estimated discrete choice model for each treatment. Then pairs of empirical distributions were tested using the method of convolutions. The method of convolutions tests the hypothesis that the difference between two random variables is equal to zero. In this study, the two random variables are the mean willingness-to-pay estimates from two experimental treatments. The probabilities in Tables C-6 and C-7 report the probability of a test of the hypothesis that the convolution (i.e., the difference between the two empirical distributions of willingness-to-pay) is equal to zero. Small probabilities indicate rejection of the null hypothesis. Tables C-6 and C-7 also report the 95 percent confidence interval for the convolution.

Statistical tests were also carried out to evaluate the hypothesis of equality between the parameters for pairs of logistic regression models. If two parameters have nearly identical estimated parameters, they will produce nearly identical willingness-to-pay values. The test of identical parameters is performed using a log likelihood ratio test. This test produces a chi-square statistic. In this case, the chi-square statistic will have two degrees of freedom. Chi-square values larger than 4.6 result in the rejection of the null hypothesis of equality at the 10 percent level. Tables C-6 and C-7 also report a Z value. This simply represents the value of a test of the difference of means, where the means being tested are mean willingness-to-pay estimates using the payment card approach (Table C-5).

Table C-6
Hypothesis Tests for Models in Which a Yes is Recorded for "Definitely Yes"
and a No is Recorded for All Other Response Categories

Pairwise Comparison of Survey Versions	Multiple Bounded				Payment Card				Single Bounded			
	Convolutions		Likelihood Ratio Test		Convolutions		Likelihood Ratio Test		Convolutions		Likelihood Ratio Test	
	P	95% Confidence Interval	χ^2	Z	P	95% Confidence Interval	χ^2	Z	P	95% Confidence Interval	χ^2	Z
1 versus 2	0.67	(-11,13)	1.6	-0.42	0.40	(-4,10)	2.3		0.40	(-4,10)	2.3	
3 versus 2	0.18	(-6,29)	2.1	-1.25	0.00	(5,22)	16.2		0.00	(5,22)	16.2	
3 versus 1	0.05	(0,32)	5.0	-1.68	0.00	(9,25)	20.1		0.00	(9,25)	20.1	
1 versus 4	0.00	(5,27)	8.9	2.17	0.00	*	50.8		0.00	*	50.8	
3 versus 5	0.00	(14,43)	19.8	3.54	0.00	*	83.3		0.00	*	83.3	
5 versus 4	0.40	(-5,12)	0.8	-0.78	0.05	(0,10)	8.5		0.05	(0,10)	8.5	
6 versus 3	0.58	(-24,13)	0.4	0.56	0.21	(-3,15)	1.9		0.21	(-3,15)	1.9	
3 versus 8	0.07	(-2,34)	3.6	1.60	0.00	(8,25)	24.3		0.00	(8,25)	24.3	
3 versus 9	0.00	(9,41)	10.5	2.40	0.00	*	63.5		0.00	*	63.5	

* Convolution does not include zero.

Table C-7
Hypothesis Tests for Models in Which a Yes is Recorded for "Definitely Yes" and "Probably Yes"
and a No is Recorded for All Other Response Categories

Pairwise Comparison of Survey Versions	Multiple Bounded			Payment Card		Single Bounded	
	<u>Convolutions</u> Z	<u>P</u> Confidence Interval	<u>Likelihood</u> Ratio Test 95%	<u>P</u> Confidence Interval	<u>Convolutions</u> 95% Confidence Interval	<u>Likelihood</u> Ratio Test χ^2	
1 versus 2	0.63	(-14,24)	2.5	-0.48	0.34	(-5,14)	5.1
3 versus 2	0.07	(-2,47)	3.4	-1.40	0.00	(8,32)	13.1
3 versus 1	0.01	(5,50)	9.8	-1.92	0.00	(14,37)	21.9
1 versus 4	0.01	(5,37)	8.2	2.13	0.00	*	55.1
3 versus 5	0.00	(21,64)	16.9	3.00	0.00	*	68.4
5 versus 4	0.41	(-9,20)	1.2	-0.83	0.06	(0,15)	6.8
6 versus 3	0.71	(-32,22)	0.1	-0.28	0.53	(-9,18)	1.3
3 versus 8	0.01	(6,54)	7.1	2.02	0.00	(15,40)	25.3
3 versus 9	0.00	(15,63)	10.7	2.55	0.00	*	58.6

* Convolution does not include zero.

Comparisons between Version 7 and Version 3 allow an assessment of how well the multiple-bounded questioning technique performed relative to the more widely accepted single-bounded dichotomous choice technique. In making this assessment, it is important to remember that in Version 7, respondents were constrained to answering either “Yes” or “No” to the valuation question. In Version 3, respondents were allowed to choose from the response categories “Definitely Yes,” “Probably Yes,” “Unsure,” “Probably No,” or “Definitely No.” The interpretation of the comparison between Version 3 and Version 7 depends, to some extent, on assumptions about how respondents in these two versions would have answered if they had been given a question with response categories of the other version. As a starting point, we might assume that all individuals in Version 3 who responded “Definitely Yes” or “Probably Yes” would have said “Yes” if they had been forced to choose between a “Yes” or “No” response category. Likewise we might assume that those who responded “Probably no” and “Definitely No” would have responded with a “No” if they had been offered only a “Yes” and “No” response category. Finally, those who responded “Unsure” could be assumed to be evenly split between “Yes” and “No.” This suggests that willingness-to-pay from Version 7 (the single-bounded dichotomous choice treatment) would be bounded by willingness-to-pay estimates derived from two multiple-bounded logistic regression models based on Version 3. The first model would be one in which “Definitely Yes” and “Probably Yes” are coded as a “Yes” and all other response categories are recorded as a “No.” The second model would be one in which “Definitely Yes,” “Probably Yes,” and “Unsure” are coded as a “Yes” and all other response categories are reported as a “No.” The results from these two models for Version 3 and the results from the two relevant multiple-bounded models derived from Version 7 are presented in Table C-8.

Table C-8
Comparison of Mean Willingness-to-Pay Estimates for Versions 3 and 7

	Multiple-Bounded Analysis of Version 3		Single-Bounded Analysis of Version 3		Version 7
Mean	\$95.5 ^a	\$136.7 ^b	\$97.0 ^a	\$130.2 ^b	\$121.8

^a “Definitely Yes” and “Probably Yes” responses to dollar amounts coded as a “Yes”; all other responses coded as a “No.”

^b “Definitely Yes,” “Probably Yes,” and “Unsure” responses to dollar amounts coded as a “Yes”; all other responses coded as a “No.”

The results reported in Tables C-6, C-7, and C-8 can be used to assess the results of the pilot test in terms of the six specific objectives of the pilot test.

Objective 1: To determine whether non-use value estimates for GCDEIS alternatives are sensitive to the scale of resource impacts under those alternatives.

Versions 1, 2, and 3 were all administered to a national sample, and differed only in the scale of the scenario being evaluated. Likewise Versions 4 and 5 were administered to residents of the marketing area and differed only in the scale of the scenario being evaluated. Significant test statistics for the comparison of Versions 1 and 3 indicates that in the national sample, survey respondents were sensitive to the scale of the scenario being evaluated. In the marketing area, the result is less clear. Based on the multiple-bounded analysis, a significant difference was not found for mean willingness-to-pay between Versions 4 and 5. However, the single-bounded analysis of the multiple-bounded data indicated that residents of the marketing area were sensitive to the scale of the scenario being evaluated.

Objective 2: To determine whether non-use values for GCDEIS alternatives would be sensitive to the scope of the resources impacted by those alternatives.

This objective is met by comparing the mean willingness-to-pay obtained in Versions 3 and 8. Both of these Versions we administered to a national sample and used the multiple-bounded questioning technique. The scenario in Version 8 was substantially smaller in scope than the scenario evaluated in Version 3. In particular, while Version 3 contained impacts to sediments, beaches, vegetation, Native Americans, native fish, trout, and power consumers, Version 8 contained impacts only to sediments, beaches and vegetation. A comparison of the estimated willingness-to-pay reveals that willingness-to-pay was significantly smaller for Version 8 than for Version 3. This is taken as evidence that survey respondents were also sensitive to the scope of the scenarios being evaluated.

Objective 3: To determine whether estimates of non-use values based on the draft instruments would be affected by seemingly innocuous changes in the wording and order of presentation of background information.

This objective was met by comparing the mean willingness-to-pay obtained from Version 3 with the estimated willingness-to-pay obtained from Version 6. The Version 6 survey materials were identical to those for Version 3 with two exceptions. First, Version 3 discussed the environmental impacts and then consequences for power consumers, whereas in Version 6, the consequences for power consumers were presented prior to the information of environmental impacts. Second, the background information for Version 6 was a slightly edited Version of the background information used for Version 3. Version 6 tended to provide slightly lower estimates

of mean willingness-to-pay than Version 3. However, the low values for the statistical tests indicate that the differences between the two estimates of willingness-to-pay are not significantly different.

Objective 4: To determine whether non-use values for GCDEIS alternatives differ between the marketing area and the nation as a whole.

Residents of the marketing area tended to express lower willingness-to-pay for the moderate fluctuating flow and the seasonally adjusted steady flow alternative than did members of the national sample. The statistical analysis indicates that these differences are significant.

Objective 5: To determine whether non-use values measured using a multiple-bounded format for contingent valuation questions would be significantly different than non-use values measured using a single-bounded contingent valuation question.

While an exact statistical test was not performed, it was hypothesized that the value from the single-bounded dichotomous choice survey version would fall between the values based on a multiple-bounded model in which "Definitely Yes" and "Probably Yes" responses were coded as a yes, and one in which "Definitely Yes," "Probably Yes," and "Unsure" are coded as a yes. The result reported in Table C-8 supports this hypothesis. While not a statistical test, this result does support the contention that inferences based on data collected using the multiple-bounded question format are consistent with inferences based on data collected using the single-bounded dichotomous choice questioning format.

Objective 6: To determine whether empathy for the effects of the alternatives on the amounts paid by consumers of power from Glen Canyon Dam has significant effects on overall non-use values for the alternatives.

This objective was met by comparing results from Version 3 with the results obtained from Version 9. Version 9 was identical to Version 3 with one exception. In Version 9, survey respondents were told that changes in dam operations would have only a very small impact on power users (utility bills would increase by less than 1 percent). Because participants in the qualitative research phase had exhibited concern about utility bill increases for residents of the marketing area, it was expected that willingness-to-pay derived from Version 9 data would be greater than willingness-to-pay derived using data from Version 3. Contrary to expectations, willingness-to-pay in Version 9 was approximately 60 percent of willingness-to-pay in Version 3. Furthermore, this difference was statistically significant. Several possible explanations could be offered for this counter-intuitive result. One possible explanation is that in Version 3, respondents were told that individuals who receive power from the dam would pay higher utility bills as a result of changed dam operations. While respondents to Version 3 might have felt empathy toward marketing area residents, they might also have felt that marketing area residents were also "doing their part" to help address environmental issues along the Colorado River

below Glen Canyon Dam. In Version 9, respondents were told that receiving power from the dam would be virtually unaffected by changes in operations. It is possible that respondents to Version 9 may have tended to reject the valuation scenario if they felt it was unfair to require taxpayers at large to address environmental concerns along the Colorado River below Glen Canyon Dam. An alternative explanation is that respondents in the national sample used the utility bill impacts as a cue in deciding how they would vote. If this cuing process was present, it would have led to higher mean values for scenarios with higher utility bill increases. The absence of a specific utility bill increase in the Version 9 scenario could not have provided this type of cuing and possibly resulted in a lower stated willingness-to-pay. However, because of the design of the pretest it was impossible to evaluate the relative merits of these two hypotheses. In particular, utility bill impacts increased along with the environmental benefits of changes in dam operations. Thus the increase in mean willingness-to-pay observed between Versions 1 and Version 3 could be explained as the consequence of survey respondents perceiving higher environmental benefits for the scenario described in Version 3.

C.7 SUMMARY OF PILOT TEST RESULTS

The results of the pilot test, in general, favored a decision to proceed to a final study. The pilot test showed that survey materials provided results that were sensitive to both scope and scale, and were not sensitive to minor changes in scenario and background information wording. Furthermore, marketing area residents expressed a positive willingness-to-pay for changes in dam operations and their values tended to be lower than values expressed by members of the national sample. The only unfavorable result from the pilot test concerned the role of empathy on the part of members of the national sample, towards individuals in the marketing area who would pay higher utility bills as a result of changed dam operations.

C.8 CHANGES TO SURVEY MATERIALS AND STUDY SUBSEQUENT TO THE PILOT TEST

Consideration of the results of the pilot test combined with review of the results by the GCES Non-Use Value Committee, an external peer review panel, and the Office of Management and Budget all resulted in a final study design that reflected a number of changes in survey materials, survey implementation procedures, and experimental design. This section summarizes the major differences between the pilot test and the final study.

C.8.1 Background Information

Changes were made to the background information materials provided with the surveys in an effort to clarify and, in some instances, correct the explanation of the impacts of various

operating alternatives on riverine and power resources. There was some concern that in the pilot test, background information materials might have led survey respondents to believe that the decline in native fish species was due solely to changes in their environment caused by the operation of Glen Canyon Dam. The background materials for the pilot test specifically identified that cold water released from the Dam may be the most important factor contributing to the decline in native fish species and listed trout as the only non-native species residing in the river. This was modified the final study to mention the presence of other non-native fish species, and a separate bullet item was added indicating that competition with these species may have contributed to the decline of native fish populations.

The background information materials used for the pilot test also provided a discussion of how change in the operation of the dam would affect the production of energy. Results of the pilot test showed that the discussion did not clearly convey the fact that a change in dam operations would affect *when* power was produced, but not *how much* power was produced. The true/false items in the pilot test that asked respondents to indicate whether reducing daily fluctuations would reduce the amount of hydroelectricity produced was the one true/false item that was missed most frequently, indicating that the explanation given in the background materials or the question itself was unclearly written. Both the discussion in the background materials and the true/false question were rewritten for the final study in an effort to clarify this point.

C.8.2 True-False Questions

Participants in the pilot test were asked to answer a series of true-false questions prior to answering the valuation questions. As noted above, analysis of the responses to the true-false questions revealed a few questions with which the respondents had difficulty. Questions with high rates of incorrect responses were edited for the final study in an attempt to remove any ambiguities (Table C-9).

Table C-9
Changes to the True/False Statements

Pilot Survey:

1. Trout are one of the *native* fish species in the Colorado River below Glen Canyon Dam.
2. The *loss* of beaches is most severe along wide sections of the river.
3. The study area consists *only* of the area in and along the river.
4. Reducing daily fluctuations will *reduce* the total amount of hydroelectricity produced.

Final Study

1. Trout are **not native** to the study area.
 2. The decrease in the number and size of beaches is most severe along **wide** sections of the river.
 3. The Study Area consists **only** of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.
 4. Reducing Daily fluctuations in the amount of water released from the dam will **reduce** the total amount of hydroelectricity produced.
-

C.8.3 Scenarios

The scenarios used in the pilot test to describe the impacts of alternative water flows were based on descriptions of the environmental consequences as they were understood in the fall of 1993 when the survey instruments were designed. Understanding of these consequences evolved between the fall of 1993 and the fall of 1994 when the final study was implemented. A decision was made to update the scenarios to reflect a more up-to-date understanding of the impacts of changes in dam operations. The majority of changes reflected an evolution of the scientific opinion regarding prospects for native fish under the low fluctuating flow and seasonally adjusted steady flow alternatives. Furthermore, additional analysis of the power systems impacts became available after completion of the pilot test. This additional information resulted in some changes in the descriptions of power price impacts for surveys administered to the national sample. The changes are summarized in Figures C-1, C-2, and C-3. In each of these figures, the pilot test scenario is reproduced in Part A and the final study scenario is produced in Part B. Shaded areas in Part B represent the items that were changed from the pilot test.

C.8.4 Contingent Valuation Question Format

The pilot test had made extensive use of the multiple-bounded questioning technique. Peer reviewers expressed strong reservations about the use of this new, and as yet unproved, question format in the final study. Thus, the final study was implemented using a single-bounded contingent valuation question. Respondents were asked if they would vote in favor of the proposal if passage of the proposal would cost them a specified amount. Response categories included "Definitely no," "Probably no," "Unsure," "Probably yes" and "Definitely yes." Panel A of Figure C-4 shows a multiple bounded contingent valuation question used in the pilot test and Panel B shows the single-bounded format used in the final study for the national sample.

Since the final study used a single-bounded contingent valuation question it was necessary to select specific dollar amounts to insert in each survey booklet. Several schemes have been devised to select dollar amounts to be used in contingent valuation questions. The optimal set of dollar amounts depends on several factors. It has been shown that if the study objective is to provide the most precise estimate of median willingness-to-pay, then a single dollar amount equal to the median willingness-to-pay should be used. Obviously this approach requires that the researcher have prior knowledge of the parameter value that is to be estimated. In the absence of prior information, the use of a single dollar amount presents a high level of risk. For example, a single dollar amount would preclude the estimation of a distribution function. If the single dollar amount selected does not represent the median, the researcher would find it difficult, if not impossible, to derive estimates of mean willingness-to-pay. Other sampling schemes provide for a large number of distinct dollar amounts. For this study, a decision was made to use a small

Figure C-1
Moderate Fluctuating Flow Alternative
Pilot Test, Part A

A PROPOSAL

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following environmental conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish. It is unlikely that the native fish populations, including those in danger of extinction, would increase from present levels.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to sustain the population.
- Monthly electric bills could increase by \$6 per month for about 3,000 households in small cities in southwest Utah.
- Monthly electric bills could increase by \$2 per month for another 1,500,000 rural and urban households in Arizona, Utah, Wyoming and New Mexico.
- Farmers in Colorado who use electricity for crop irrigation could experience a decrease in income of up to 1%.

(continued)

Figure C-1 (continued)
Moderate Fluctuating Flow Alternative
Final Study, Part B

A PROPOSAL

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites, and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish.
- Native fish populations, including those in danger of extinction, would probably continue to decline in numbers.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to *maintain* the population.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households and a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

Figure C-2
Low Fluctuating Flow Alternative
Pilot Test, Part A

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following environmental conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish. It is not certain if native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.
- Monthly electric bills could increase by \$6 per month for about 3,000 households in small cities in southwest Utah.
- Monthly electric bills could increase by \$2 per month for another 1,500,000 rural and urban households in Arizona, Utah, Wyoming and New Mexico.
- Farmers in Colorado who use electricity for crop irrigation could experience a decrease in income of up to 1%.

(continued)

Figure C-2 (continued)
Low Fluctuating Flow Alternative
Final Study, Part B

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish.
- It is likely, but not certain, that native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households to a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

**Figure C-3
Seasonally Fluctuating Steady Flow Alternative
Pilot Test, Part A**

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following environmental conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 5% so that the area available for birds and other forms of wildlife would increase by about 5%.
- There would be a major improvement in conditions for native fish. Populations of most native fish, including one of the species in danger of extinction, would increase.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- Monthly electric bills could increase by \$21 per month for about 3,000 households in small cities in southwest Utah.
- Monthly electric bills could increase by \$7 per month for another 1,500,000 rural and urban households in Arizona, Utah, Wyoming and New Mexico.
- Farmers in Colorado who use electricity for crop irrigation could experience a decrease in income of up to 5%.

(continued)

Figure C-3 (continued)
Seasonally Adjusted Steady Flow Alternative
Final Study, Part B

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- The average electric bill would increase by \$9 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$21 per month for 3,600 households to a minimum of no increase for 300,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 6%.

number of dollar amounts. One reason for this decision was a desire to preserve the option to use non-parametric methods to estimate mean willingness-to-pay. These non-parametric methods require multiple observations for a range of dollar amounts. The specific dollar amounts used in the final study were based on the results of the pilot test. Dollar amounts were selected to cover a range such that at the low end of the range a large percentage of respondents would vote in favor of the proposal, and at the upper end of the range, a large percentage of respondents would vote against the program. A same set of dollar amounts was used in all versions of the survey. This was done to avoid confounding any effects of the survey version with effects that might arise from a change in the structure of the dollar amounts on which respondents were asked to vote.

C.8.5 Emphasis of Budget Constraints

During the OMB approval process, concern was expressed whether the pilot test survey instruments had adequately reminded survey respondents of their budget constraints. To address this concern a decision was made to add three questions to the survey. In one question, survey respondents were asked to indicate the items on which they would spend less money if the proposal passed. After explicitly considering their budget constraints, respondents were provided an opportunity to change their votes. These three questions appear as Questions 4, 5, and 6 in the final study survey versions (see Appendix E).

C.8.6 Respondents Self-Reports on Perceived Validity

Three more questions were added to the final survey to collect data about various aspects of the respondents' perception of the validity of the survey and its results. The first question asked respondents if they thought they would be affected if the proposal passed. In the national sample, respondents were asked if they felt their taxes would really go up if the proposal passed. For the marketing area, respondents were asked if they thought their utility bills would actually increase if the proposal passed. A second question asked respondents if they believed government officials *would* consider the results of the survey when making decisions about the future operations of Glen Canyon Dam. The third question asked if respondents thought government officials *should* consider the results of the survey when making decisions about future dam operations. These questions appear as Questions 7, 8, and 9 in the final survey versions.

C.8.7 Were Payment Vehicles Relevant?

Some concern was expressed that survey respondents might express high willingness-to-pay amounts if the payment vehicles (taxes in the national sample versions and utility bills in the marketing area sample) were not relevant to the respondent. To address this concern, two questions were added. In the national sample versions, one question asked if respondents had taxes withheld from a paycheck in the previous year, and a second question asked if they had filed a federal income tax form in the previous year. In the marketing area sample versions, one question asked respondents if they owned or rented their residence, and the second question asked if the respondent was responsible for paying the utility bills. These two questions appeared as Questions 28 and 29 in the final survey revisions.

In addition to the changes to the survey materials themselves, several changes were made to the sampling and implementation procedures used in the final study.

C.8.8 Sampling

Pilot test samples were purchased from Survey Sampling Inc. (SSI), an independent firm that specializes in maintaining marketing databases. For the national sample, a sample of U.S. residents, 18 years old or older was purchased. Unfortunately, we were not aware that SSI routinely excludes Alaska and Hawaii from U.S. samples unless the purchaser specifically requests that they be included. However, since extrapolation to a national population was not a purpose of the pilot test, this error was unlikely to have affected the pilot test results in any significant way. This oversight was corrected for the final study, and Alaska and Hawaii residents were included in the national sampling frame. Including Alaska and Hawaii in the sample for the final study resulted in 21 cases from these two states being included in the sample.

Power from Glen Canyon Dam is marketed in five western states. These include Colorado, New Mexico, Utah, Arizona, and Wyoming. However, only a portion of the residents within these states actually receive power that is produced at the dam. Thus, the marketing area sample was defined by postal ZIP codes that fall within the service territories of utilities with long-term firm contracts for Salt Lake City Area Integrated Projects (SLCA/IP) power. The sample as originally defined for the Glen Canyon Nonuse Survey Pilot Test was provided by Clayton Palmer of Western Area Power Administration. Procedures by which appropriate ZIP codes were identified are described in an informal memorandum, written by Clayton Palmer to Marty Phillips (Figure C-5).

Figure C-4
Panel A: Multiple-Bounded Contingent Valuation Question Format

If the higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal, taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. How would you vote on this proposal if passage of the proposal would cost your household these amounts every year for the foreseeable future? (CIRCLE ONE LETTER FOR EACH DOLLAR AMOUNT TO SHOW HOW YOU WOULD VOTE)

Cost to you per year?	Approx. cost per month?	Definitely Yes	Probably Yes	Not Sure	Probably No	Definitely No
10¢	1¢	A	B	C	D	E
50¢	4¢	A	B	C	D	E
\$1	8¢	A	B	C	D	E
\$5	42¢	A	B	C	D	E
\$10	83¢	A	B	C	D	E
\$20	\$1.67	A	B	C	D	E
\$30	\$2.50	A	B	C	D	E
\$40	\$3.33	A	B	C	D	E
\$50	\$4.17	A	B	C	D	E
\$75	\$6.25	A	B	C	D	E
\$100	\$8.33	A	B	C	D	E
\$150	\$12.50	A	B	C	D	E
\$200	\$16.70	A	B	C	D	E

(continued)

Figure C-4, continued

Panel B: Single-Bounded Contingent Valuation Question Format

If the higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal, taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. How would you vote on this proposal if passage of the proposal would cost your household \$ _____ every year for the foreseeable future? (*CIRCLE ONE NUMBER*)
- 1 Yes - I would vote for the proposal to change operations at Glen Canyon Dam even though I would have to pay more taxes.
 - 2 No - I would vote against the proposal.
-

Figure C-5
Procedures for Identifying ZIP Codes

Informal Memorandum

Date: January 5th, 1994
TO: Ms. Marty Phillips
HBRS, INC
585 Science Drive, Suite A
Madison, WI 53711
FROM: S. Clayton Palmer, Western Area Power Administration
SUBJECT: Zip Codes of Customer Service Areas

Enclosed you will find the zip codes that pertain to the service areas of long-term firm power customers of the Salt Lake City Area Integrated Projects (SLCA/IP) of Western Area Power Administration (Western).

These zip codes pertaining to customers' service areas were identified differently for municipalities than for Rural Electric Associations (REA) and Cooperatives. For municipalities, we selected the zip code pertinent to that municipality. In the few instances where more than one pertained, we included those zip codes that were entirely contained within the municipal's service area (exceptions are noted). For REAs, we first identified the service areas. We overlaid maps of service area with maps of the first three digits of a zip codes. We then identified the common geographic area of both. Once this was accomplished, we looked up the zip code of every city or town identified on the zip code map.

To clarify the process used for the zip code identification for the REAs, let me take an example. Moon Lake Electric Cooperative is a SLCA/IP firm power customer. Its service area is Northeast Utah. According to the zip code map, the three-digit zip codes 840 and 841 pertain to Northern central Utah. There are 13 towns that are in the common geographic area. By observation, there are seven towns that are certainly within the service area boundaries. The other towns are enough on the border that we were uncertain about whether they were actually in the service area. What towns are included in our list are just those that we were certain about. For a few REAs (including Moon Lake Electric), we contacted by telephone in order to add certainty to the list provided.

There are two caveats that I wish to pass on to you at this time. The first relates to municipalities. A few households may be served by a post office but may be outside of the service area of a SLCA/IP customer. In Bountiful, for example, some parts of unincorporated Davis County are served by the Bountiful Post Office, but receive electrical power service from Utah Power and Light. I don't know how wide-spread a problem this is. To use my previous example, Bountiful Power and Light has 13,212 electrical meters. All of these are in the Bountiful zip code: 84010. The Bountiful post office serves 14,356 mailing addresses. So, 144 residences and businesses have a 84010 zip code, but do not receive electrical power

from Bountiful City.

The second caveat relates to REAs. There are pockets within our customers' service areas which are not served by our customers. These pockets are usually not on service area maps.

Despite these caveats, I am fairly confident that we have those zip codes which are wholly within the service areas of the SLCA/IP customer served by Western's Salt Lake Area Office.

Please call me at (801) 524-3522 (or Valarie Varallo, who did all of the work, at 4445) if you have any questions.

Sincerely:

S. Clayton Palmer
Natural Resource Economist

After completion of the pilot test, a random sub-sample of 100 cases were drawn from the full marketing area sample that was purchased for the pilot test. Using the addresses as a key, these cases were divided by service utility and sent to these utilities to verify that the sampled addresses were listed as residential accounts. This was done to determine how well the sample represented the marketing area. Results showed relatively high (greater than 90 percent) "hit" rates for all locations except New Mexico. As a result, procedures for identifying appropriate ZIP codes in New Mexico were refined and a new sample of ZIP codes was assembled for that state. For the final study, the new ZIP codes in New Mexico were substituted for those used in the pilot test sampling plan, and the updated ZIP code list was used to select the sample of addresses for the final phase of the Glen Canyon Non-Use Values Survey.

Characteristics of pilot test respondents showed them to be significantly different from the population. For example, pilot test results show a disproportionate percentage of males responding to the survey compared to the true percentage of males in the sample frame. It is likely that this result is a factor of the sampling procedures used. For the pilot test, the survey was addressed to the individual named in the sample. Typically, this individual is the head of household who is most frequently male. Several members of the committee expressed concern about the over-representation of males in the pilot test. In turn, the committee decided to implement the final study using procedures that would randomly select survey respondents from among the adult members of the household. Thus, in the final study, random selection of survey participants within a household was accomplished in the following way. If the selected sample point was John Smith, all survey materials were addressed to the "Smith Household, care of John Smith." Survey materials indicated that the adult member of the household whose birthday occurred the latest in the calendar year should complete the survey.

Additional differences were observed between the characteristics of pilot test respondents and the population. Pilot test respondents tended to be older, have higher incomes and higher levels of education than the national population. It was not possible to determine whether this result was a consequence of survey non-responses or whether the sampling frame did not represent the national population. The SSI sampling frame is typically based on telephone directories and is subject to non-coverage to the extent that households do not have telephones or do have unlisted numbers. In an attempt to improve the sampling frame, the sample for the final study was drawn from a sampling frame based on telephone listings augmented by drivers license records where available (23 states).

C.8.9 Monetary Incentive

Given the implementation procedures used in the pilot test, a response rate of 70 percent was expected. This expectation was based upon prior experience in conducting similar types of

surveys, as well as a response rate prediction model HBRS had developed (Heberlein and Baumgartner, 1978; 1981). The pilot study mail survey for the marketing area sample met our expectation with a response rate of 76 percent. However, for the national sample, the pilot study mail survey response rate was 60 percent. As a consequence of the lower than expected response rate in the national sample, it was decided to increase the monetary incentive included with the initial survey mailing. A \$2 incentive was used in the pilot test. In the final study, a \$3 incentive was used.

C.8.10 Telephone Survey

Concerns about the response rate led to a decision to change survey implementation procedures by adding an additional effort to contact potential survey respondents. In the pilot test, potential respondents received an advance letter, an initial survey mailing, a follow-up post card, and up to two additional survey mailings to non-respondents. The final study used these procedures and added a telephone call to non-respondents after the third survey mailing. The purpose of the telephone call was to encourage potential respondents to complete the survey, and to collect a limited set of environmental attitude and socio-demographic data.

APPENDIX D
QUALITY OF SAMPLES

This appendix addresses issues relating to the quality of the samples purchased for this study. Information is first provided about the source of the samples and the selection procedures. Following this, demographic characteristics are repeated for the population, the sample frame, and survey respondents.

D.1 SAMPLE SELECTION

One goal of the sampling plan was to obtain a sample that represents the households in the United States. We refer to this as the "national sample." Because the national sample was designed to represent all households, it included households from the marketing area in proportion to their size in the total population. However, because only a small percentage of households in the U.S. reside in areas served by power produced at Glen Canyon Dam, we expected only a small number of marketing area households to be selected for the national sample. As a result, we selected a second sample that represents those households that reside in the areas of the United States that receive power produced at Glen Canyon Dam and whose electric bills would be directly affected by any changes in dam operations. We refer to this second sample as the "marketing area sample." The marketing area sample of households was selected from addresses in ZIP codes in service territories for utilities with firm power contracts for Salt Lake City Area Integrated Projects (SLCA/IP). Glen Canyon Dam represents about 80 percent of SLCA/IP power.

High-quality general population mail survey samples purchased from reputable vendors, may not accurately represent the national population. One reason is that mail samples are typically selected from white-page telephone directories, thus excluding the sectors of the population without telephones and those with unlisted telephone numbers. Approximately 5.1 percent of households in the continental United States do not have telephones, while an additional 26.1 percent of the households in the continental United States have unlisted telephone numbers. Households with unlisted telephone numbers tend to be more mobile and are more likely to reside in rented, urban multi-family units (Piekarski, 1989). Furthermore, people who have unlisted numbers are more likely to be unmarried, have lower incomes and educational levels, and are more likely to belong to a minority group.

Listed samples tend to overrepresent "retired" householders, whereas unlisted householders are significantly younger.

In an effort to improve the coverage of the mail survey sampling frame, samples were drawn from a database of listed households, supplemented with drivers license records from those states that publish these data. At the time the samples were drawn for this study, driver's license records were available from 23 states.

Both the national and the regional samples for this study were purchased from Survey Sampling Inc. (SSI), an independent firm specializing in national survey databases. Because the percentage of households with no telephones and the percentage of households with listed telephone numbers differs by state and region within states, the mail survey sampling frame does not contain the correct distribution of the number of households by state. To correct this potential source of sampling error, SSI uses census data to estimate the total number of households by state and region within states, and bases the number of households to be selected in each geographic strata on the estimated total number of households in each strata. Based on these factors, we feel that SSI's mail survey sampling frame provides as much coverage of our target populations as any samples that were readily available and practically affordable for this study.

The national sample for this study was drawn from SSI's supplemented database that included all states in the United States. The marketing sample, on the other hand, was restricted to certain geographical areas defined by ZIP codes. Market area ZIP codes were identified by Western Area Power Administration (WAPA) to represent the geographic areas served by utilities that had firm power contracts for SLCA/IP, for the WAPA Salt Lake City office. Like the national sample, the marketing area sample was also drawn from SSI's data base supplemented with driver's license records.

Both samples were submitted to a "deduping" process in which all sample points for the final study were compared to the pilot test sample to ensure there was no overlap of cases. This process is carried out by comparing the telephone numbers of each case. Since a portion of the final study samples did not have listed telephone numbers (i.e., sample points from driver's license records), there was only a very small possibility of overlap between the two samples. However, given the size of SSI's data base and the total number of households in the United States, the likelihood of overlap between the pilot sample and the final sample was remote. No duplicate cases were identified during this procedure for either the national or the marketing area samples.

SSI suggests that researchers using their mail samples can expect a 'deliverable rate' between 85 percent and 87 percent depending on the geography of the survey area. The deliverable rate is impacted by two factors. First, 12 percent to 15 percent of the names included in a mail sample can change due to normal population mobility. Second, 5 percent to 10 percent of records nationwide are rural -- frequently with addresses consisting of only two lines -- and are thus sometimes considered to be undeliverable by local post offices (Survey Sampling, Inc., 1992). Prior to selecting a sample of households, SSI screens all samples to exclude nonresidential addresses.

D.2 COMPARISON OF THE POPULATION, SAMPLE FRAME, AND SURVEY RESPONDENTS

As described above, even if a high-quality sample is purchased, there are likely to be differences between the characteristics of the individuals in the sample frame and those of the population. Such differences are difficult to avoid given the limitations of existing data sources. A comparison of the demographic characteristics of the population with the characteristics of the sample frame can provide some indication of how well the sample represents the population. In turn, comparisons between the characteristics of the sample frame and survey respondents can provide some indication of the characteristics of nonrespondents.

Comparisons between the population, sample frame and survey respondents are shown in Table D-1 for the national sample.¹ The first column reports projected U.S. Census estimates for 1993. U.S. Census projections for 1995 were not available for all the categories shown. All Census projections are based on data collected during the 1990 Census.

The characteristics of the national sample frame were provided by SSI along with the purchased sample. SSI reports that these characteristics of the sample frame were also projected using the 1990 U.S. Census data. SSI estimates of sampling frame characteristics are not based on a random sample from the sampling frame. Consequently, useful conclusions based on comparisons between the population and the sample frame cannot be made.

In Column 3, characteristics were tabulated from the survey results. Results from the mail and telephone surveys were combined to estimate the respondent characteristics. Telephone survey respondents were added in order to mitigate biases that could occur because of nonresponse to the mail survey.

Several caveats should be kept in mind when comparing characteristics reported in the three columns of Table D-1. First, the three estimates were obtained from three different sources, each using a different method of estimation. Population characteristics in Column 1 for instance, are based on 1990 Census data projected to 1993. Sample frame characteristics are also based on 1990 Census data but are projected to 1994 and are calculated by SSI, not the Census Bureau. In contrast, respondent characteristics are based on actual responses to the GCES non-use value mail or telephone survey. One major difference between the sources is the unit of sampling. Population and sample frame characteristics are reported for the population and for households, whereas respondent characteristics are reported for

¹ Comparable data for the marketing area sample was not assembled, given the difficulty in obtaining appropriate Census data for locations identified by ZIP codes.

individuals selected within households (different from the population). Age, percent male, and education reported for the population and the sample frame refer to the population or a portion of the population, while those reported for respondents are for a household representative.

Keeping these limitations in mind, Table D-1 compares all three sources on five characteristics. A comparison of the age distribution shows that the sample frame closely resembles the population. In contrast, the age distribution of survey respondents shows them to be significantly older. The next three variables, sex, education, and household size, were not provided by SSI for the sample frame.

Compared to the national population, survey respondents are more likely to be males and to have achieved a higher level of education. Comparison of household income is difficult given the variety of ways in which income is reported. Average household size of survey respondents appears to be about the same as that reported for the population.

The U.S. Census Bureau reports median household income and median family income, making a distinction between the two; SSI reported an average household income for the sample frame; and the survey data provided average and median household income. The Census Bureau defines a "household" as a group of individuals living together and sharing living expenses. In contrast, a "family" is defined as a group of related individuals who live in the same dwelling and share living expenses. Because of these distinctions, comparisons between the population and the sample frame are not possible.

Comparing income for the sample frame and survey respondents across income categories shows that survey respondents have higher household incomes than the sample frame. However, on average, respondents' household income is only slightly higher than the sample frame.

The survey results can also be compared to Census figures for households and families. Recall that the household was the unit of selection for this study. Study results show that the median household income for survey respondents is larger than median household income as projected by the Census. However, the survey respondents' median income appears to be similar to the median family income calculated by the Census. Given the inherent biases in a mail survey sample, we might assume that survey respondents' median household income is much closer to the median family income reported by the U.S. Census.

Table D-1
Characteristics of the Population, Sample Frame, and Survey Respondents

	Population Characteristics ^a	National Sample Frame Characteristics ^b	National Sample Respondent Characteristics ^c
Age:			
18 - 24 Years	13.4%	14.4%	4.1%
25 - 34 Years	22.0	22.0	17.5
35 - 44 Years	21.4	20.7	22.7
45 - 54 Years	15.0	14.5	19.8
55 - 64 Years	11.0	11.3	12.5
65 Years or older	17.2	17.1	23.4
	(190,674,000)	(190,282,531)	(1,913)
Percent Male:			
	47.9%	NA	52.8%
	(190,674,000)		(1,878)
Education:^d			
High school graduate or higher	80.2%	NA	91.6%
	(165,012,000)		(1,789)
Bachelors degree or higher ^e	21.9%	NA	43.8%
	(165,012,000)		(1,789)
Average Household Size:			
	2.6 people	NA	2.7 people
	(96,391,000)		(1,765)
Household Income:			
\$0 - \$9,999	NA	14.2%	7.1%
\$10 - \$14,999		8.4	7.2
\$15 - \$24,999		16.5	15.1
\$25 - \$34,999		15.3	18.0
\$35 - \$49,999		17.9	19.4
\$50 - \$99,999		21.9	26.9
\$100,000 or more		5.7	6.3
		(94,705,985)	(1,741)

(continued)

Table D-1
Characteristics of the Population, Sample Frame, and Survey Respondents
(Continued)

Income:^f			
Average household	NA	\$41,911 (94,705,985)	\$42,856 (1,741)
Median household	\$30,786 (96,391,000)	NA	\$37,250 (1,741)
Median family	\$36,950 (68,100,000)	NA	NA

^a U.S. Census projected estimates for 1993.

^b Information provided by SSI, projected forward from the 1990 U.S. Census.

^c To more fully represent the portion of the national sample contacted, results are reported for the combined mail and telephone survey data. For cases where respondents might be represented in both data sets, the mail survey data is excluded.

^d Education is reported for individuals 25 years old or older.

^e Information reported for national sample respondent characteristics represents respondents who reported being a college or technical school graduate or having completed post graduate work.

^f Median household income reported for the population is projected for 1992, in 1992 dollars, and the median family income is projected for 1993, in 1993 dollars.

() Numbers in parentheses indicate the number of valid cases.

NA Information is not available.

D.3 CONCLUSIONS

If the assumption can be made that the characteristics of the sample frame closely resemble U.S. Census statistics, then some general conclusions about how well the *sample frame* represents the population and how well the *sample respondents* represent the sampling frame can be made. Survey respondents are somewhat older than either the population or the sample frame, are more likely to be male, and have achieved higher levels of education. Survey household size appears to be about the same as the population. Average household income for respondents is roughly similar to that reported for the sample frame, and median household income is similar to median family income reported for the population.

Although these figures are comparatively close, we can not definitively say how well the survey *sample* represents the sample frame or the population, because the characteristics of the sample frame and the population are both based on U.S. Census figures. The mail sample was drawn from a database that, in and of itself, is subject to potential biases. Although an attempt was made to compensate for these biases, there is no way to determine how well this effort at reducing the biases worked since not all individuals in the sample were reached. Thus, it is not possible to distinguish whether differences between survey respondents and the sample frame are due to biases in the sample resulting from the selection procedures or due to nonresponse bias.

APPENDIX E
SURVEY MATERIALS

Mail Survey Materials - National Sample
Mail Survey Materials - Marketing Area Sample
Telephone Survey

Mail Survey Materials -- National Sample



IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-2

Greetings,

I am writing to ask you to share your views about an important issue affecting the Colorado River in Grand Canyon National Park. In the next several weeks, you will receive a survey in the mail. The survey is part of a national study of issues concerning the operation of Glen Canyon Dam. Glen Canyon Dam controls the water level in the Colorado River in the bottom of the Grand Canyon and affects the resources in and along the river. The study is a cooperative effort between the Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, Western Area Power Administration, and several Southwest American Indian tribes.

Government officials will soon be making decisions about how the dam is to be operated. The decisions will affect both the river environment at the bottom of the Canyon and the production of electricity. The way that the dam is operated affects the water level in the Colorado River which in turn affects natural and cultural resources in and along the river. The way the dam is operated also determines the value of the electricity produced by the dam. The decision makers need to know how people in households like yours feel about the tradeoffs between natural and cultural resources, such as fish, vegetation, and beaches at the bottom of the Grand Canyon, and the production of electricity from Glen Canyon Dam.

Even if you have never heard of the Glen Canyon Dam, your answers are important to this study. We cannot send this survey to every household in the country. Instead, a random sample of households was drawn. Your household was scientifically selected to receive this survey. In this study, your household represents many other households similar to yours. What U.S. households think about these issues is important for making future decisions on how to operate the Glen Canyon Dam.

The survey will arrive in the next week or so. HBRS, Inc., an independent research firm, has been hired to design and carry out the study. The survey will take about 30 minutes to complete. To ensure a random selection of respondents, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year. The survey package will provide information about Glen Canyon Dam and the natural and cultural resources downstream. You will only be asked to give your opinions and responses to questions about how you feel. The survey does not require any technical knowledge of hydroelectricity or dam operations. A stamped envelope will be supplied to return the survey to HBRS. If you have any questions about the study, you can call Mike Welsh, the HBRS survey project manager, collect at 0-608-232-2800.

We are very interested in hearing from your household so that we get an accurate picture of the range of opinions about the issues related to Glen Canyon Dam and the downstream resources. I hope you will help us out. Thank you, in advance, for your participation.

Thank you,

David L. Wegner
Glen Canyon Studies Project Manager



IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-3

Greetings,

Here is the survey I told you about in my letter last week. This study is about the Glen Canyon Dam, which controls the water level in the Colorado River as it flows through Grand Canyon National Park. Government officials will soon be making decisions about how to operate the dam. Your participation in the study will help them understand how people in households like yours feel about trade-offs between cultural and natural resources, such as fish, vegetation, and beaches, at the bottom of the Grand Canyon and the production of electricity from Glen Canyon Dam. Answers to this survey will affect future decisions about how the dam is operated.

Your response to this survey is very important. We could not send this survey to every household in the nation. Your household is part of a relatively small group of households who have been randomly selected to participate in this survey. Your answers will represent the views of many other households similar to yours and will ensure that all households are represented in decisions about the operation of the Glen Canyon Dam. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Before beginning the survey, please read the colored information sheets included in the package. This background information describes Glen Canyon Dam, the resources below the dam, and how the operation of the dam affects these resources. I realize you may not have heard about Glen Canyon Dam before you received this survey. The background information was designed by scientists studying the dam and the Grand Canyon resources downstream to help you understand the issues. The survey does not require any technical knowledge about hydroelectricity or dam operations. The survey takes about 30 minutes to complete. People who have filled the survey out tell us they found it interesting and informative.

Answers to this survey are confidential; your name will never be revealed. Information from the survey will only be reported in statistical terms. There is an identification number on the back of the survey so that HBRS, Inc., the firm conducting the survey, will know who has already returned the survey and whom to send reminders to.

When the survey is completed, simply return it in the enclosed postage-paid envelope. If you have any questions about the study, we would like to hear from you. You can call Mike Welsh, the HBRS survey project manager, collect at 0-608-232-2800.

I appreciate your help in this study. I know your time is valuable and, in recognition, have enclosed a small gift as a token of appreciation. In addition, if you would like to receive a newsletter providing more information about the Glen Canyon Dam and this study, write to the Glen Canyon Studies Office at P.O. Box 22459, Flagstaff, AZ 86002-2459.

Thank you,

David L. Wegner
Glen Canyon Studies Project Manager

Remember -- This survey
is to be filled out by the
adult in your household
with the latest birthday
in the calendar year.

**BACKGROUND INFORMATION ABOUT THIS STUDY
PLEASE READ THESE PAGES BEFORE
YOU COMPLETE THE SURVEY**

E-5

INFORMATION ABOUT GLEN CANYON DAM AND THE STUDY AREA

Before you fill out the survey, we want to describe the Glen Canyon Dam and the resources downstream from Glen Canyon Dam in the Study Area.

Glen Canyon Dam

- Glen Canyon Dam is located on the Colorado River in Arizona.
 - It is just upstream from the Grand Canyon.
 - It was built to provide water supplies and hydroelectricity.
 - It was completed about 30 years ago.
 - It controls the water flow through the Grand Canyon.
 - Revenues from the sale of hydroelectricity are used to repay costs.

The Study Area

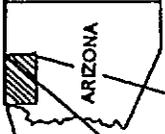
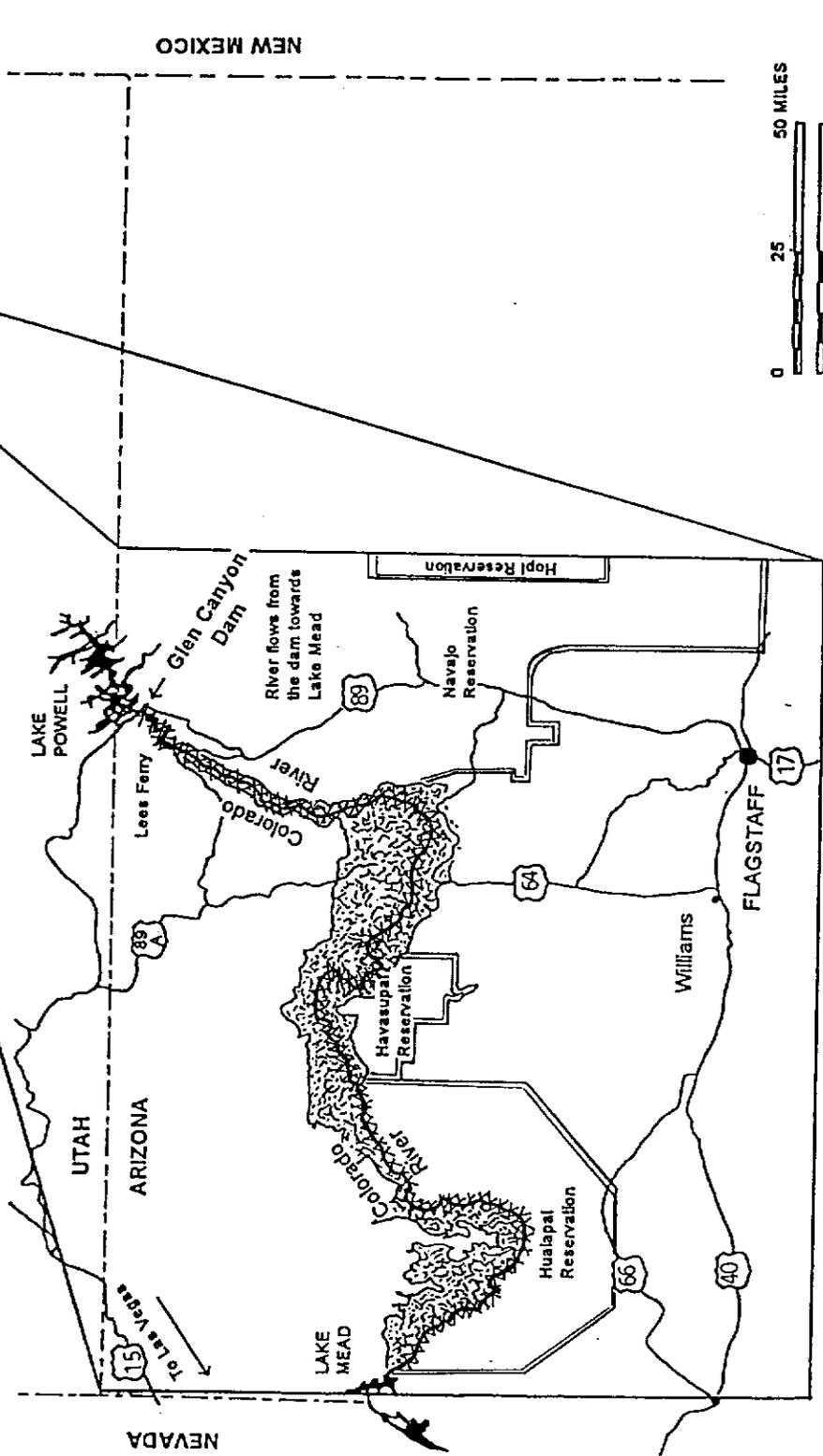
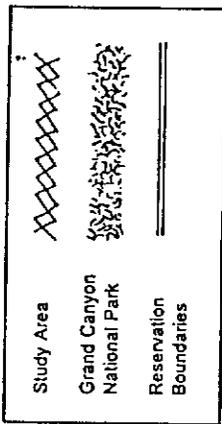
- The Study Area consists only of the area in and along the Colorado River at the bottom of the Grand Canyon.
- The Study Area begins at Glen Canyon Dam.
- The Study Area continues for nearly 300 miles.
- The Study Area ends at Lake Mead near Las Vegas.
- Part of the Study Area is within the Grand Canyon National Park.
- Part of the Study Area is bordered by American Indian reservations.
- The cover of the survey booklet shows one view of the Colorado River in the Study Area.

How Glen Canyon Dam affects the Colorado River in the Study Area

- The amount of electricity produced by Glen Canyon Dam depends on the amount of water released from the dam: the more water released, the more electricity produced.
- More water is released during periods of high demand for electricity and less water is released during periods of low demand for electricity.
 - On a seasonal basis, more water is released during the hottest summer months and the coldest winter months.
 - On a daily basis, more water is released during the day than at night.
 - The amount of water released can vary from hour to hour throughout the day.
- In some places in the Grand Canyon, this can result in the river rising and falling as much as ten feet in a day.

This study deals with the ways Glen Canyon Dam could be operated to benefit natural and cultural resources in the Study Area. A map showing the location of the Dam and the Study Area appears on the next page. A description of the resources in the Study Area is contained on the pages following the map.

NOTE: The map included with the surveys was color-coded. The study area was identified by a red line drawn coincident with the Colorado River, reservation boundaries were outlined in blue, and Glen Canyon Dam was identified in orange. The key was changed for this map to allow for easy duplication in black and white.



NATURAL RESOURCES IN THE STUDY AREA

E-7

The natural resources in the Study Area are located in and along the Colorado River below Glen Canyon Dam.

- **Deposits of sand, mud, and gravel, sometimes called beaches, are scattered along the river. The rest of the river bank consists of cliffs and steep slopes covered with rocks, boulders, and desert vegetation.**
 - Beaches vary greatly in size. Some are as large as several acres, and others consist of a little sand at the river's edge.
- **Some beaches are covered with vegetation.**
 - Beaches with vegetation provide habitat for birds and other small animals.
- **Archeological sites are located along the river.**
 - These sites are associated with American Indian cultures that have inhabited or used the Grand Canyon for thousands of years.
 - These sites contain evidence of ancient human activity along the river, including pots and tools.
- **Present-day American Indians have sacred sites and traditional-use areas along the river.**
 - American Indians gather materials from these sites for use in their everyday life.
- **Native fish species live in the Study Area.**
 - Only one of these native species is found outside the Colorado River and its tributaries.
- **Trout also live in the river.**
 - Trout are not native to this section of the Colorado River.
 - People fish for these trout in the first 15 miles of river downstream from Glen Canyon Dam.
- **Several other non-native fish species, including carp, catfish, and fathead minnows, also live in the Study Area.**
- **Only a small percentage of visitors to the Grand Canyon National Park actually see or use the resources in the Study Area.**
 - The only people who see the resources in the Study Area are American Indians using resources in the Study Area, river rafters, backpackers, and people who fish there.

SOME PEOPLE ARE CONCERNED ABOUT THESE RESOURCES

E-8

- Because of erosion, the number and size of beaches along the river are decreasing.
 - Between 1973 and 1991, the *number* of beaches decreased from 276 to 258; many of the remaining beaches are *smaller*.
 - The loss is most severe along the narrow sections of river.
- 27 known archeological sites have been affected by erosion. An unknown number of other sites may be affected.
- Resources important to American Indians are also affected by erosion.
 - Loss of archeological sites destroys important links to the past.
 - Sacred sites exist in places that may be damaged by erosion.
 - Plants, animals, and minerals used by American Indians are affected by erosion.
- Populations of native fish in the Study Area have declined.
 - Eight species of native fish evolved in the Colorado River when the water was warmer than it is today.
 - Three of the eight native fish species are no longer found in the Study Area.
 - Two of five remaining native species, the humpback chub and razorback sucker, are in danger of becoming extinct.
 - Cold water released from Glen Canyon Dam may be the most important factor in the decline of native fish populations.
 - Competition from non-native fish (trout, carp, catfish, minnow species) may have contributed to the decline of native species.
- Conditions for trout are affected by daily fluctuations in water level.
 - Maintenance of recreational trout fishing requires annual stocking.
 - Trout eggs dry out and die during low-water periods.
 - Food for trout is reduced because of exposure during low-water periods.

Scientists have learned that by changing the way water is released from the dam, primarily by reducing the size of daily fluctuations, some of the concerns about the natural resources in the Study Area could be addressed.

- Reducing fluctuations in water released from the dam could affect the following resources in the Study Area:
 - The number and size of beaches.
 - Conditions for native fish.
 - Conditions for trout.
 - The amount of vegetation available for bird and wildlife habitat.
 - Archeological sites along the river.

Changing the way water is released from the dam will not reduce the total amount of electricity produced at Glen Canyon Dam.

However, there will be changes in when and where electricity is produced.

- During the day:
 - Less electricity will be produced at Glen Canyon Dam.
 - More electricity will be produced from power plants burning gas or oil.
- During the night:
 - More electricity will be produced at Glen Canyon Dam.
 - Less electricity will be produced from power plants burning coal.
- Since oil and gas are more expensive fuel sources than coal, the overall cost of meeting electrical demand will increase.

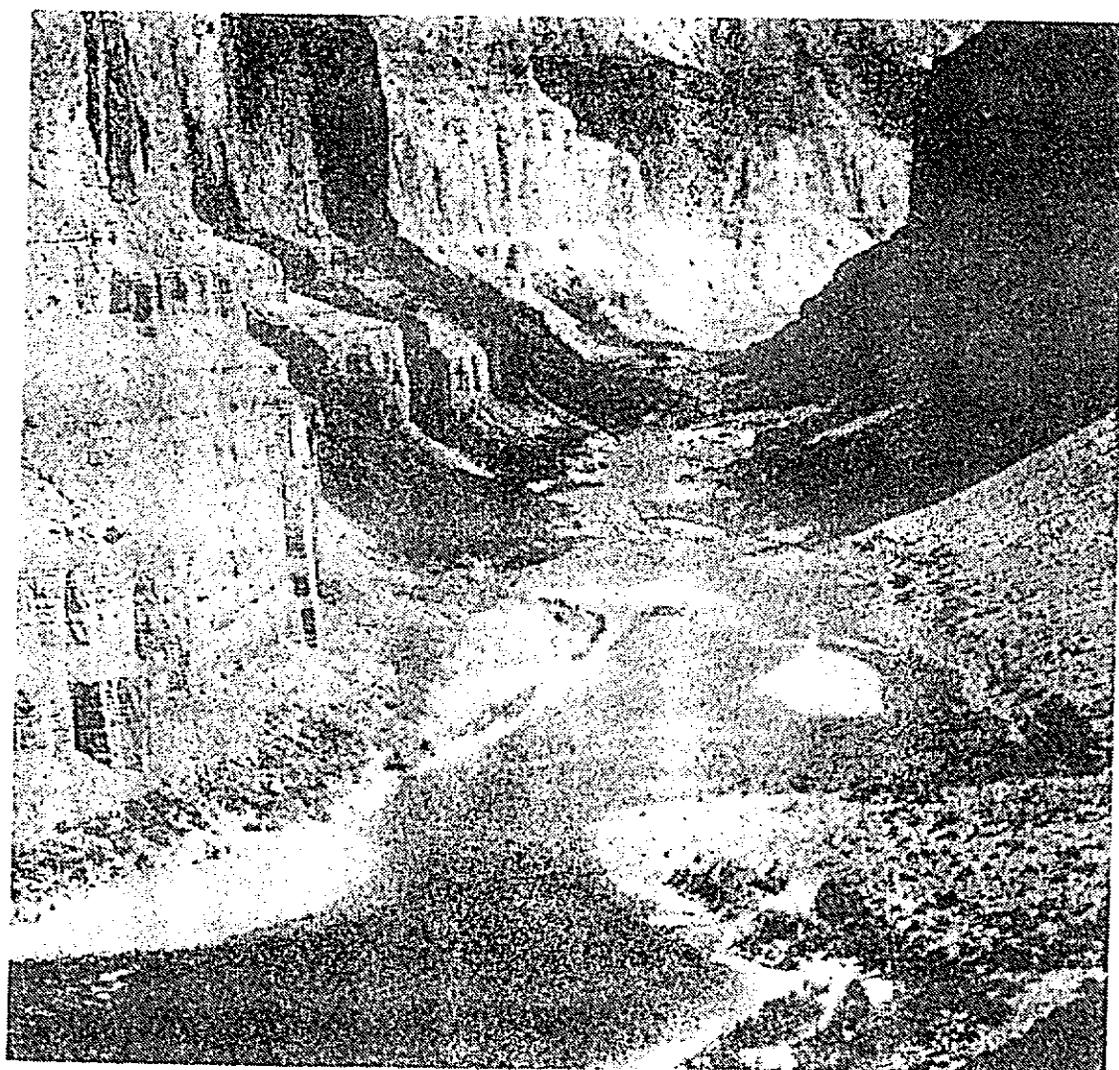
Some households receiving power from Glen Canyon Dam could see their monthly electric bill increase.

- About 4.5 million households live in states surrounding Glen Canyon Dam.
- About 1.5 million of these households receive some, or all, of their electricity from Glen Canyon Dam.
- Most of the 1.5 million households receiving power from Glen Canyon Dam are located in rural areas and smaller towns.
- The amount of increase in a household's electric bill depends on how much of their electricity comes from Glen Canyon Dam.

Some farmers using electricity to pump irrigation water will also be affected.

- Higher costs for pumping irrigation water will reduce some farmers' incomes.

GLEN CANYON SURVEY



View of the Colorado River in the Grand Canyon at Nankoweap.
Photo by Gary Ladd

Privacy Act Statement: Your participation in this survey is voluntary. There are no penalties for not answering some or all of the questions, but since you will represent many others who will not be surveyed, your cooperation is extremely important. The answers you provide are confidential. An identification number on the questionnaire is for mailing purposes only. Our results will be summarized so that the answers you provide cannot be associated with you or anyone in your household. Your name and address will not be given to any other group or used by us beyond the purposes of this study.

Public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, gathering and monitoring data, and completing and reviewing the form. Send comments regarding the burden estimate or any other aspect of this form to the Chief Publications and Records Management Branch, Code D-7920, Bureau of Reclamation, Denver Federal Center, PO Box 25007, Denver, CO 80225-0007; and the Office of Management and Budget, Paperwork Reduction 1006-0016, Washington, D.C. 20503.

We presented a lot of material in the background information. In this section, we will ask a few questions about the background information to make sure it was clearly presented. Please feel free to refer to the information sheets when answering these questions.

1. For each statement below, please circle the letter "T" if you think the statement is true, or the letter "F" if you think the statement is false.
(CIRCLE ONE LETTER FOR EACH STATEMENT)

	TRUE	FALSE
There are now many more beaches along the Colorado River than there were 20 years ago.	T	F
Native fish populations in the Colorado River have declined.	T	F
The decrease in the number and size of beaches is most severe along wide sections of the river.	T	F
None of the beaches along the river have vegetation.	T	F
There are American Indian traditional-use areas and sacred sites located along the Colorado River below Glen Canyon Dam.	T	F
Archeological sites are not being affected by erosion.	T	F
Trout are not native to the study area.	T	F
All native fish species have disappeared from the Grand Canyon.	T	F
Nearly all visitors to the Grand Canyon National Park use the beaches along the river.	T	F

(CONTINUED)

	TRUE	FALSE
American Indian traditional-use areas are affected by erosion.	T	F
Water levels are constant throughout the day.	T	F
The Study Area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.	T	F
The shoreline in the study area consists only of beaches.	T	F
Vegetation on beaches provides habitat for birds and other wildlife.	T	F
Two of the native fish species are in danger of extinction.	T	F
Reducing daily fluctuations in the amount of water released from the dam will reduce the total amount of hydroelectricity produced.	T	F

Government Officials Are Deciding How to Operate Glen Canyon Dam in Future Years.

- Their decision on how the dam should be operated could cost you money. For example:
 - Changes in operations of the dam could reduce the revenue earned by the dam -- as a result, taxpayers would have to make up the difference.
 - If you live in an area receiving power from Glen Canyon Dam, your utility bill would increase.

INSTRUCTIONS FOR NEXT QUESTION

Government officials will consider many factors when deciding whether or not to change dam operations. One factor they would like to consider is whether various proposals are personally worthwhile to people like you. In the next question, we will describe the effects of a specific proposal to change dam operations. We would like you to tell us if you would vote "YES" or "NO" on this proposal.

Some people might vote "NO" because:

- the cost of the proposal is too high.
- the effects of the proposal are not worth anything (not even 10¢) to them.
- they just can't afford the cost.

Some people might vote "YES" because:

- the cost of the proposal is low enough.
- the effects of the proposal are worth what it would cost them.

At this point in time, it is not certain what the cost would be to any specific individual, so we are asking different people about different amounts. Even if the amount we ask you about seems very low or very high, please answer carefully. This will allow us to determine whether people think the proposal is worthwhile at whatever level the final cost is determined to be. For this study, it is important that you tell us how you would vote, based only on **your personal evaluation** of whether changes in dam operations and their effects, are worth the additional cost to you.

Version 1: Moderate Fluctuating Flow Alternative -- Survey Page 5**A PROPOSAL**

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites, and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish.
- Native fish populations, including those in danger of extinction, would probably continue to decline in numbers.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to maintain the population.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households and a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (**CIRCLE ONE NUMBER**)

- 1 No----->SKIP TO QUESTION 8
- 2 Yes
- 3 I would choose not to vote
on this proposal----->SKIP TO QUESTION 8

Version 2: Low Fluctuating Flow Alternative -- Survey Page 5

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish.
- It is likely, but not certain, that native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households to a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (*CIRCLE ONE NUMBER*)

- 1 No----->*SKIP TO QUESTION 8*
 2 Yes
 3 I would choose not to vote
 on this proposal----->*SKIP TO QUESTION 8*

**Version 3: Seasonally Adjusted Steady Flow Alternative --
Survey Page 5**

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- The average electric bill would increase by \$9 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$21 per month for 3,600 households to a minimum of no increase for 300,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 6%.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 1 No----->SKIP TO QUESTION 8
 2 Yes
 3 I would choose not to vote
 on this proposal----->SKIP TO QUESTION 8

**Version 4: Seasonally Adjusted Steady Flow with Moderate
Fluctuating Flow Price Impacts Alternative -- Survey Page 5**

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households to a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 1 No-----> SKIP TO QUESTION 8
- 2 Yes
- 3 I would choose not to vote
on this proposal-----> SKIP TO QUESTION 8

The higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal. Taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. Would you vote for this proposal if passage of the proposal would cost your household \$ _____ in increased taxes every year for the foreseeable future?
(CIRCLE ONE NUMBER)

- 1 Definitely No - I would definitely vote against the proposal.
 2 Probably No - I would probably vote against the proposal.
 3 Not Sure - I am not sure if I would vote for the proposal.
 4 Probably Yes - I would probably vote for the proposal.
 5 Definitely Yes - I would definitely vote for the proposal.

4. If this proposal passes and you had to pay \$ _____ every year for the foreseeable future, on what sorts of things would you spend less money in order to pay for the cost of this proposal? (FILL IN THE BLANK)

5. Now that you have had an additional chance to think about what you would have to give up if the proposal passes, would you like to change your vote?
(CIRCLE ONE NUMBER)

- 1 No----->SKIP TO QUESTION 7
 2 Yes

6. Now how would you vote on the proposal? (CIRCLE ONE NUMBER)

- 1 Definitely No - I would definitely vote against the proposal.
 2 Probably No - I would probably vote against the proposal.
 3 Not Sure - I am not sure if I would vote for the proposal.
 4 Probably Yes - I would probably vote for the proposal.
 5 Definitely Yes - I would definitely vote for the proposal.

7. Do you believe your taxes will increase if this proposal passes?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

8. Do you think public officials will consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

9. Do you think public officials should consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

10. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

11. Before receiving this survey had you heard of Glen Canyon Dam?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes----->What had you heard about Glen Canyon Dam before receiving this survey?
(FILL IN THE BLANK)

12. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please indicate how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
	1	2	3	4	5
When humans interfere with nature, it often produces disastrous consequences.	1	2	3	4	5
Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
The balance of nature is very delicate and easily upset.	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5
Humans were meant to rule the rest of nature.	1	2	3	4	5
Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
Plants and animals have as much right as humans to exist.	1	2	3	4	5
Human ingenuity will ensure that we do not make the earth unlivable.	1	2	3	4	5
Humans are severely abusing the environment.	1	2	3	4	5
The so-called ecological crisis facing humankind has been greatly exaggerated.	1	2	3	4	5
We are approaching the limit of the number of people the earth can support.	1	2	3	4	5
The earth is like a spaceship with very limited room and resources.	1	2	3	4	5
The earth has plenty of natural resources, if we just learn how to develop them.	1	2	3	4	5
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5

13. The following statements discuss economic and environmental issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
Economic security and well-being should be considered first; then we can worry about environmental problems.	1	2	3	4	5
It is possible to protect our environment and natural resources and still maintain a healthy economy.	1	2	3	4	5
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market.	1	2	3	4	5
Some pollution is inevitable if we are going to continue to improve our standard of living.	1	2	3	4	5
I would be willing to pay somewhat higher prices (5 to 10 percent higher) for products that would cause less pollution or environmental damage.	1	2	3	4	5
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	1	2	3	4	5
Some land in the United States should be set aside from human use so it can remain completely untouched, regardless of its economic value.	1	2	3	4	5

14. The following statements discuss American Indian issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
It is our responsibility to protect those areas of historical or religious importance to American Indians.	1	2	3	4	5
We have gone too far in granting American Indians special rights to use public lands and resources, such as fish and wildlife.	1	2	3	4	5
Our society can learn important lessons from studying earlier cultures that inhabited our country.	1	2	3	4	5
We can't afford to let concern for preserving artifacts of earlier American Indian cultures stand in the way of operating hydroelectric dams.	1	2	3	4	5
American Indian concerns should be equally as important as our society's economic needs when deciding how to use land.	1	2	3	4	5

15. The following statements discuss hydroelectricity. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
The benefits of hydroelectric dams on the Colorado River outweigh the impacts to the natural environment and historical places along the river.	1	2	3	4	5
Hydroelectric dams should not be constructed on rivers that flow through national parks.	1	2	3	4	5
Hydroelectric dams have fewer environmental impacts than coal, oil, or gas-burning power plants.	1	2	3	4	5
Hydroelectric dams can have serious impacts on the plants and animals that live in or along the river.	1	2	3	4	5
Hydroelectric dams produce relatively cheap electricity compared to other sources.	1	2	3	4	5
Hydroelectric dams should be developed wherever it is economically feasible, even if it means that some rivers will be changed.	1	2	3	4	5
Rivers without dams are a unique and irreplaceable resource that should be protected from hydroelectric dams.	1	2	3	4	5

In this section, we would like to learn how you feel about national parks in the United States.

16. Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes
- 3 Don't know

17. We are interested in learning how you feel about national parks in general. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below.

(CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
	1	2	3	4	5
National parks are a "luxury" we cannot afford in difficult economic times.	1	2	3	4	5
National parks help us to remember that our future is tied to the preservation of nature and natural resources.	1	2	3	4	5
It is important that national parks offer us a chance to see America as the early settlers saw it.	1	2	3	4	5
Americans need places like national parks to "recharge their batteries."	1	2	3	4	5
An important function of the National Park Service is to protect native birds, plants, and animals.	1	2	3	4	5

(CONTINUED)

	STRONGLY AGREE			STRONGLY DISAGREE	
National parks are only valuable to the people who visit them.	1	2	3	4	5
Oil and natural gas finds on national park lands should be developed since it is in the national interest.	1	2	3	4	5
The National Park Service places too much emphasis on preservation.	1	2	3	4	5
I am glad there are national parks, even if I don't visit them.	1	2	3	4	5
People can think a place is valuable, even if they do not actually go there themselves.	1	2	3	4	5
The American people should provide greater financial support for the National Park Service to avoid more commercial activities in the national parks.	1	2	3	4	5
If the National Park Service needs more financial support, they should develop more gift shops and commercial activities to raise money.	1	2	3	4	5

In this section, we are interested in learning about trips you may have taken to Grand Canyon National Park.

18. As best you can recall, have you ever flown over Grand Canyon National Park in an aircraft? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 20
 - 2 Yes
19. Did you fly over Grand Canyon National Park while you were on a commercial airliner, or did you fly over the park as part of a sightseeing air tour that included the park? (CIRCLE ALL NUMBERS THAT APPLY)
- 1 I flew over Grand Canyon National Park while on a commercial aircraft
 - 2 I flew over Grand Canyon National Park as part of a sightseeing air tour
 - 3 Other (please describe: _____)
20. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 23
 - 2 Yes
21. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 23
 - 2 Yes
22. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No
 - 2 Yes
23. How likely do you think it is that you will visit the Grand Canyon National Park in the future? (CIRCLE ONE NUMBER)
- 1 Not at all likely
 - 2 Somewhat unlikely
 - 3 Somewhat likely
 - 4 Very likely

In this last section, we would like to ask you some questions about your background that will help us compare your answers with those of other people. We stress that all of your responses are strictly confidential.

24. Are you: (CIRCLE ONE NUMBER)

- 1 Male
- 2 Female

25. How old are you? (FILL IN THE BLANK)

_____ Years old

26. How many years of schooling have you completed? (CIRCLE ONE NUMBER)

- 1 Eight years or less
- 2 Some high school
- 3 High school graduate
- 4 Some college or technical school
- 5 College or technical school graduate
- 6 Post graduate work

27. How many people live in your household? (FILL IN ALL BLANKS)

NUMBER

_____ People 18 years old or older

_____ People under the age of 18

_____ Total number of people in the household

28. Did you or any members in your household have any taxes withheld from a paycheck or other earnings in 1993? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

29. Did you or any members of your household file a Federal income tax form for 1993?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

30. Which of the following categories comes closest to your total 1993 household income?
(CIRCLE ONE NUMBER)

- | | | | |
|---|----------------------|----|----------------------|
| 1 | Less than \$10,000 | 9 | \$45,000 to \$49,999 |
| 2 | \$10,000 to \$14,999 | 10 | \$50,000 to \$59,999 |
| 3 | \$15,000 to \$19,999 | 11 | \$60,000 to \$69,999 |
| 4 | \$20,000 to \$24,999 | 12 | \$70,000 to \$79,999 |
| 5 | \$25,000 to \$29,999 | 13 | \$80,000 to \$89,999 |
| 6 | \$30,000 to \$34,999 | 14 | \$90,000 to \$99,999 |
| 7 | \$35,000 to \$39,999 | 15 | Over \$100,000 |
| 8 | \$40,000 to \$44,999 | | |

THANK YOU FOR YOUR HELP!

Comments:

**Please feel free to keep the colored background
information materials**

**Please return only this survey booklet in the
enclosed, postage-paid envelope to:**

**Glen Canyon Studies
c/o HBRIS, Inc.
University Research Park
455 Science Drive
Madison, WI 53711**

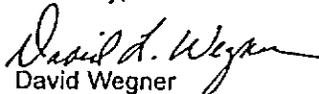
Hello,

A few days ago your household received a questionnaire about the tradeoffs between production of electricity at Glen Canyon Dam and the natural and cultural resources along the Colorado River in the Grand Canyon. If the survey has been completed and returned, please consider this a "thank you." Otherwise, I hope you will be able to fill it out and return it soon.

Your household's responses to this survey are very important. We can only survey a small number of households, so your responses will represent many other households like yours, who are not able to participate in this study.

Thank you for your participation.

Sincerely,


David Wegner
Glen Canyon Studies Manager

Glen Canyon Studies c/o HBRS, Inc.

455 Science Drive

Madison, WI 53711



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-32

IN REPLY REFER TO:

Greetings!

About two weeks ago, we sent a questionnaire to your household. The survey asked about your opinions on how the Glen Canyon Dam on the Colorado River should be operated. Hearing from your household is very important. If you have already completed and returned the questionnaire, please accept our sincere thanks. If you have not done so, we would still very much like to hear from your household.

Even if you have never heard about Glen Canyon Dam prior to receiving this survey, your opinions are very important for this study. You don't need to have any special knowledge about hydroelectricity, dam operations, or environmental issues to fill out the survey. The background information sheets enclosed with the survey were prepared to help people understand the relation between the operation of the dam and downstream cultural and natural resources.

Government officials will soon be making decisions about how to operate the dam. Your participation in the study will help them understand how people in households like yours feel about trade-offs between cultural and natural resources, such as fish, vegetation, and beaches, at the bottom of the Grand Canyon and the production of electricity from Glen Canyon Dam. Answers to this survey will affect future decisions about how the dam is operated.

We could not send this survey to every household in the nation. Your household is part of a relatively small group of households who have been randomly selected to participate in this survey. Your answers will represent the views of many other households similar to yours and will ensure that the opinions of all households are represented in decisions about the operation of the Glen Canyon Dam. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Your responses are confidential, and your name will not be revealed. Information from the surveys will only be reported in statistical terms, such as "10 percent of all respondents have seen the Colorado River in Grand Canyon National Park."

I have enclosed another copy of the survey in case the first one was lost or misplaced. There is an identification number on the back of the survey so that HBRS, Inc., the firm conducting the survey, will know who has already returned the survey and who to send reminders to.

When the survey is completed, simply return it in the enclosed postage-paid envelope. We hope that you find the survey interesting and enjoyable to fill out. If you have any questions or concerns about this survey or the study, please feel free to call Mike Welsh, the HBRS survey project manager, collect at 0-608-232-2800.

I appreciate your help in this study.

Sincerely,

David L. Wegner
Glen Canyon Studies Manager



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-33

IN REPLY REFER TO.

Greetings!

I am sorry if this certified letter has caused you any inconvenience. This survey is very important and I wanted to make sure it reached your household.

About three weeks ago, I sent a survey concerning the operations of Glen Canyon Dam. Even if you don't live near Glen Canyon Dam or the Grand Canyon, it is still important to hear from you, even if it is only to tell us that you simply don't care how Glen Canyon Dam is operated. Some people have told us that they felt they did not know enough to answer the questionnaire. The background information sheets enclosed with the survey were prepared to help people understand the relation between the operation of the dam and downstream cultural and natural resources. This background information will enable you to participate in this study even if you don't feel that you know very much about the Glen Canyon Dam.

Government officials will soon be making decisions about how the dam is operated. In making these decisions, they would like to know more about how individuals like you feel about the issues that are discussed in the questionnaire. Your household was chosen at random to participate in this study. Since we can't send surveys to every household, your response will represent the opinions of households similar to yours that were not selected to participate in the study. We need to hear from everyone to make sure that we have a representative sample of opinions about this issue.

I am enclosing another copy of the questionnaire and a stamped self-addressed envelope in case you have misplaced the previous ones. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Thank you for your help in this study. Your cooperation in completing this questionnaire will help to make this a successful project.

Sincerely,

David L. Wegner
Glen Canyon Studies Manager

P.S. If for some reason, you can't complete the questionnaire, please write a note on the questionnaire booklet and mail it back. It is better for us to hear something from you than nothing at all. Or if you prefer, you can call HBRS collect at 608-232-2800. Ask for Mike Welsh, the Glen Canyon Studies project manager.

Mail Survey Materials -- Marketing Area Sample



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-35

IN REPLY REFER TO:

Greetings,

I am writing to ask you to share your views about an important issue affecting the Colorado River in Grand Canyon National Park. In the next several weeks, you will receive a survey in the mail. The survey is part of a national study of issues concerning the operation of Glen Canyon Dam. Glen Canyon Dam controls the water level in the Colorado River in the bottom of the Grand Canyon and affects the resources in and along the river. The study is a cooperative effort between the Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, Western Area Power Administration, and several Southwest American Indian tribes.

Government officials will soon be making decisions about how the dam is to be operated. The decisions will affect both the river environment at the bottom of the Canyon and the production of electricity. The way that the dam is operated affects the water level in the Colorado River which in turn affects natural and cultural resources in and along the river. The way the dam is operated also determines the value of the electricity produced by the dam. The decision makers need to know how people in households like yours feel about the tradeoffs between natural and cultural resources, such as fish, vegetation, and beaches at the bottom of the Grand Canyon, and the production of electricity from Glen Canyon Dam.

Even if you have never heard of the Glen Canyon Dam, your answers are important to this study. We cannot send this survey to every household in the country. Instead, a random sample of households was drawn. Your household was scientifically selected to receive this survey. In this study, your household represents many other households similar to yours. What U.S. households think about these issues is important for making future decisions on how to operate the Glen Canyon Dam.

The survey will arrive in the next week or so. HBRS, Inc., an independent research firm, has been hired to design and carry out the study. The survey will take about 30 minutes to complete. To ensure a random selection of respondents, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year. The survey package will provide information about Glen Canyon Dam and the natural and cultural resources downstream. You will only be asked to give your opinions and responses to questions about how you feel. The survey does not require any technical knowledge of hydroelectricity or dam operations. A stamped envelope will be supplied to return the survey to HBRS. If you have any questions about the study, you can call Mike Welsh, the HBRS survey project manager, collect at 0-608-232-2800.

We are very interested in hearing from your household so that we get an accurate picture of the range of opinions about the issues related to Glen Canyon Dam and the downstream resources. I hope you will help us out. Thank you, in advance, for your participation.

Thank you,

David L. Wegner
Glen Canyon Studies Project Manager



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-36

IN REPLY REFER TO:

Greetings,

Here is the survey I told you about in my letter last week. This study is about the Glen Canyon Dam, which controls the water level in the Colorado River as it flows through Grand Canyon National Park. Government officials will soon be making decisions about how to operate the dam. Your participation in the study will help them understand how people in households like yours feel about trade-offs between cultural and natural resources, such as fish, vegetation, and beaches, at the bottom of the Grand Canyon and the production of electricity from Glen Canyon Dam. Answers to this survey will affect future decisions about how the dam is operated.

Your response to this survey is very important. We could not send this survey to every household in the nation. Your household is part of a relatively small group of households who have been randomly selected to participate in this survey. Your answers will represent the views of many other households similar to yours and will ensure that all households are represented in decisions about the operation of the Glen Canyon Dam. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Before beginning the survey, please read the colored information sheets included in the package. This background information describes Glen Canyon Dam, the resources below the dam, and how the operation of the dam affects these resources. I realize you may not have heard about Glen Canyon Dam before you received this survey. The background information was designed by scientists studying the dam and the Grand Canyon resources downstream to help you understand the issues. The survey does not require any technical knowledge about hydroelectricity or dam operations. The survey takes about 30 minutes to complete. People who have filled the survey out tell us they found it interesting and informative.

Answers to this survey are confidential; your name will never be revealed. Information from the survey will only be reported in statistical terms. There is an identification number on the back of the survey so that HBRS, Inc., the firm conducting the survey, will know who has already returned the survey and whom to send reminders to.

When the survey is completed, simply return it in the enclosed postage-paid envelope. If you have any questions about the study, we would like to hear from you. You can call Mike Welsh, the HBRS survey project manager, collect at 0-608-232-2800.

I appreciate your help in this study. I know your time is valuable and, in recognition, have enclosed a small gift as a token of appreciation. In addition, if you would like to receive a newsletter providing more information about the Glen Canyon Dam and this study, write to the Glen Canyon Studies Office at P.O. Box 22459, Flagstaff, AZ 86002-2459.

Thank you,

David L. Wegner
Glen Canyon Studies Project Manager

Remember -- This survey
is to be filled out by the
adult in your household
with the latest birthday
in the calendar year.

**BACKGROUND INFORMATION ABOUT THIS STUDY
PLEASE READ THESE PAGES BEFORE
YOU COMPLETE THE SURVEY**

E-38

INFORMATION ABOUT GLEN CANYON DAM AND THE STUDY AREA

Before you fill out the survey, we want to describe the Glen Canyon Dam and the resources downstream from Glen Canyon Dam in the Study Area.

Glen Canyon Dam

- Glen Canyon Dam is located on the Colorado River in Arizona.
 - It is just upstream from the Grand Canyon.
 - It was built to provide water supplies and hydroelectricity.
 - It was completed about 30 years ago.
 - It controls the water flow through the Grand Canyon.
 - Revenues from the sale of hydroelectricity are used to repay costs.

The Study Area

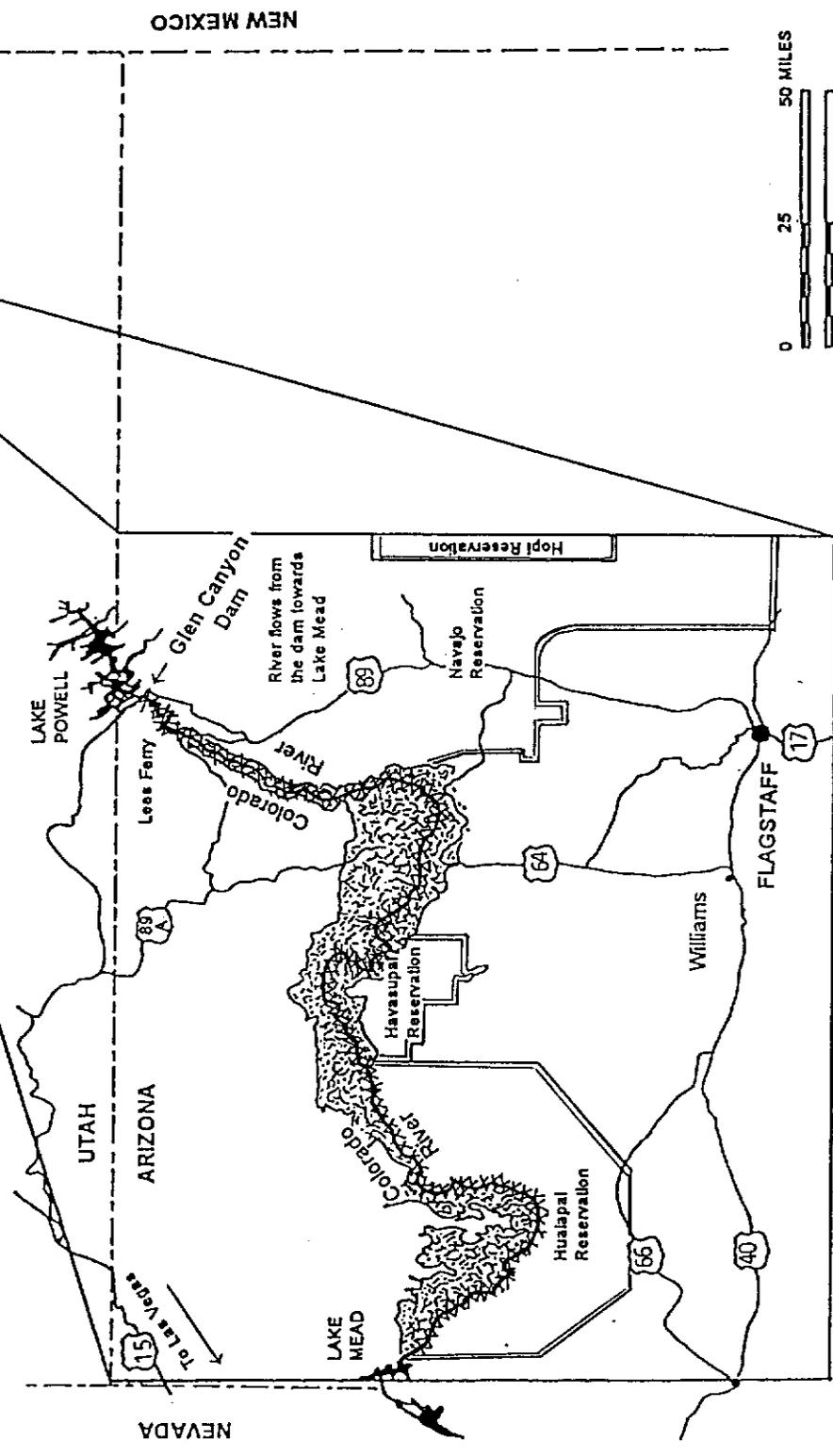
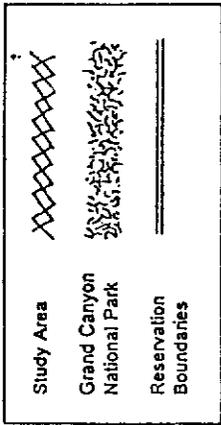
- The Study Area consists only of the area in and along the Colorado River at the bottom of the Grand Canyon.
- The Study Area begins at Glen Canyon Dam.
- The Study Area continues for nearly 300 miles.
- The Study Area ends at Lake Mead near Las Vegas.
- Part of the Study Area is within the Grand Canyon National Park.
- Part of the Study Area is bordered by American Indian reservations.
- The cover of the survey booklet shows one view of the Colorado River in the Study Area.

How Glen Canyon Dam affects the Colorado River in the Study Area

- The amount of electricity produced by Glen Canyon Dam depends on the amount of water released from the dam: the more water released, the more electricity produced.
- More water is released during periods of high demand for electricity and less water is released during periods of low demand for electricity.
 - On a seasonal basis, more water is released during the hottest summer months and the coldest winter months.
 - On a daily basis, more water is released during the day than at night.
 - The amount of water released can vary from hour to hour throughout the day.
- In some places in the Grand Canyon, this can result in the river rising and falling as much as ten feet in a day.

This study deals with the ways Glen Canyon Dam could be operated to benefit natural and cultural resources in the Study Area. A map showing the location of the Dam and the Study Area appears on the next page. A description of the resources in the Study Area is contained on the pages following the map.

NOTE: The map included with the surveys was color-coded. The study area was identified by a red line drawn coincident with the Colorado River, reservation boundaries were outlined in blue, and Glen Canyon Dam was identified in orange. The key was changed for this map to allow for easy duplication in black and white.



NATURAL RESOURCES IN THE STUDY AREA

The natural resources in the Study Area are located in and along the Colorado River below Glen Canyon Dam.

- **Deposits of sand, mud, and gravel, sometimes called beaches, are scattered along the river. The rest of the river bank consists of cliffs and steep slopes covered with rocks, boulders, and desert vegetation.**
 - Beaches vary greatly in size. Some are as large as several acres, and others consist of a little sand at the river's edge.
- **Some beaches are covered with vegetation.**
 - Beaches with vegetation provide habitat for birds and other small animals.
- **Archeological sites are located along the river.**
 - These sites are associated with American Indian cultures that have inhabited or used the Grand Canyon for thousands of years.
 - These sites contain evidence of ancient human activity along the river, including pots and tools.
- **Present-day American Indians have sacred sites and traditional-use areas along the river.**
 - American Indians gather materials from these sites for use in their everyday life.
- **Native fish species live in the Study Area.**
 - Only one of these native species is found outside the Colorado River and its tributaries.
- **Trout also live in the river.**
 - Trout are not native to this section of the Colorado River.
 - People fish for these trout in the first 15 miles of river downstream from Glen Canyon Dam.
- **Several other non-native fish species, including carp, catfish, and fathead minnows, also live in the Study Area.**
- **Only a small percentage of visitors to the Grand Canyon National Park actually see or use the resources in the Study Area.**
 - The only people who see the resources in the Study Area are American Indians using resources in the Study Area, river rafters, backpackers, and people who fish there.

SOME PEOPLE ARE CONCERNED ABOUT THESE RESOURCES

E-41

- **Because of erosion, the number and size of beaches along the river are decreasing.**
 - Between 1973 and 1991, the *number* of beaches decreased from 276 to 258; many of the remaining beaches are *smaller*.
 - The loss is most severe along the narrow sections of river.
- **27 known archeological sites have been affected by erosion. An unknown number of other sites may be affected.**
- **Resources important to American Indians are also affected by erosion.**
 - Loss of archeological sites destroys important links to the past.
 - Sacred sites exist in places that may be damaged by erosion.
 - Plants, animals, and minerals used by American Indians are affected by erosion.
- **Populations of native fish in the Study Area have declined.**
 - Eight species of native fish evolved in the Colorado River when the water was warmer than it is today.
 - Three of the eight native fish species are no longer found in the Study Area.
 - Two of five remaining native species, the humpback chub and razorback sucker, are in danger of becoming extinct.
 - Cold water released from Glen Canyon Dam may be the most important factor in the decline of native fish populations.
 - Competition from non-native fish (trout, carp, catfish, minnow species) may have contributed to the decline of native species.
- **Conditions for trout are affected by daily fluctuations in water level.**
 - Maintenance of recreational trout fishing requires annual stocking.
 - Trout eggs dry out and die during low-water periods.
 - Food for trout is reduced because of exposure during low-water periods.

Scientists have learned that by changing the way water is released from the dam, primarily by reducing the size of daily fluctuations, some of the concerns about the natural resources in the Study Area could be addressed.

- Reducing fluctuations in water released from the dam could affect the following resources in the Study Area:
 - The number and size of beaches.
 - Conditions for native fish.
 - Conditions for trout.
 - The amount of vegetation available for bird and wildlife habitat.
 - Archeological sites along the river.

Changing the way water is released from the dam will not reduce the total amount of electricity produced at Glen Canyon Dam.

However, there will be changes in when and where electricity is produced.

- During the day:
 - Less electricity will be produced at Glen Canyon Dam.
 - More electricity will be produced from power plants burning gas or oil.
- During the night:
 - More electricity will be produced at Glen Canyon Dam.
 - Less electricity will be produced from power plants burning coal.
- Since oil and gas are more expensive fuel sources than coal, the overall cost of meeting electrical demand in your area will increase.

GLEN CANYON SURVEY



View of the Colorado River in the Grand Canyon at Nankoweap.
Photo by Gary Ladd

Privacy Act Statement: Your participation in this survey is voluntary. There are no penalties for not answering some or all of the questions, but since you will represent many others who will not be surveyed, your cooperation is extremely important. The answers you provide are confidential. An identification number on the questionnaire is for mailing purposes only. Our results will be summarized so that the answers you provide cannot be associated with you or anyone in your household. Your name and address will not be given to any other group or used by us beyond the purposes of this study.

Public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, gathering and monitoring data, and completing and reviewing the form. Send comments regarding the burden estimate or any other aspect of this form to the Chief Publications and Records Management Branch, Code D-7920, Bureau of Reclamation, Denver Federal Center, PO Box 25007, Denver, CO 80225-0007; and the Office of Management and Budget, Paperwork Reduction 1006-0016, Washington, D.C. 20503.

We presented a lot of material in the background information. In this section, we will ask a few questions about the background information to make sure it was clearly presented. Please feel free to refer to the information sheets when answering these questions.

1. For each statement below, please circle the letter "T" if you think the statement is true, or the letter "F" if you think the statement is false.

(CIRCLE ONE LETTER FOR EACH STATEMENT)

	TRUE	FALSE
There are now many more beaches along the Colorado River than there were 20 years ago.	T	F
Native fish populations in the Colorado River have declined.	T	F
The decrease in the number and size of beaches is most severe along wide sections of the river.	T	F
None of the beaches along the river have vegetation.	T	F
There are American Indian traditional-use areas and sacred sites located along the Colorado River below Glen Canyon Dam.	T	F
Archeological sites are not being affected by erosion.	T	F
Trout are not native to the study area.	T	F
All native fish species have disappeared from the Grand Canyon.	T	F
Nearly all visitors to the Grand Canyon National Park use the beaches along the river.	T	F

(CONTINUED)

	TRUE	FALSE
American Indian traditional-use areas are affected by erosion.	T	F
Water levels are constant throughout the day.	T	F
The Study Area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.	T	F
The shoreline in the study area consists only of beaches.	T	F
Vegetation on beaches provides habitat for birds and other wildlife.	T	F
Two of the native fish species are in danger of extinction.	T	F
Reducing daily fluctuations in the amount of water released from the dam will reduce the total amount of hydroelectricity produced.	T	F

Government Officials Are Deciding How to Operate Glen Canyon Dam in Future Years.

- Their decision on how the dam should be operated could cost you money.
- Since you live in an area receiving power from Glen Canyon Dam, if operations are changed, your utility bill will increase.

INSTRUCTIONS FOR NEXT QUESTION

Government officials will consider many factors when deciding whether or not to change dam operations. One factor they would like to consider is whether various proposals are personally worthwhile to people like you. In the next question, we will describe the effects of a specific proposal to change dam operations. We would like you to tell us if you would vote "YES" or "NO" on this proposal.

Some people might vote "NO" because:

- the cost of the proposal is too high.
- the effects of the proposal are not worth anything (not even 10¢) to them.
- they just can't afford the cost.

Some people might vote "YES" because:

- the cost of the proposal is low enough.
- the effects of the proposal are worth what it would cost them.

At this point in time, it is not certain how much utility bills would increase in your area if the operation of Glen Canyon Dam is changed so we are asking different people about different amounts. Even if the amount we ask you about seems very low or very high, please answer carefully. This will allow us to determine whether people think the proposal is worthwhile at whatever level the final cost is determined to be. For this study, it is important that you tell us how you would vote, based only on your personal evaluation of whether changes in dam operations and their effects, are worth the additional cost to you.

Version 5: Moderate Fluctuating Flow Alternative -- Survey Page 5

A PROPOSAL

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish.
- Native fish populations, including those in danger of extinction, would probably continue to decline in numbers.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to maintain the population.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 1 No----->SKIP TO QUESTION 8
- 2 Yes
- 3 I would choose not to vote
on this proposal----->SKIP TO QUESTION 8

Version 6: Low Fluctuating Flow Alternative -- Survey Page 5

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish.
- It is likely, but not certain, that native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 1 No----->SKIP TO QUESTION 8
- 2 Yes
- 3 I would choose not to vote
on this proposal----->SKIP TO QUESTION 8

Version 7: Seasonally Adjusted Steady Flow Alternative – Survey Page 5

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 1 No----->SKIP TO QUESTION 8
- 2 Yes
- 3 I would choose not to vote
on this proposal----->SKIP TO QUESTION 8

How would you vote on this proposal if passage meant your utility bill would increase? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. Would you vote for this proposal if passage meant your utility bill would increase by \$ _____ every year (that would be about \$ _____ per month) for the foreseeable future? (CIRCLE ONE NUMBER)
- 1 Definitely No - I would definitely vote against the proposal.
 - 2 Probably No - I would probably vote against the proposal.
 - 3 Not Sure - I am not sure if I would vote for the proposal.
 - 4 Probably Yes - I would probably vote for the proposal.
 - 5 Definitely Yes - I would definitely vote for the proposal.
4. If this proposal passes and you had to pay \$ _____ every year for the foreseeable future, on what sorts of things would you spend less money in order to pay for the cost of this proposal? (FILL IN THE BLANK)
- _____
- _____
- _____
5. Now that you have had an additional chance to think about what you would have to give up if the proposal passes, would you like to change your vote? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 7
 - 2 Yes
6. Now how would you vote on the proposal? (CIRCLE ONE NUMBER)
- 1 Definitely No - I would definitely vote against the proposal.
 - 2 Probably No - I would probably vote against the proposal.
 - 3 Not Sure - I am not sure if I would vote for the proposal.
 - 4 Probably Yes - I would probably vote for the proposal.
 - 5 Definitely Yes - I would definitely vote for the proposal.

7. Do you believe your utility bill will increase if this proposal passes?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

8. Do you think public officials will consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

9. Do you think public officials should consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

10. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

11. Before receiving this survey had you heard of Glen Canyon Dam?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

----->What had you heard about Glen Canyon Dam before receiving this survey?
(FILL IN THE BLANK)

12. People often have different views about environmental issues. On a scale of 1 to 5, with 1

being strongly agree and 5 being strongly disagree, please indicate how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
	1	2	3	4	5
When humans interfere with nature, it often produces disastrous consequences.	1	2	3	4	5
Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
The balance of nature is very delicate and easily upset.	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5
Humans were meant to rule the rest of nature.	1	2	3	4	5
Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
Plants and animals have as much right as humans to exist.	1	2	3	4	5
Human ingenuity will ensure that we do not make the earth unlivable.	1	2	3	4	5
Humans are severely abusing the environment.	1	2	3	4	5
The so-called ecological crisis facing humankind has been greatly exaggerated.	1	2	3	4	5
We are approaching the limit of the number of people the earth can support.	1	2	3	4	5
The earth is like a spaceship with very limited room and resources.	1	2	3	4	5
The earth has plenty of natural resources, if we just learn how to develop them.	1	2	3	4	5
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5

13. The following statements discuss economic and environmental issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
Economic security and well-being should be considered first; then we can worry about environmental problems.	1	2	3	4	5
It is possible to protect our environment and natural resources and still maintain a healthy economy.	1	2	3	4	5
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market.	1	2	3	4	5
Some pollution is inevitable if we are going to continue to improve our standard of living.	1	2	3	4	5
I would be willing to pay somewhat higher prices (5 to 10 percent higher) for products that would cause less pollution or environmental damage.	1	2	3	4	5
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	1	2	3	4	5
Some land in the United States should be set aside from human use so it can remain completely untouched, regardless of its economic value.	1	2	3	4	5

14. The following statements discuss American Indian issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
It is our responsibility to protect those areas of historical or religious importance to American Indians.	1	2	3	4	5
We have gone too far in granting American Indians special rights to use public lands and resources, such as fish and wildlife.	1	2	3	4	5
Our society can learn important lessons from studying earlier cultures that inhabited our country.	1	2	3	4	5
We can't afford to let concern for preserving artifacts of earlier American Indian cultures stand in the way of operating hydroelectric dams.	1	2	3	4	5
American Indian concerns should be equally as important as our society's economic needs when deciding how to use land.	1	2	3	4	5

15. The following statements discuss hydroelectricity. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
	1	2	3	4	5
The benefits of hydroelectric dams on the Colorado River outweigh the impacts to the natural environment and historical places along the river.	1	2	3	4	5
Hydroelectric dams should not be constructed on rivers that flow through national parks.	1	2	3	4	5
Hydroelectric dams have fewer environmental impacts than coal, oil, or gas-burning power plants.	1	2	3	4	5
Hydroelectric dams can have serious impacts on the plants and animals that live in or along the river.	1	2	3	4	5
Hydroelectric dams produce relatively cheap electricity compared to other sources.	1	2	3	4	5
Hydroelectric dams should be developed wherever it is economically feasible, even if it means that some rivers will be changed.	1	2	3	4	5
Rivers without dams are a unique and irreplaceable resource that should be protected from hydroelectric dams.	1	2	3	4	5

In this section, we would like to learn how you feel about national parks in the United States.

16. Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes
- 3 Don't know

17. We are interested in learning how you feel about national parks in general. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below.
(CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE	
	1	2	3	4	5
National parks are a "luxury" we cannot afford in difficult economic times.	1	2	3	4	5
National parks help us to remember that our future is tied to the preservation of nature and natural resources.	1	2	3	4	5
It is important that national parks offer us a chance to see America as the early settlers saw it.	1	2	3	4	5
Americans need places like national parks to "recharge their batteries."	1	2	3	4	5
An important function of the National Park Service is to protect native birds, plants, and animals.	1	2	3	4	5

(CONTINUED)

	STRONGLY AGREE			STRONGLY DISAGREE	
National parks are only valuable to the people who visit them.	1	2	3	4	5
Oil and natural gas finds on national park lands should be developed since it is in the national interest.	1	2	3	4	5
The National Park Service places too much emphasis on preservation.	1	2	3	4	5
I am glad there are national parks, even if I don't visit them.	1	2	3	4	5
People can think a place is valuable, even if they do not actually go there themselves.	1	2	3	4	5
The American people should provide greater financial support for the National Park Service to avoid more commercial activities in the national parks.	1	2	3	4	5
If the National Park Service needs more financial support, they should develop more gift shops and commercial activities to raise money.	1	2	3	4	5

In this section, we are interested in learning about trips you may have taken to Grand Canyon National Park.

18. As best you can recall, have you ever flown over Grand Canyon National Park in an aircraft? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 20
 - 2 Yes
19. Did you fly over Grand Canyon National Park while you were on a commercial airliner, or did you fly over the park as part of a sightseeing air tour that included the park? (CIRCLE ALL NUMBERS THAT APPLY)
- 1 I flew over Grand Canyon National Park while on a commercial aircraft
 - 2 I flew over Grand Canyon National Park as part of a sightseeing air tour
 - 3 Other (please describe: _____)
20. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 23
 - 2 Yes
21. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No----->SKIP TO QUESTION 23
 - 2 Yes
22. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 1 No
 - 2 Yes
23. How likely do you think it is that you will visit the Grand Canyon National Park in the future? (CIRCLE ONE NUMBER)
- 1 Not at all likely
 - 2 Somewhat unlikely
 - 3 Somewhat likely
 - 4 Very likely

In this last section, we would like to ask you some questions about your background that will help us compare your answers with those of other people. We stress that all of your responses are strictly confidential.

24. Are you: (CIRCLE ONE NUMBER)

- 1 Male
- 2 Female

25. How old are you? (FILL IN THE BLANK)

_____ Years old

26. How many years of schooling have you completed? (CIRCLE ONE NUMBER)

- 1 Eight years or less
- 2 Some high school
- 3 High school graduate
- 4 Some college or technical school
- 5 College or technical school graduate
- 6 Post graduate work

27. How many people live in your household? (FILL IN ALL BLANKS)

NUMBER

_____ People 18 years old or older

_____ People under the age of 18

_____ Total number of people in the household

28. Do you, or another member of your household, own or rent this residence?
(CIRCLE ONE NUMBER)

- 1 Own
- 2 Rent
- 3 Other (please describe: _____)

29. Are you, or another member of your household, responsible for paying the utility bill?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes

30. Which of the following categories comes closest to your total 1993 household income?
(CIRCLE ONE NUMBER)

- | | | | |
|---|----------------------|----|----------------------|
| 1 | Less than \$10,000 | 9 | \$45,000 to \$49,999 |
| 2 | \$10,000 to \$14,999 | 10 | \$50,000 to \$59,999 |
| 3 | \$15,000 to \$19,999 | 11 | \$60,000 to \$69,999 |
| 4 | \$20,000 to \$24,999 | 12 | \$70,000 to \$79,999 |
| 5 | \$25,000 to \$29,999 | 13 | \$80,000 to \$89,999 |
| 6 | \$30,000 to \$34,999 | 14 | \$90,000 to \$99,999 |
| 7 | \$35,000 to \$39,999 | 15 | Over \$100,000 |
| 8 | \$40,000 to \$44,999 | | |

THANK YOU FOR YOUR HELP!

Comments:

**Please feel free to keep the colored background
information materials**

**Please return only this survey booklet in the
enclosed, postage-paid envelope to:**

**Glen Canyon Studies
c/o HBRS, Inc.
University Research Park
455 Science Drive
Madison, WI 53711**

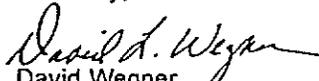
Hello,

A few days ago your household received a questionnaire about the tradeoffs between production of electricity at Glen Canyon Dam and the natural and cultural resources along the Colorado River in the Grand Canyon. If the survey has been completed and returned, please consider this a "thank you." Otherwise, I hope you will be able to fill it out and return it soon.

Your household's responses to this survey are very important. We can only survey a small number of households, so your responses will represent many other households like yours, who are not able to participate in this study.

Thank you for your participation.

Sincerely,


David Wegner
Glen Canyon Studies Manager

Glen Canyon Studies c/o HBRS, Inc.

455 Science Drive

Madison, WI 53711



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-64

IN REPLY REFER TO:

Greetings!

About two weeks ago, we sent a questionnaire to your household. The survey asked about your opinions on how the Glen Canyon Dam on the Colorado River should be operated. Hearing from your household is very important. If you have already completed and returned the questionnaire, please accept our sincere thanks. If you have not done so, we would still very much like to hear from your household.

Even if you have never heard about Glen Canyon Dam prior to receiving this survey, your opinions are very important for this study. You don't need to have any special knowledge about hydroelectricity, dam operations, or environmental issues to fill out the survey. The background information sheets enclosed with the survey were prepared to help people understand the relation between the operation of the dam and downstream cultural and natural resources.

Government officials will soon be making decisions about how to operate the dam. Your participation in the study will help them understand how people in households like yours feel about trade-offs between cultural and natural resources, such as fish, vegetation, and beaches, at the bottom of the Grand Canyon and the production of electricity from Glen Canyon Dam. Answers to this survey will affect future decisions about how the dam is operated.

We could not send this survey to every household in the nation. Your household is part of a relatively small group of households who have been randomly selected to participate in this survey. Your answers will represent the views of many other households similar to yours and will ensure that the opinions of all households are represented in decisions about the operation of the Glen Canyon Dam. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Your responses are confidential, and your name will not be revealed. Information from the surveys will only be reported in statistical terms, such as "10 percent of all respondents have seen the Colorado River in Grand Canyon National Park."

I have enclosed another copy of the survey in case the first one was lost or misplaced. There is an identification number on the back of the survey so that HBRIS, Inc., the firm conducting the survey, will know who has already returned the survey and who to send reminders to.

When the survey is completed, simply return it in the enclosed postage-paid envelope. We hope that you find the survey interesting and enjoyable to fill out. If you have any questions or concerns about this survey or the study, please feel free to call Mike Welsh, the HBRIS survey project manager, collect at 0-608-232-2800.

I appreciate your help in this study.

Sincerely,

David L. Wegner
Glen Canyon Studies Manager



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Glen Canyon Environmental Studies
P.O. Box 22459
Flagstaff, Arizona 86002-2459

E-65

IN REPLY REFER TO:

Greetings!

I am sorry if this certified letter has caused you any inconvenience. This survey is very important and I wanted to make sure it reached your household.

About three weeks ago, I sent a survey concerning the operations of Glen Canyon Dam. Even if you don't live near Glen Canyon Dam or the Grand Canyon, it is still important to hear from you, even if it is only to tell us that you simply don't care how Glen Canyon Dam is operated. Some people have told us that they felt they did not know enough to answer the questionnaire. The background information sheets enclosed with the survey were prepared to help people understand the relation between the operation of the dam and downstream cultural and natural resources. This background information will enable you to participate in this study even if you don't feel that you know very much about the Glen Canyon Dam.

Government officials will soon be making decisions about how the dam is operated. In making these decisions, they would like to know more about how individuals like you feel about the issues that are discussed in the questionnaire. Your household was chosen at random to participate in this study. Since we can't send surveys to every household, your response will represent the opinions of households similar to yours that were not selected to participate in the study. We need to hear from everyone to make sure that we have a representative sample of opinions about this issue.

I am enclosing another copy of the questionnaire and a stamped self-addressed envelope in case you have misplaced the previous ones. To ensure a random selection of respondents within a household, we are asking that the survey be filled out by the adult member of your household with the latest birthday in the calendar year.

Thank you for your help in this study. Your cooperation in completing this questionnaire will help to make this a successful project.

Sincerely,

David L. Wegner
Glen Canyon Studies Manager

P.S. If for some reason, you can't complete the questionnaire, please write a note on the questionnaire booklet and mail it back. It is better for us to hear something from you than nothing at all. Or if you prefer, you can call HBRS collect at 608-232-2800. Ask for Mike Welsh, the Glen Canyon Studies project manager.

Telephone Survey

Hi, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. I'm trying to reach the (Name) household at (Phone Number). Do I have the right number? (CIRCLE ONE NUMBER)

- 1 No----->(THANK AND TERMINATE)
- 2 Yes
- 3 Hung up

Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam. To help us understand the survey results we need to understand the reasons people have for not participating in the study.

1. We asked that the adult in your household with the latest birthday in the calendar year read and complete the survey. Are you the adult in your household who had the latest birthday in the calendar year? (CIRCLE ONE NUMBER)

1 No----->May I please speak to (him/her)? (CIRCLE ONE NUMBER)

1 No/not available----->When would be a good time for me to reach (him/her)? Who should we ask for when we call back? (FILL IN BLANK AND GET FIRST NAME)

2 Yes----->Hello, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam.

9 Refusal

- 2 Yes
- 9 Refusal

To help us understand the survey results we need to understand the reasons people have for not participating in the study.

2. Do you remember receiving the questionnaire in the mail? (CIRCLE ONE NUMBER)

1 No----->(PROBE: It was a (color) booklet that came in a package with several other sheets of paper. There was also an envelope for you to return the questionnaire in. Do you remember that (color) booklet, it had a picture of the Colorado River on the cover? (CIRCLE ONE NUMBER)

1 No----->I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____

Last name: _____

Street address: _____

City: _____

State: _____

ZIP Code: _____

(SKIP TO QUESTION 8)

2 Yes

9 Refusal

2 Yes

9 Refusal----->(SKIP TO QUESTION 8)

3. Did you look through the package of materials and the questionnaire? (CIRCLE ONE NUMBER)

1 No----->Why not? (FILL IN BLANK) _____

2 Yes

9 Refusal----->(SKIP TO QUESTION 5)

4. Did you read the background information that described the study and the situation with the Glen Canyon Dam? (CIRCLE ONE NUMBER)

1 No----->Why not? (FILL IN BLANK) _____

2 Yes

9 Refusal

5. Did you start to fill out the questionnaire booklet? (CIRCLE ONE NUMBER)

- 1 No----->Why not? (FILL IN BLANK) _____
- 2 Yes
- 9 Refusal----->(SKIP TO QUESTION 7)

6. Did you finish filling out the questionnaire booklet? (CIRCLE ONE NUMBER)

- 1 No----->Why not? (FILL IN BLANK) _____
- 2 Yes
- 9 Refusal

7. Do you still have the questionnaire booklet? (CIRCLE ONE NUMBER)

- 1 No/Don't know----->Why not? (FILL IN BLANK) _____
- 2 Yes
- 9 Refusal

Another reason I'm calling you is that we need to find out a little bit about the people who didn't return the questionnaire booklet, so we can learn whether the results might have been different if we had heard from everyone.

8. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes
- 8 Don't recall
- 9 Refusal

9. Before receiving this survey had you heard of Glen Canyon Dam?
(CIRCLE ONE NUMBER)

- 1 No
- 2 Yes----->What had you heard about Glen Canyon Dam before receiving this survey? (FILL IN THE BLANK)

- 9 Refusal

10. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)

1 No/Don't recall----->Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)

- 1 No
- 2 Yes
- 3 Don't know
- 9 Refusal

(SKIP TO QUESTION 13)

2 Yes

9 Refusal----->(SKIP TO QUESTION 13)

11. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)

1 No/Don't recall----->(SKIP TO QUESTION 13)

2 Yes

9 Refusal

12. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)

1 No

2 Yes

3 Don't recall

9 Refusal

13. How likely do you think it is that you will visit the Grand Canyon National Park in the future? Are you not at all likely, somewhat unlikely, somewhat likely, or very likely to visit the Grand Canyon in the future? (CIRCLE ONE NUMBER)

1 Not at all likely

2 Somewhat unlikely

3 Somewhat likely

4 Very likely

8 Don't know

9 Refusal

Next, I'm going to read you some statements and ask you whether you agree or disagree with each statement. There are no right or wrong answers, we just want to know your opinion

14. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about each statement I read. (READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE			REFUSAL
	1	2	3	4	5		
a. When humans interfere with nature, it often produces disastrous consequences.	1	2	3	4	5	9	

On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

b. Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5	9	
c. The balance of nature is very delicate and easily upset.	1	2	3	4	5	9	
d. Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5	9	
e. If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5	9	

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

f. Humans were meant to rule the rest of nature.	1	2	3	4	5	9	
g. Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5	9	
h. Plants and animals have as much right as humans to exist.	1	2	3	4	5	9	
i. Human ingenuity will ensure that we do not make the earth unlivable.	1	2	3	4	5	9	
j. Humans are severely abusing the environment.	1	2	3	4	5	9	

(Continued)

STRONGLY
AGREE

STRONGLY
DISAGREE

REFUSAL

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

- | | | | | | | |
|--|---|---|---|---|---|---|
| k. The so-called ecological crisis facing humankind has been greatly exaggerated. | 1 | 2 | 3 | 4 | 5 | 9 |
| l. We are approaching the limit of the number of people the earth can support. | 1 | 2 | 3 | 4 | 5 | 9 |
| m. The earth is like a spaceship with very limited room and resources. | 1 | 2 | 3 | 4 | 5 | 9 |
| n. The earth has plenty of natural resources, if we just learn how to develop them. | 1 | 2 | 3 | 4 | 5 | 9 |
| o. The balance of nature is strong enough to cope with the impacts of modern industrial nations. | 1 | 2 | 3 | 4 | 5 | 9 |

15. OK, the last few statements I am going to read to you discuss economic and environmental issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell me how you feel about each statement I read. (READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)

STRONGLY
AGREE

STRONGLY
DISAGREE

REFUSAL

- | | | | | | | |
|---|---|---|---|---|---|---|
| a. Economic security and well-being should be considered first; then we can worry about environmental problems. | 1 | 2 | 3 | 4 | 5 | 9 |
| b. If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market | 1 | 2 | 3 | 4 | 5 | 9 |
| c. Some pollution is inevitable if we are going to continue to improve our standard of living. | 1 | 2 | 3 | 4 | 5 | 9 |
| d. The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds. | 1 | 2 | 3 | 4 | 5 | 9 |

The last few questions I have are about your background. These questions will help us compare your answers with those of other people. All of your responses are strictly confidential.

16. How old are you? (FILL IN THE BLANK)

_____ Years old

999 Refusal

17. How many years of schooling have you completed? (READ LIST; CIRCLE ONE NUMBER)

- 1 Eight years or less
- 2 Some high school
- 3 High school graduate
- 4 Some college or technical school
- 5 College or technical school graduate
- 6 Post graduate work
- 9 Refusal

18. Including yourself, how many people live in your household? How many of these people are less than 18 years old? (FILL IN ALL BLANKS)

NUMBER

- _____ People under the age of 18
- _____ People 18 years old or older
- _____ Total number of people in the household
- 99 Refusal

19. Which of the following categories comes closest to your total 1993 household income? (READ LIST; CIRCLE ONE NUMBER)

- | | |
|----------------------------------|------------------------------------|
| 1 Less than \$10,000 | 9 \$45,000 to less than \$50,000 |
| 2 \$10,000 to less than \$15,000 | 10 \$50,000 to less than \$60,000 |
| 3 \$15,000 to less than \$20,000 | 11 \$60,000 to less than \$70,000 |
| 4 \$20,000 to less than \$25,000 | 12 \$70,000 to less than \$80,000 |
| 5 \$25,000 to less than \$30,000 | 13 \$80,000 to less than \$90,000 |
| 6 \$30,000 to less than \$35,000 | 14 \$90,000 to less than \$100,000 |
| 7 \$35,000 to less than \$40,000 | 15 Over \$100,000 |
| 8 \$40,000 to less than \$45,000 | 98 Don't know |
| | 99 Refusal |

[CHECK RESPONSE TO QUESTION 7. IF NO LONGER HAS SURVEY, SKIP TO QUESTION 19b.]

19a. Earlier, you said that you still have a copy of the questionnaire booklet. It would really help me out if you could spend a few minutes reading the background information materials and completing at least the first 9 questions in the survey booklet and mail it back to us in the envelope. Do you think you would be able to do that in the next few days? (CIRCLE ONE NUMBER)

- 1 No-----> OK, Thanks for your help.
- 2 Yes-----> I would really appreciate it if you could fill out at least the first 9 questions of the survey and put it in the mail in the next few days.
- 9 Refusal

19b. Earlier, you said you may not have a copy of the survey booklet. If we mailed you another copy, could you spend a few minutes reading the background information and completing at least the first 9 questions of the survey booklet? If would really help me out. (CIRCLE ONE NUMBER)

- 1 No----->OK, thanks for your help.
- 2 Yes----->OK, I will mail you another copy of the survey. (VERIFY ADDRESS IF NOT ALREADY DONE)

I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____

Last name: _____

Street address: _____

City: _____

State: _____

ZIP Code: _____

9 Refusal

Thank you for your time. I'd really like to encourage you to return your survey. Do you have any questions or comments? (FILL IN BLANK)

000 No comments

(INTERVIEWER -- IS RESPONDENT . . . ?) (CIRCLE ONE NUMBER)

- 1 Male
- 2 Female
- 8 Unsure

APPENDIX F
GLEN CANYON NON-USE VALUE SURVEY FREQUENCIES

Mail Survey	-National Sample
Mail Survey	-Marketing Area Sample
Telephone Survey	-National Sample
Telephone Survey	-Marketing Area Sample

**Mail Survey Frequencies --
National Sample**

The frequencies presented in this section are based on 1,696 mail surveys that were completed and returned from national sample respondents in time to be included in the electronic dataset. Percentages shown for each question are based on the total number of cases with valid responses. The number of valid responses is shown in parentheses for each question. Invalid responses (item nonresponse) can be calculated by subtracting the number of valid responses from the total number that should have responded to the question. For example, all respondents were asked to answer the first true/false item in Question 1. Of the total number of respondents who should have answered the question, 1,673 actually answered it (valid responses), and 23 did not (invalid responses). When calculating item nonresponse, keep in mind that not all survey respondents were required to answer all questions: some respondents were asked to skip some questions, depending on their answers to previous questions.

Survey Version

24.6%	National Sample: Moderate Fluctuating Flow
24.8	National Sample: Low Fluctuating Flow
25.3	National Sample: Seasonally Adjusted Steady Flow
25.2	National Sample: Seasonally Adjusted Steady Flow with Moderate Fluctuating Flow Price Impacts

(1,696)

We presented a lot of material in the background information. In this section, we will ask a few questions about the background information to make sure it was clearly presented. Please feel free to refer to the information sheets when answering these questions.

1. For each statement below, please circle the letter "T" if you think the statement is true, or the letter "F" if you think the statement is false. (CIRCLE ONE LETTER FOR EACH STATEMENT)

	TRUE	FALSE	
There are now many more beaches along the Colorado River than there were 20 years ago.	8.1%	91.9%	(1,673)
Native fish populations in the Colorado River have declined.	96.0	4.0	(1,670)
The decrease in the number and size of beaches is most severe along wide sections of the river.	14.1	85.9	(1,649)
None of the beaches along the river have vegetation.	4.0	96.0	(1,660)
There are American Indian traditional-use areas and sacred sites located along the Colorado River below Glen Canyon Dam.	97.9	2.1	(1,652)
Archeological sites are not being affected by erosion.	5.0	95.0	(1,662)
Trout are not native to the study area.	85.4	14.6	(1,662)
All native fish species have disappeared from the Grand Canyon.	4.5	95.5	(1,664)
Nearly all visitors to the Grand Canyon National Park use the beaches along the river.	9.9	90.1	(1,654)
American Indian traditional-use areas are affected by erosion.	94.7	5.3	(1,634)
Water levels are constant throughout the day.	7.1	92.9	(1,631)
The Study Area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.	88.0	12.0	(1,612)
The shoreline in the study area consists only of beaches.	4.0	96.0	(1,605)
Vegetation on beaches provides habitat for birds and other wildlife.	98.5	1.5	(1,634)
Two of the native fish species are in danger of extinction.	89.4	10.6	(1,630)
Reducing daily fluctuations in the amount of water released from the dam will reduce the total amount of hydroelectricity produced.	31.9	68.1	(1,619)

Government Officials Are Deciding How to Operate Glen Canyon Dam in Future Years.

- Their decision on how the dam should be operated could cost you money. For example:
 - Changes in operations of the dam could reduce the revenue earned by the dam -- as a result, taxpayers would have to make up the difference.
 - If you live in an area receiving power from Glen Canyon Dam, your utility bill would increase.

INSTRUCTIONS FOR NEXT QUESTION

Government officials will consider many factors when deciding whether or not to change dam operations. One factor they would like to consider is whether various proposals are personally worthwhile to people like you. In the next question, we will describe the effects of a specific proposal to change dam operations. We would like you to tell us if you would vote "YES" or "NO" on this proposal.

Some people might vote "NO" because:

- the cost of the proposal is too high.
- the effects of the proposal are not worth anything (not even 10¢) to them.
- they just can't afford the cost.

Some people might vote "YES" because:

- the cost of the proposal is low enough.
- the effects of the proposal are worth what it would cost them.

At this point in time, it is not certain what the cost would be to any specific individual, so we are asking different people about different amounts. Even if the amount we ask you about seems very low or very high, please answer carefully. This will allow us to determine whether people think the proposal is worthwhile at whatever level the final cost is determined to be. For this study, it is important that you tell us how you would vote, based only on **your personal evaluation** of whether changes in dam operations and their effects, are worth the additional cost to you.

Version 1

A PROPOSAL

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites, and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish.
- Native fish populations, including those in danger of extinction, would probably continue to decline in numbers.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to maintain the population.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households and a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

Version 2

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish.
- It is likely, but not certain, that native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households to a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

Version 3

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- The average electric bill would increase by \$9 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$21 per month for 3,600 households to a minimum of no increase for 300,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 6%.

Version 4

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.
- The average electric bill would increase by \$3 per month for 1.5 million households receiving power from Glen Canyon Dam. This average reflects a maximum increase of \$9 per month for 3,600 households to a minimum of no increase for 800,000 households.
- On average, farm incomes would not change significantly. However, about 300 farmers in southern Utah would see their incomes drop by 3%.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

- 11.8% No----->SKIP TO QUESTION 8
 - 78.2 Yes
 - 10.0 I would choose not to vote on this proposal----->SKIP TO QUESTION 8
- (1,635)

The higher electric rates described earlier cannot make up for all the revenue lost as a result of this proposal. Taxpayers would have to make up the difference. How would you, as a taxpayer, vote on this proposal? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. Would you vote for this proposal if passage of the proposal would cost your household \$_____ in increased taxes every year for the foreseeable future? (CIRCLE ONE NUMBER)

Annual cost of proposal

- 12.9% \$5
 - 13.3 \$15
 - 12.7 \$30
 - 11.9 \$60
 - 11.8 \$90
 - 12.6 \$120
 - 13.0 \$150
 - 11.9 \$200
- (1,696)

- 12.0% Definitely No - I would definitely vote against the proposal.
 - 17.1 Probably No - I would probably vote against the proposal.
 - 16.6 Not Sure - I am not sure if I would vote for the proposal.
 - 35.5 Probably Yes - I would probably vote for the proposal.
 - 18.8 Definitely Yes - I would definitely vote for the proposal.
- (1,266)

4. If this proposal passes and you had to pay \$_____ every year for the foreseeable future, on what sorts of things would you spend less money in order to pay for the cost of this proposal? (FILL IN THE BLANK)

<u>Category</u>	<u>Percent of Responses¹</u>	<u>Percent of Cases²</u>
Vacation	4.0%	6.2%
Travel/trips	3.6	5.5
Food/drink	19.2	29.6
Recreation/hobbies	8.2	12.6
Clothing	8.0	12.4
Entertainment	18.5	28.5
Needless items	7.5	11.7
No effect	8.2	12.7
Gifts/toys	1.4	2.2
Irrigation	.1	.1
Newspaper	1.9	2.9
Phone	.2	.4
Can't afford	.5	.7
Donations	3.3	5.1
Savings	2.7	4.2
Vehicle expenses	2.2	3.4
Utility usage	2.1	3.3
Living expenses	2.4	3.7
Government programs	.1	.2
Computer/electronics	.2	.3
Housing improvements	.4	.6
Tobacco	1.3	2.0
Other	3.4	5.2
Health care	.1	.2
Education	.2	.3
Insurance	.2	.3
Bills	.1	.2
	100.0%	154.5% (1,107)

¹ Respondents were allowed to record multiple responses. This column reflects percentage of the total number of responses recorded.

² This column reflects percentage of the total number of respondents citing each item listed. Since respondents were allowed to record multiple responses, the column does not sum to 100 percent.

5. Now that you have had an additional chance to think about what you would have to give up if the proposal passes, would you like to change your vote? (CIRCLE ONE NUMBER)

94.2% No----->SKIP TO QUESTION 7
 5.8 Yes
 (1,262)

6. Now how would you vote on the proposal? (CIRCLE ONE NUMBER)

- 8.6% Definitely No - I would definitely vote against the proposal.
 - 12.9 Probably No - I would probably vote against the proposal.
 - 30.0 Not Sure - I am not sure if I would vote for the proposal.
 - 42.9 Probably Yes - I would probably vote for the proposal.
 - 5.7 Definitely Yes - I would definitely vote for the proposal.
- (70)

7. Do you believe your taxes will increase if this proposal passes? (CIRCLE ONE NUMBER)

- 28.4% No
 - 71.6 Yes
- (1,255)

8. Do you think public officials will consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future? (CIRCLE ONE NUMBER)

- 39.2% No
 - 60.8 Yes
- (1,633)

9. Do you think public officials should consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future? (CIRCLE ONE NUMBER)

- 4.9% No
 - 95.1 Yes
- (1,646)

10. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

- 89.0% No
 - 11.0 Yes
- (1,661)

11. Before receiving this survey had you heard of Glen Canyon Dam? (CIRCLE ONE NUMBER)

- 70.9% No
 - 29.1% Yes----->What had you heard about Glen Canyon Dam before receiving this survey? (FILL IN THE BLANK)
- (1,652)

- 0.2% Heard about this study
 - 8.7 Heard about environmental impacts of dam operations
 - 91.1 Heard other things about Glen Canyon Dam
- (426)

12. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please indicate how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
When humans interfere with nature, it often produces disastrous consequences.	38.0%	28.2%	24.6%	6.1%	3.1%	(1,654)
Humans will eventually learn enough about how nature works to be able to control it.	7.4	14.9	25.1	26.5	26.2	(1,655)
The balance of nature is very delicate and easily upset.	47.3	28.9	14.0	6.9	3.0	(1,648)
Humans have the right to modify the natural environment to suit their needs.	6.5	10.5	28.1	24.9	30.0	(1,652)
If things continue on their present course, we will soon experience a major ecological catastrophe.	25.2	26.1	25.1	13.2	10.4	(1,649)
Humans were meant to rule the rest of nature.	8.3	8.1	14.6	22.5	46.5	(1,650)
Despite our special abilities, humans are still subject to the laws of nature.	60.2	27.6	8.1	2.0	2.1	(1,639)
Plants and animals have as much right as humans to exist.	46.4	21.7	16.4	9.4	6.1	(1,652)
Human ingenuity will ensure that we do not make the earth unlivable.	12.1	19.6	33.8	22.3	12.1	(1,649)
Humans are severely abusing the environment.	40.6	27.5	18.5	8.2	5.2	(1,656)
The so-called ecological crisis facing humankind has been greatly exaggerated.	8.8	13.9	26.7	28.3	22.4	(1,641)
We are approaching the limit of the number of people the earth can support.	22.2	21.8	28.6	15.7	11.7	(1,650)
The earth is like a spaceship with very limited room and resources.	25.3	25.4	24.2	14.0	11.1	(1,646)
The earth has plenty of natural resources, if we just learn how to develop them.	28.6	31.3	21.9	12.2	6.0	(1,659)
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	5.5	9.9	22.2	33.4	29.0	(1,654)

13. The following statements discuss economic and environmental issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
Economic security and well-being should be considered first; then we can worry about environmental problems.	6.0%	10.8%	25.4%	31.3%	26.6%	(1,656)
It is possible to protect our environment and natural resources and still maintain a healthy economy.	45.7	39.5	11.2	2.3	1.3	(1,664)
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market.	7.4	13.6	25.6	32.1	21.2	(1,658)
Some pollution is inevitable if we are going to continue to improve our standard of living.	14.2	30.8	25.6	20.0	9.3	(1,657)
I would be willing to pay somewhat higher prices (5 to 10 percent higher) for products that would cause less pollution or environmental damage.	32.0	37.2	19.5	6.9	4.5	(1,658)
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	4.2	7.5	24.4	33.0	30.9	(1,653)
Some land in the United States should be set aside from human use so it can remain completely untouched, regardless of its economic value.	55.5	20.6	12.1	6.9	5.0	(1,664)

14. The following statements discuss American Indian issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
It is our responsibility to protect those areas of historical or religious importance to American Indians.	49.5%	27.8%	15.7%	4.3%	2.6%	(1,664)
We have gone too far in granting American Indians special rights to use public lands and resources, such as fish and wildlife.	7.7	11.2	19.3	24.7	37.1	(1,665)
Our society can learn important lessons from studying earlier cultures that inhabited our country.	46.7	31.7	15.5	4.1	2.0	(1,665)
We can't afford to let concern for preserving artifacts of earlier American Indian cultures stand in the way of operating hydroelectric dams.	5.8	9.0	19.7	29.0	36.5	(1,661)
American Indian concerns should be equally as important as our society's economic needs when deciding how to use land.	36.7	26.0	23.3	9.7	4.3	(1,663)

15. The following statements discuss hydroelectricity. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
The benefits of hydroelectric dams on the Colorado River outweigh the impacts to the natural environment and historical places along the river.	6.8%	11.8%	29.8%	30.2%	21.4%	(1,614)
Hydroelectric dams should not be constructed on rivers that flow through national parks.	18.0	15.7	31.9	23.3	11.1	(1,613)
Hydroelectric dams have fewer environmental impacts than coal, oil, or gas-burning power plants.	23.6	32.9	28.8	9.7	5.1	(1,593)
Hydroelectric dams can have serious impacts on the plants and animals that live in or along the river.	32.9	36.4	20.4	6.8	3.4	(1,609)
Hydroelectric dams produce relatively cheap electricity compared to other sources.	29.5	40.0	24.0	3.3	3.2	(1,601)
Hydroelectric dams should be developed wherever it is economically feasible, even if it means that some rivers will be changed.	8.5	15.4	31.9	26.5	17.7	(1,609)
Rivers without dams are a unique and irreplaceable resource that should be protected from hydroelectric dams.	20.0	19.1	38.4	15.3	7.2	(1,604)

In this section, we would like to learn how you feel about national parks in the United States.

16. Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)

15.9% No
82.5 Yes
1.7 Don't know
(1,619)

17. We are interested in learning how you feel about national parks in general. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
1 National parks are a "luxury" we cannot afford in difficult economic times.	4.2%	3.2%	8.7%	22.8%	61.1%	(1,633)
National parks help us to remember that our future is tied to the preservation of nature and natural resources.	61.2	26.3	8.1	2.4	2.1	(1,636)
It is important that national parks offer us a chance to see America as the early settlers saw it.	50.1	30.4	14.7	3.2	1.6	(1,634)
Americans need places like national parks to "recharge their batteries."	49.6	28.2	15.5	3.9	2.9	(1,631)
An important function of the National Park Service is to protect native birds, plants, and animals.	66.1	23.8	7.2	1.6	1.3	(1,636)
National parks are only valuable to the people who visit them.	5.9	5.1	7.4	29.9	51.8	(1,640)
Oil and natural gas finds on national park lands should be developed since it is in the national interest.	6.7	9.8	28.7	23.1	31.6	(1,635)
The National Park Service places too much emphasis on preservation.	4.0	5.2	18.0	29.7	43.1	(1,637)
I am glad there are national parks, even if I don't visit them.	76.6	17.2	5.1	0.4	0.7	(1,623)
People can think a place is valuable, even if they do not actually go there themselves.	75.6	18.7	4.5	0.7	0.6	(1,639)
The American people should provide greater financial support for the National Park Service to avoid more commercial activities in the national parks.	37.3	26.1	25.0	7.2	4.3	(1,637)
If the National Park Service needs more financial support, they should develop more gift shops and commercial activities to raise money.	9.8	16.7	30.1	22.0	21.4	(1,638)

In this section, we are interested in learning about trips you may have taken to Grand Canyon National Park.

18. As best you can recall, have you ever flown over Grand Canyon National Park in an aircraft? (CIRCLE ONE NUMBER)
- 60.9% No----->SKIP TO QUESTION 20
39.1 Yes
(1,635)
19. Did you fly over Grand Canyon National Park while you were on a commercial airliner, or did you fly over the park as part of a sightseeing air tour that included the park? (CIRCLE ALL NUMBERS THAT APPLY)
- 94.2% flew over Grand Canyon National Park while on a commercial aircraft
(637)
5.3% flew over Grand Canyon National Park as part of a sightseeing air tour
(637)
- flew over Grand Canyon National Park as part of a:
- 53.6% Military flight
32.1 Private plane
3.6 Corporate plane
3.6 Charter flight
3.6 Medical evacuation
3.6 Testing navigation
(28)
20. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 65.9% No----->SKIP TO QUESTION 23
34.1 Yes
(1,638)
21. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 8.3% No----->SKIP TO QUESTION 23
91.7 Yes
(553)
22. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)
- 80.6% No
19.4 Yes
(510)
23. How likely do you think it is that you will visit the Grand Canyon National Park in the future? (CIRCLE ONE NUMBER)
- 16.4% Not at all likely
14.7 Somewhat unlikely
35.0 Somewhat likely
33.9 Very likely
(1,635)

In this last section, we would like to ask you some questions about your background that will help us compare your answers with those of other people. We stress that all of your responses are strictly confidential.

24. Are you: (CIRCLE ONE NUMBER)

54.1% Male
45.9 Female
(1,647)

25. How old are you? (FILL IN THE BLANK)

AVERAGE AGE
49.0 Years old
(1,630)

26. How many years of schooling have you completed? (CIRCLE ONE NUMBER)

2.3% Eight years or less
5.5 Some high school
19.9 High school graduate
27.2 Some college or technical school
26.7 College or technical school graduate
18.5 Post graduate work
(1,642)

27. How many people live in your household? (FILL IN ALL BLANKS)

AVERAGE NUMBER
2.00 People 18 years old or older
(1,517)
0.73 People under the age of 18
(1,394)
2.69 Total number of people in the household
(1,535)

28. Did you or any members in your household have any taxes withheld from a paycheck or other earnings in 1993? (CIRCLE ONE NUMBER)

17.1% No
82.9 Yes
(1,619)

29. Did you or any members of your household file a Federal income tax form for 1993? (CIRCLE ONE NUMBER)

7.2% No
92.8 Yes
(1,620)

30. Which of the following categories comes closest to your total 1993 household income? (CIRCLE ONE NUMBER)

6.9%	Less than \$10,000	6.2%	\$45,000 to \$49,999
7.1	\$10,000 to \$14,999	10.0	\$50,000 to \$59,999
5.9	\$15,000 to \$19,999	6.6	\$60,000 to \$69,999
8.4	\$20,000 to \$24,999	5.6	\$70,000 to \$79,999
9.2	\$25,000 to \$29,999	3.7	\$80,000 to \$89,999
8.2	\$30,000 to \$34,999	2.3	\$90,000 to \$99,999
6.8	\$35,000 to \$39,999	6.2	Over \$100,000
6.9	\$40,000 to \$44,999	(1,540)	

**Mail Survey Frequencies --
Marketing Area Sample**

The frequencies presented in this section are based on 1,392 mail surveys that were completed and returned from marketing area sample respondents in time to be included in the electronic dataset. Percentages shown for each question are based on the total number of cases with valid responses. The number of valid responses is shown in parentheses for each question. Invalid responses (item nonresponse) can be calculated by subtracting the number of valid responses from the total number that should have responded to the question. For example, all respondents were asked to answer the first true/false item in Question 1. Of the total number of respondents who should have answered the question, 1,362 actually answered it (valid responses), and 30 did not (invalid responses). When calculating item nonresponse, keep in mind that not all survey respondents were required to answer all questions: some respondents were asked to skip some questions, depending on their answers to previous questions.

Survey Version

33.0%	Marketing Area Sample: Moderate Fluctuating Flow
32.4	Marketing Area Sample: Low Fluctuating Flow
34.6	Marketing Area Sample: Seasonally Adjusted Steady Flow
(1,392)	

We presented a lot of material in the background information. In this section, we will ask a few questions about the background information to make sure it was clearly presented. Please feel free to refer to the information sheets when answering these questions.

1. For each statement below, please circle the letter "T" if you think the statement is true, or the letter "F" if you think the statement is false.
(CIRCLE ONE LETTER FOR EACH STATEMENT)

	TRUE	FALSE	
There are now many more beaches along the Colorado River than there were 20 years ago.	9.8%	90.2%	(1,362)
Native fish populations in the Colorado River have declined .	94.9	5.1	(1,364)
The decrease in the number and size of beaches is most severe along wide sections of the river.	14.3	85.7	(1,336)
None of the beaches along the river have vegetation.	2.4	97.6	(1,357)
There are American Indian traditional-use areas and sacred sites located along the Colorado River below Glen Canyon Dam.	98.8	1.2	(1,365)
Archeological sites are not being affected by erosion.	4.3	95.7	(1,359)
Trout are not native to the study area.	86.1	13.9	(1,356)
All native fish species have disappeared from the Grand Canyon.	3.2	96.8	(1,358)
Nearly all visitors to the Grand Canyon National Park use the beaches along the river.	8.4	91.6	(1,365)
American Indian traditional-use areas are affected by erosion.	95.9	4.1	(1,324)
Water levels are constant throughout the day.	5.2	94.8	(1,327)
The Study Area consists only of the area in and along the Colorado River between Glen Canyon Dam and Lake Mead.	88.7	11.3	(1,317)
The shoreline in the study area consists only of beaches.	3.6	96.4	(1,321)
Vegetation on beaches provides habitat for birds and other wildlife.	98.9	1.1	(1,336)
Two of the native fish species are in danger of extinction.	90.6	9.4	(1,325)
Reducing daily fluctuations in the amount of water released from the dam will reduce the total amount of hydroelectricity produced.	28.6	71.4	(1,318)

Government Officials Are Deciding How to Operate Glen Canyon Dam in Future Years.

- Their decision on how the dam should be operated could cost you money.
- Since you live in an area receiving power from Glen Canyon Dam, if operations are changed, your utility bill will increase.

INSTRUCTIONS FOR NEXT QUESTION

Government officials will consider many factors when deciding whether or not to change dam operations. One factor they would like to consider is whether various proposals are personally worthwhile to people like you. In the next question, we will describe the effects of a specific proposal to change dam operations. We would like you to tell us if you would vote "YES" or "NO" on this proposal.

Some people might vote "NO" because:

- the cost of the proposal is too high.
- the effects of the proposal are not worth anything (not even 10¢) to them.
- they just can't afford the cost.

Some people might vote "YES" because:

- the cost of the proposal is low enough.
- the effects of the proposal are worth what it would cost them.

At this point in time, it is not certain how much utility bills would increase in your area if the operation of Glen Canyon Dam is changed so we are asking different people about different amounts. Even if the amount we ask you about seems very low or very high, please answer carefully. This will allow us to determine whether people think the proposal is worthwhile at whatever level the final cost is determined to be. For this study, it is important that you tell us how you would vote, based only on **your personal evaluation** of whether changes in dam operations and their effects, are worth the additional cost to you.

Version 5

A PROPOSAL

Under this proposal, there would be a moderate reduction in the daily fluctuations in the river level. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a small improvement in conditions for native fish.
- Native fish populations, including those in danger of extinction, would probably continue to decline in numbers.
- There would be a small improvement in conditions for trout, but stocking of trout would still be required to maintain the population.

Version 6

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be greatly reduced. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10%, so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a moderate improvement in conditions for native fish.
- It is likely, but not certain, that native fish populations, including those in danger of extinction, would increase.
- There would be a moderate improvement in conditions for trout. The trout population could increase and it would require less annual stocking.

Version 7

A PROPOSAL

Under this proposal, daily fluctuations in the river level would be eliminated. Seasonal releases would also be changed so that releases would be highest during the spring, just like before the dam was built. However, the highest spring releases would still be lower than the average springtime flow prior to the dam. If this proposal is selected, it will result in the following conditions along the Colorado River in the Grand Canyon:

- In the long-term, the number and size of beaches would remain at present levels.
- The risk of erosion to Native American traditional-use areas, sacred sites and archeological sites would decrease substantially.
- The area available for vegetation would increase by about 10% so that the area available for birds and other forms of wildlife would increase by about 10%.
- There would be a major improvement in conditions for fish.
- Native fish, including one of the endangered species, would most likely increase in numbers. However, competition from non-native fish may still limit the growth of native fish populations.
- There would be a major improvement in conditions for trout. The size and number of trout would increase. Maintenance of the trout population would no longer require any annual stocking.

2. Think about a situation in which you had an opportunity to vote on this proposal. If passage of this proposal would not cost you anything would you support this proposal? (CIRCLE ONE NUMBER)

11.4% No----->SKIP TO QUESTION 8

82.1 Yes

6.6 I would choose not to vote

on this proposal----->SKIP TO QUESTION 8

(1,338)

How would you vote on this proposal if passage meant your utility bill would increase? As you think about your answer, please remember that if this proposal passes, you would have less money for household expenses or to spend on other environmental issues.

3. Would you vote for this proposal if passage meant your utility bill would increase by \$_____ every year for the foreseeable future? (CIRCLE ONE NUMBER)

Annual cost of proposal

12.9%	\$5
13.5	\$15
11.7	\$30
12.1	\$60
12.5	\$90
12.4	\$120
12.1	\$150
12.7	\$200
(1,392)	

14.4%	Definitely No	- I would <u>definitely vote against</u> the proposal.
16.1	Probably No	- I would <u>probably vote against</u> the proposal.
13.3	Not Sure	- I am <u>not sure</u> if I would vote for the proposal.
34.7	Probably Yes	- I would <u>probably vote for</u> the proposal.
21.5	Definitely Yes	- I would <u>definitely vote for</u> the proposal.
(1,084)		

4. If this proposal passes and you had to pay \$_____ every year for the foreseeable future, on what sorts of things would you spend less money in order to pay for the cost of this proposal? (FILL IN THE BLANK)

Category	Percent of Responses ¹	Percent of Respondents ²
Vacation	2.5%	3.7%
Travel/trips	3.8	5.8
Food/drink	20.4	31.1
Recreation/hobbies	8.8	13.3
Clothing	7.6	11.5
Entertainment	16.9	25.8
Needless items	4.8	7.2
No effect	8.2	12.5
Gifts/toys	.9	1.4
Newspaper	1.8	2.8
Phone	.8	1.3
Can't afford	.8	1.3
Donations	1.5	2.3
Savings	2.4	3.6
Vehicle expenses	4.2	6.4
Utility usage	4.0	6.1
Living expenses	4.8	7.3
Government programs	.1	.1
Housing improvements	.5	.7
Tobacco	.6	.9
Other	3.5	5.3
Health care	.5	.7
Education	.1	.2
Insurance	.4	.5
Taxes	.1	.2
	100.0%	152.1% (939)

¹ Respondents were allowed to record multiple responses. This column reflects percentage of the total number of responses recorded.

² This column reflects percentage of the total number of respondents citing each item listed. Since respondents were allowed to record multiple responses, the column does not sum to 100 percent.

5. Now that you have had an additional chance to think about what you would have to give up if the proposal passes, would you like to change your vote? (CIRCLE ONE NUMBER)

94.6% No----->SKIP TO QUESTION 7
 5.4 Yes
 (1,072)

6. Now how would you vote on the proposal? (CIRCLE ONE NUMBER)

12.7% Definitely No - I would definitely vote against the proposal.
 27.3 Probably No - I would probably vote against the proposal.
 20.0 Not Sure - I am not sure if I would vote for the proposal.
 29.1 Probably Yes - I would probably vote for the proposal.
 10.9 Definitely Yes - I would definitely vote for the proposal.
 (55)

7. Do you believe your utility bill will increase if this proposal passes? (CIRCLE ONE NUMBER)

16.8% No
 83.2 Yes
 (1,076)

8. Do you think public officials will consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future? (CIRCLE ONE NUMBER)

41.9% No
 58.1 Yes
 (1,331)

9. Do you think public officials should consider the results of this study, along with other evidence, in deciding how Glen Canyon Dam should be operated in the future? (CIRCLE ONE NUMBER)

5.0% No
 95.0 Yes
 (1,337)

10. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

54.7% No
 45.3 Yes
 (1,351)

11. Before receiving this survey had you heard of Glen Canyon Dam? (CIRCLE ONE NUMBER)

28.1% No
 71.9 Yes----->What had you heard about Glen Canyon Dam before receiving
 (1,351) this survey? (FILL IN THE BLANK)

0.0% Heard through media specifically about the study
 8.5 Heard about environmental effects of the dam or dam
 operations on downriver resources
 0.0 Both of the above
 91.5 Other
 0.0 Don't know
 (838)

12. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly

agree and 5 being strongly disagree, please indicate how you feel about each statement written below.
(CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
When humans interfere with nature, it often produces disastrous consequences.	37.8%	22.6%	26.3%	8.0%	5.3%	(1,356)
Humans will eventually learn enough about how nature works to be able to control it.	7.0	12.9	24.1	27.1	28.8	(1,352)
The balance of nature is very delicate and easily upset.	44.5	26.5	17.6	7.7	3.7	(1,352)
Humans have the right to modify the natural environment to suit their needs.	7.8	14.5	25.7	22.9	29.1	(1,352)
If things continue on their present course, we will soon experience a major ecological catastrophe.	25.8	20.3	25.3	15.6	13.0	(1,350)
Humans were meant to rule the rest of nature.	9.9	9.9	17.3	18.6	44.2	(1,348)
Despite our special abilities, humans are still subject to the laws of nature.	62.9	25.4	7.5	2.0	2.2	(1,343)
Plants and animals have as much right as humans to exist.	44.4	20.0	17.3	8.8	9.6	(1,348)
Human ingenuity will ensure that we do not make the earth unlivable.	12.0	19.3	32.0	21.3	15.5	(1,338)
Humans are severely abusing the environment.	39.7	23.7	20.8	9.4	6.4	(1,349)
The so-called ecological crisis facing humankind has been greatly exaggerated.	13.2	17.3	26.5	22.0	21.2	(1,338)
We are approaching the limit of the number of people the earth can support.	25.5	18.2	25.2	15.1	16.0	(1,350)
The earth is like a spaceship with very limited room and resources.	27.3	22.5	23.0	13.8	13.5	(1,345)
The earth has plenty of natural resources, if we just learn how to develop them.	30.8	28.9	21.7	11.8	6.7	(1,352)
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	6.2	8.8	22.9	33.7	28.3	(1,348)

13. The following statements discuss economic and environmental issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
Economic security and well-being should be considered first; then we can worry about environmental problems.	7.9%	10.5%	29.9%	28.6%	23.1%	(1,372)
It is possible to protect our environment and natural resources and still maintain a healthy economy.	45.1	40.0	11.2	2.0	1.6	(1,374)
If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market.	9.5	16.7	28.3	25.4	20.1	(1,360)
Some pollution is inevitable if we are going to continue to improve our standard of living.	15.0%	29.4%	27.4%	16.8%	11.4%	(1,367)
I would be willing to pay somewhat higher prices (5 to 10 percent higher) for products that would cause less pollution or environmental damage.	31.2	32.6	23.5	8.1	4.6	(1,364)
The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	5.6	8.4	27.4	30.4	28.2	(1,363)
Some land in the United States should be set aside from human use so it can remain completely untouched, regardless of its economic value.	46.0	21.5	13.3	9.1	10.2	(1,369)

14. The following statements discuss American Indian issues. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE		STRONGLY DISAGREE			
	1	2	3	4	5	
It is our responsibility to protect those areas of historical or religious importance to American Indians.	40.8%	29.9%	17.8%	6.8%	4.6%	(1,374)
We have gone too far in granting American Indians special rights to use public lands and resources, such as fish and wildlife.	13.9	14.3	21.8	21.2	28.2	(1,370)
Our society can learn important lessons from studying earlier cultures that inhabited our country.	44.9	30.4	17.7	4.7	2.3	(1,373)
We can't afford to let concern for preserving artifacts of earlier American Indian cultures stand in the way of operating hydroelectric dams.	6.9	11.0	23.0	26.7	32.4	(1,372)
American Indian concerns should be equally as important as our society's economic needs when deciding how to use land.	33.9	24.6	25.7	9.7	6.1	(1,372)

15. The following statements discuss hydroelectricity. We would like to understand how you feel about these issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
The benefits of hydroelectric dams on the Colorado River outweigh the impacts to the natural environment and historical places along the river.	9.8%	14.6%	33.2%	23.9%	18.5%	(1,333)
Hydroelectric dams should not be constructed on rivers that flow through national parks.	16.7	13.2	29.9	25.1	15.1	(1,336)
Hydroelectric dams have fewer environmental impacts than coal, oil, or gas-burning power plants.	29.7	31.3	25.7	8.3	5.1	(1,324)
Hydroelectric dams can have serious impacts on the plants and animals that live in or along the river.	30.7	34.2	23.0	7.2	4.8	(1,341)
Hydroelectric dams produce relatively cheap electricity compared to other sources.	33.7	38.5	21.5	3.3	3.0	(1,328)
Hydroelectric dams should be developed wherever it is economically feasible, even if it means that some rivers will be changed.	12.6	17.3	29.1	22.4	18.6	(1,340)
Rivers without dams are a unique and irreplaceable resource that should be protected from hydroelectric dams.	19.9	16.1	34.3	20.6	9.1	(1,335)

In this section, we would like to learn how you feel about national parks in the United States.

16. Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)

4.4%	No
94.9	Yes
0.7	Don't know
(1,349)	

17. We are interested in learning how you feel about national parks in general. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell us how you feel about each statement written below. (CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
National parks are a "luxury" we cannot afford in difficult economic times.	4.3%	3.8%	9.0%	24.1%	58.8%	(1,351)
National parks help us to remember that our future is tied to the preservation of nature and natural resources.	57.0	27.8	9.9	3.2	2.1	(1,350)
It is important that national parks offer us a chance to see America as the early settlers saw it.	49.2	29.3	14.9	4.0	2.7	(1,355)
Americans need places like national parks to "recharge their batteries."	48.6	28.3	15.8	3.2	4.1	(1,352)
An important function of the National Park Service is to protect native birds, plants, and animals.	58.8	27.5	9.5	1.7	2.5	(1,351)
National parks are only valuable to the people who visit them.	4.9	5.9	8.8	29.1	51.2	(1,345)
Oil and natural gas finds on national park lands should be developed since it is in the national interest.	8.4	10.6	26.6	23.4	31.0	(1,337)
The National Park Service places too much emphasis on preservation.	4.8	9.1	19.5	28.6	38.0	(1,341)
I am glad there are national parks, even if I don't visit them.	72.8	18.9	6.3	0.8	1.2	(1,332)
People can think a place is valuable, even if they do not actually go there themselves.	72.6	21.5	4.0	0.8	1.0	(1,345)
The American people should provide greater financial support for the National Park Service to avoid more commercial activities in the national parks.	38.8	22.7	24.0	8.1	6.3	(1,341)
If the National Park Service needs more financial support, they should develop more gift shops and commercial activities to raise money.	10.3	11.6	28.4	24.4	25.3	(1,339)

In this section, we are interested in learning about trips you may have taken to Grand Canyon National Park.

18. As best you can recall, have you ever flown over Grand Canyon National Park in an aircraft? (CIRCLE ONE NUMBER)
- | | |
|---------|-----------------------------|
| 57.1% | No----->SKIP TO QUESTION 20 |
| 42.9 | Yes |
| (1,341) | |
19. Did you fly over Grand Canyon National Park while you were on a commercial airliner, or did you fly over the park as part of a sightseeing air tour that included the park? (CIRCLE ALL NUMBERS THAT APPLY)
- | | |
|-------|--|
| 91.5% | flew over Grand Canyon National Park while on a commercial aircraft |
| (564) | |
| 6.4% | flew over Grand Canyon National Park as part of a sightseeing air tour |
| (564) | |
| | flew over Grand Canyon National Park as part of a: |
| 20.0% | Military flight |
| 63.1 | Private plane |
| 4.6 | Charter flight |
| 1.5 | Medical evacuation |
| 6.2 | Helicopter |
| 1.5 | Fire fighter |
| 1.5 | Mail plane |
| 1.5 | Small craft |
| (65) | |
20. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)
- | | |
|---------|-----------------------------|
| 33.9% | No----->SKIP TO QUESTION 23 |
| 66.1 | Yes |
| (1,354) | |
21. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)
- | | |
|-------|-----------------------------|
| 7.9% | No----->SKIP TO QUESTION 23 |
| 92.1 | Yes |
| (884) | |
22. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)
- | | |
|-------|-----|
| 77.8% | No |
| 22.2 | Yes |
| (819) | |
23. How likely do you think it is that you will visit the Grand Canyon National Park in the future? (CIRCLE ONE NUMBER)
- | | |
|---------|-------------------|
| 8.7% | Not at all likely |
| 11.2 | Somewhat unlikely |
| 34.4 | Somewhat likely |
| 45.6 | Very likely |
| (1,353) | |

In this last section, we would like to ask you some questions about your background that will help us compare your answers with those of other people. We stress that all of your responses are strictly confidential.

24. Are you: (CIRCLE ONE NUMBER)

56.9%	Male
43.1	Female
(1,361)	

25. How old are you? (FILL IN THE BLANK)

AVERAGE AGE
51.6 Years old
(1,353)

26. How many years of schooling have you completed? (CIRCLE ONE NUMBER)

2.8%	Eight years or less
4.3	Some high school
18.5	High school graduate
32.3	Some college or technical school
25.4	College or technical school graduate
16.8	Post graduate work
(1,353)	

27. How many people live in your household? (FILL IN ALL BLANKS)

AVERAGE NUMBER
2.00 People 18 years old or older
(1,228)
0.90 People under the age of 18
(1,137)
2.80 Total number of people in the household
(1,258)

28. Do you, or another member of your household, own or rent this residence? (CIRCLE ONE NUMBER)

84.6%	Own
13.9	Rent
1.5	Other
(1,354)	

29. Are you, or another member of your household, responsible for paying the utility bill? (CIRCLE ONE NUMBER)

2.4%	No
97.6	Yes
(1,357)	

30. Which of the following categories comes closest to your total 1993 household income? (CIRCLE ONE NUMBER)

6.9%	Less than \$10,000	7.2	\$45,000 to \$49,999
8.0	\$10,000 to \$14,999	7.7	\$50,000 to \$59,999
9.8	\$15,000 to \$19,999	6.9	\$60,000 to \$69,999
9.4	\$20,000 to \$24,999	4.3	\$70,000 to \$79,999
9.0	\$25,000 to \$29,999	2.1	\$80,000 to \$89,999
8.6	\$30,000 to \$34,999	1.5	\$90,000 to \$99,999
7.1	\$35,000 to \$39,999	4.2	Over \$100,000
7.4	\$40,000 to \$44,999	(1,292)	

**Telephone Survey Frequencies --
National Sample**

The frequencies presented in this section are based on 248 telephone interviews that were completed with nonrespondents to the mail survey for the national sample. Percentages shown for each question are based on the total number of cases with valid responses. The number of valid responses is shown in parentheses for each question. Invalid responses (item nonresponse) can be calculated by subtracting the number of valid responses from the total number that should have responded to the question. For example, all respondents were asked to answer Question 8. Of the total number of respondents who should have answered the question, 246 actually answered it (valid responses), and 2 refused (invalid responses). When calculating item nonresponse, keep in mind that not all survey respondents were required to answer all questions: some respondents were asked to skip some questions, depending on their answers to previous questions.

Survey Version

25.8% National Sample: Moderate Fluctuating Flow
 21.4 National Sample: Low Fluctuating Flow
 27.8 National Sample: Seasonally Adjusted Steady Flow
 25.0 National Sample: Seasonally Adjusted Steady Flow with Moderate Fluctuating Flow
 Price Impacts
 (248)

Hi, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. I'm trying to reach the (Name) household at (Phone Number). Do I have the right number? (CIRCLE ONE NUMBER)

- 1 No----->(THANK AND TERMINATE)
 2 Yes
 3 Hung up

Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam. To help us understand the survey results we need to understand the reasons people have for not participating in the study.

1. We asked that the adult in your household with the latest birthday in the calendar year read and complete the survey. Are you the adult in your household who had the latest birthday in the calendar year? (CIRCLE ONE NUMBER)

1 No----->May I please speak to (him/her)? (CIRCLE ONE NUMBER)

1 No/not available----->When would be a good time for me to reach (him/her)? Who should we ask for when we call back? (FILL IN BLANK AND GET FIRST NAME)

2 Yes----->Hello, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam.

2 Yes

To help us understand the survey results we need to understand the reasons people have for not participating in the study.

2. Do you remember receiving the questionnaire in the mail? (CIRCLE ONE NUMBER)

31.3% No----->(PROBE: It was a (color) booklet that came in a package with several other sheets of paper. There was also an envelope for you to return the questionnaire in. Do you remember that (color) booklet, it had a picture of the Colorado River on the cover? (CIRCLE ONE NUMBER)

87.0% No----->I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____
 Last name: _____
 Street address: _____
 City: _____
 State: _____
 ZIP Code: _____
 (SKIP TO QUESTION 8)

		13.0	Yes
		(77)	
68.7	Yes		
(246)			

3. Did you look through the package of materials and the questionnaire? (CIRCLE ONE NUMBER)

30.2% No----->Why not? (FILL IN BLANK)

		52.2%	No time/ too busy
		13.0	Not interested/ not important
		2.2	Lost booklet
		6.5	Threw away/gave away
		4.3	Vision impaired/couldn't read
		2.2	Didn't understand/too hard
		4.3	In process of moving
		2.2	Confusion about proper respondent
		4.3	Thought it was junk
		2.2	Out of town, country
		2.2	Don't do surveys
		4.3	Don't know
		(46)	
69.8	Yes		
(179)			

4. Did you read the background information that described the study and the situation with the Glen Canyon Dam? (CIRCLE ONE NUMBER)

32.0% No----->Why not? (FILL IN BLANK)

- 42.1% No time/too busy
- 7.9 Not interested/not important
- 2.6 Lost booklet
- 2.6 Not enough information to answer
- 7.9 Vision impaired/couldn't read
- 2.6 Just didn't/no reason
- 10.5 Didn't understand/too hard
- 2.6 Just looked at it
- 5.3 Too long, wordy, detailed
- 2.6 Put it off/forgot about it
- 2.6 Confusion about proper respondent
- 5.3 Thought it was junk
- 5.3 Don't know

(38)

68.0 Yes
(125)

5. Did you start to fill out the questionnaire booklet? (CIRCLE ONE NUMBER)

75.8% No----->Why not? (FILL IN BLANK)

- 43.7% No time/too busy
- 10.9 Not interested/not important
- 0.8 Threw away/gave away
- 3.4 Not enough information to answer
- 4.2 Vision impaired/couldn't read
- 0.8 How information will be used
- 1.7 Just didn't/no reason
- 9.2 Didn't understand/too hard
- 0.8 Never been there (Glen Canyon Dam/Colorado River)
- 0.8 Just looked at it
- 1.7 My opinion not important
- 4.2 Too long, wordy, detailed
- 1.7 Put it off/forgot about it
- 1.7 In process of moving
- 5.9 Confusion about prop
- 4.2 Thought it was junk
- 0.8 Didn't think it was
- 0.8 Don't do surveys
- 2.5 Don't know

(119)

24.2 Yes
(178)

6. Did you finish filling out the questionnaire booklet? (CIRCLE ONE NUMBER)

74.4% No----->Why not? (FILL IN BLANK)

	55.6%	No time/too busy
	3.7	Lost booklet
	14.8	Not enough information to answer
	3.7	Had questions
	3.7	Too far away
	3.7	Just didn't/no reason
	3.7	Put it off/forgot about it
	3.7	Did not mail it yet
	3.7	Out of town, country
	3.7	Don't know what it is
	(27)	
25.6	Yes	
(43)		

7. Do you still have the questionnaire booklet? (CIRCLE ONE NUMBER)

57.9% No/Don't know----->Why not? (FILL IN BLANK)

	1.1%	No time/too busy
	4.5	Not interested/not important
	13.6	Lost booklet
	50.0	Threw away/gave away
	1.1	Vision impaired/couldn't read
	5.7	Mailed it back
	1.1	Just didn't/no reason
	1.1	In process of moving
	1.1	Confusion about prop
	1.1	Did not mail it yet
	2.3	Thought it was junk
	17.0	Don't know
	(88)	
42.1	Yes	
(178)		

Another reason I'm calling you is that we need to find out a little bit about the people who didn't return the questionnaire booklet, so we can learn whether the results might have been different if we had heard from everyone.

8. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

91.9% No
 6.9 Yes
 1.2 Don't recall
 (246)

9. Before receiving this survey had you heard of Glen Canyon Dam?
 (CIRCLE ONE NUMBER)

74.8% No
 25.2 Yes----->What had you heard about Glen Canyon Dam before
 (246) receiving this survey? (FILL IN THE BLANK)

0.0% Heard through media specifically about the study
 5.3 Heard about the environmental effects of the dam or dam
 operations on downriver resources
 0.0 Both of the above
 82.5 Other comments
 12.3 Don't know
 (57)

10. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)

81.7% No/Don't recall----->Have you ever visited any national parks in the United
 States? (CIRCLE ONE NUMBER)

52.2% No
 45.3 Yes
 2.5 Don't know
 (201)

(SKIP TO QUESTION 13)

18.3 Yes
 (246)

11. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)

20.0% No/Don't recall----->(SKIP TO QUESTION 13)
 80.0 Yes
 (45)

12. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)

86.1%	No
13.9	Yes
0.0	Don't recall
(36)	

13. How likely do you think it is that you will visit the Grand Canyon National Park in the future? Are you not at all likely, somewhat unlikely, somewhat likely, or very likely to visit the Grand Canyon in the future? (CIRCLE ONE NUMBER)

33.6%	Not at all likely
13.4	Somewhat unlikely
35.6	Somewhat likely
16.2	Very likely
1.2	Don't know
(247)	Refusal

Next, I'm going to read you some statements and ask you whether you agree or disagree with each statement. There are no right or wrong answers, we just want to know your opinion

14. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about each statement I read. (READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
a. When humans interfere with nature, it often produces disastrous consequences.	44.4%	18.8%	23.0%	6.7%	7.1%	(239)

On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

b. Humans will eventually learn enough about how nature works to be able to control it.	17.2	13.1	20.9	18.9	29.9	(244)
c. The balance of nature is very delicate and easily upset.	55.7	19.4	13.1	5.9	5.9	(237)
d. Humans have the right to modify the natural environment to suit their needs.	13.5	11.0	26.6	16.9	32.1	(237)
e. If things continue on their present course, we will soon experience a major ecological catastrophe.	43.0	14.5	20.0	9.8	12.8	(235)

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

f. Humans were meant to rule the rest of nature.	13.6	7.4	13.2	18.6	47.1	(242)
g. Despite our special abilities, humans are still subject to the laws of nature.	61.1	22.1	11.5	2.5	2.9	(244)
h. Plants and animals have as much right as humans to exist.	63.8	14.4	9.9	4.1	7.8	(243)
i. Human ingenuity will ensure that we do not make the earth unlivable.	18.7	17.9	31.5	17.0	14.9	(235)
j. Humans are severely abusing the environment.	50.0	18.2	16.5	9.9	5.4	(242)

(Continued)

STRONGLY AGREE					STRONGLY DISAGREE	
1	2	3	4	5		

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

k.	The so-called ecological crisis facing humankind has been greatly exaggerated.	11.3%	11.8%	28.2%	24.4%	24.4%	(238)
l.	We are approaching the limit of the number of people the earth can support.	26.7	19.8	27.2	13.8	12.5	(232)
m.	The earth is like a spaceship with very limited room and resources.	29.5	21.1	22.8	12.2	14.3	(237)
n.	The earth has plenty of natural resources, if we just learn how to develop them.	49.0	21.8	16.3	7.9	5.0	(239)
o.	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	14.2	12.1	25.4	19.0	29.3	(232)

15. OK, the last few statements I am going to read to you discuss economic and environmental issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell me how you feel about each statement I read. *(READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)*

STRONGLY AGREE					STRONGLY DISAGREE	
1	2	3	4	5		

a.	Economic security and well-being should be considered first; then we can worry about environmental problems.	12.1%	11.6%	24.5%	22.8%	28.6%	(241)
b.	If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market	11.3	20.0	31.3	21.3	16.1	(230)
c.	Some pollution is inevitable if we are going to continue to improve our standard of living.	20.3	36.7	19.8	12.7	10.5	(237)
d.	The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	9.1	9.5	26.7	26.7	28.0	(232)

The last few questions I have are about your background. These questions will help us compare your answers with those of other people. All of your responses are strictly confidential.

16. How old are you? (FILL IN THE BLANK)

AVERAGE AGE
46.2 **Years old**
(243)

17. How many years of schooling have you completed? (READ LIST; CIRCLE ONE NUMBER)

6.2% **Eight years or less**
9.1 **Some high school**
26.7 **High school graduate**
25.9 **Some college or technical school**
19.8 **College or technical school graduate**
12.3 **Post graduate work**
(243)

18. Including yourself, how many people live in your household? How many of these people are less than 18 years old? (FILL IN ALL BLANKS)

AVERAGE NUMBER
0.85 **People under the age of 18**
(245)
1.89 **People 18 years old or older**
(245)
2.74 **Total number of people in the household**
(245)

19. Which of the following categories comes closest to your total 1993 household income? (READ LIST; CIRCLE ONE NUMBER)

8.3%	Less than \$10,000	5.5%	\$45,000 to less than \$50,000
7.4	\$10,000 to less than \$15,000	6.0	\$50,000 to less than \$60,000
6.9	\$15,000 to less than \$20,000	4.6	\$60,000 to less than \$70,000
13.8	\$20,000 to less than \$25,000	3.7	\$70,000 to less than \$80,000
12.9	\$25,000 to less than \$30,000	2.3	\$80,000 to less than \$90,000
10.6	\$30,000 to less than \$35,000	1.4	\$90,000 to less than \$100,000
4.1	\$35,000 to less than \$40,000	6.5	Over \$100,000
6.0	\$40,000 to less than \$45,000	(217)	

[CHECK RESPONSE TO QUESTION 7. IF NO LONGER HAS SURVEY, SKIP TO QUESTION 19b.]

19a. Earlier, you said that you still have a copy of the questionnaire booklet. It would really help me out if you could spend a few minutes reading the background information materials and completing at least the first 9 questions in the survey booklet and mail it back to us in the envelope. Do you think you would be able to do that in the next few days? (CIRCLE ONE NUMBER)

6.7% No-----> OK, Thanks for your help.

93.3 Yes-----> I would really appreciate it if you could fill out at least the first 9 questions of the survey and put it in the mail in the next few days.

(75)

19b. Earlier, you said you may not have a copy of the survey booklet. If we mailed you another copy, could you spend a few minutes reading the background information and completing at least the first 9 questions of the survey booklet? It would really help me out. (CIRCLE ONE NUMBER)

24.0% No----->OK, thanks for your help.

76.0 Yes----->OK, I will mail you another copy of the survey. (VERIFY ADDRESS IF NOT ALREADY DONE)

(167)

I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____
Last name: _____
Street address: _____
City: _____
State: _____
ZIP Code: _____

Thank you for your time. I'd really like to encourage you to return your survey. Do you have any questions or comments? (FILL IN BLANK)

(INTERVIEWER -- IS RESPONDENT . . . ?) (CIRCLE ONE NUMBER)

44.1% Male

55.9 Female

(247)

**Telephone Survey Frequencies --
Marketing Area Sample**

The frequencies presented in this section are based on 193 telephone interviews that were completed with nonrespondents to the mail survey for the marketing area sample. Percentages shown for each question are based on the total number of cases with valid responses. The number of valid responses is shown in parentheses for each question. Invalid responses (item nonresponse) can be calculated by subtracting the number of valid responses from the total number that should have responded to the question. For example, all respondents were asked to answer Question 8. Of the total number of respondents who should have answered the question, 192 actually answered it (valid responses), and one refused (invalid response). When calculating item nonresponse, keep in mind that not all survey respondents were required to answer all questions: some respondents were asked to skip some questions, depending on their answers to previous questions.

Survey Version

- 32.1% Marketing Area Sample: Moderate Fluctuating Flow
 - 30.1 Marketing Area Sample: Low Fluctuating Flow
 - 37.8 Marketing Area Sample: Seasonally Adjusted Steady Flow
- (193)

Hi, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. I'm trying to reach the (Name) household at (Phone Number). Do I have the right number? (CIRCLE ONE NUMBER)

- 1 No----->(THANK AND TERMINATE)
- 2 Yes
- 3 Hung up

Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam. To help us understand the survey results we need to understand the reasons people have for not participating in the study.

1. We asked that the adult in your household with the latest birthday in the calendar year read and complete the survey. Are you the adult in your household who had the latest birthday in the calendar year? (CIRCLE ONE NUMBER)

1 No----->May I please speak to (him/her)? (CIRCLE ONE NUMBER)

1 No/not available----->When would be a good time for me to reach (him/her)? Who should we ask for when we call back? (FILL IN BLANK AND GET FIRST NAME)

2 Yes----->Hello, my name is _____. I'm with HBRS, a research firm that's working with the Bureau of Reclamation on the Glen Canyon Studies. Late last year we sent your household a questionnaire asking about issues related to the operation of the Glen Canyon Dam.

2 Yes

To help us understand the survey results we need to understand the reasons people have for not participating in the study.

2. Do you remember receiving the questionnaire in the mail? (CIRCLE ONE NUMBER)

25.9% No----->(PROBE: It was a (color) booklet that came in a package with several other sheets of paper. There was also an envelope for you to return the questionnaire in. Do you remember that (color) booklet, it had a picture of the Colorado River on the cover? (CIRCLE ONE NUMBER)

100.0% No----->I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____
 Last name: _____
 Street address: _____
 City: _____
 State: _____
 ZIP Code: _____
 (SKIP TO QUESTION 8)

		0.0	Yes
		(50)	
74.1	Yes		
(193)			

3. Did you look through the package of materials and the questionnaire? (CIRCLE ONE NUMBER)

25.2% No----->Why not? (FILL IN BLANK)

- 47.1% No time/ too busy
- 11.8 Not interested/ not important
- 2.9 Threw away/ gave away
- 2.9 Vision impaired/couldn't read
- 5.9 Put it off/forgot about it
- 2.9 In process of moving
- 5.9 Confusion about proper respondent
- 2.9 Thought it was junk
- 2.9 My opinion won't count
- 2.9 Never opened it
- 2.9 Didn't receive background
- 2.9 Don't know what it is
- 2.9 Questions phrased poorly
- 2.9 Don't know

74.8	Yes	
(143)		

4. Did you read the background information that described the study and the situation with the Glen Canyon Dam? (CIRCLE ONE NUMBER)

38.3% No----->Why not? (FILL IN BLANK)

- 60.0% No time/too busy
- 7.5 Not interested/not important
- 2.5 Threw away/gave away
- 7.5 Not enough information to answer
- 2.5 Vision impaired/couldn't read
- 7.5 Didn't understand/too hard
- 2.5 Too long, wordy, detailed
- 5.0 Put it off/forgot about it
- 2.5 Never received survey
- 2.5 Don't know

61.7 Yes
(107)

5. Did you start to fill out the questionnaire booklet? (CIRCLE ONE NUMBER)

77.6% No----->Why not? (FILL IN BLANK)

- 45.4% No time/too busy
- 12.4 Not interested/not important
- 1.0 Lost booklet
- 2.1 Threw away/gave away
- 6.2 Not enough information to answer
- 1.0 Vision impaired/couldn't read
- 1.0 Too far away
- 2.1 Just didn't/no reason
- 9.3 Didn't understand/too hard
- 1.0 Never been there (Glen Canyon Dam/Colorado River)
- 1.0 My opinion not important
- 1.0 Too long, wordy, detailed
- 4.1 Put it off/forgot it
- 1.0 In process of moving
- 2.1 Confusion about proper respondent
- 3.1 Out of town, country
- 1.0 Never opened it
- 1.0 Had trouble with last one
- 1.0 Don't know what it is
- 1.0 Never received survey
- 1.0 Questions phrased poorly
- 1.0 Don't know

22.4 Yes
(143)

6. Did you finish filling out the questionnaire booklet? (CIRCLE ONE NUMBER)

78.1%	No----->Why not? (FILL IN BLANK)	
		45.5% No time/too busy
		9.1 Not interested/not important
		9.1 Lost booklet
		13.6 Not enough information to answer
		4.5 Vision impaired/couldn't read
		4.5 Didn't understand/too hard
		4.5 Too long, wordy, detailed
		4.5 Questions phrased poorly
		4.5 Don't know
		(22)
21.9	Yes	
(32)		

7. Do you still have the questionnaire booklet? (CIRCLE ONE NUMBER)

58.5%	No/Don't know----->Why not? (FILL IN BLANK)	
		5.6% No time/too busy
		2.8 Not interested/not important
		13.9 Lost booklet
		48.6 Threw away/gave away
		2.8 Not enough information to answer
		1.4 Vision impaired/couldn't read
		4.2 Mailed it back
		1.4 Didn't understand/too hard
		1.4 In process of moving
		1.4 Never opened it
		2.8 Don't know what it is
		1.4 Never received survey
		12.5 Don't know
		(72)
41.5	Yes	
(142)		

Another reason I'm calling you is that we need to find out a little bit about the people who didn't return the questionnaire booklet, so we can learn whether the results might have been different if we had heard from everyone.

8. Have you ever been to Glen Canyon Dam in Arizona? (CIRCLE ONE NUMBER)

76.6%	No
22.9	Yes
0.5	Don't recall
(192)	

9. Before receiving this survey had you heard of Glen Canyon Dam?
(CIRCLE ONE NUMBER)

45.8%	No	
54.2	Yes----->	What had you heard about Glen Canyon Dam before receiving this survey? (FILL IN THE BLANK)
(192)		
	0.0%	Heard through media specifically about the study
	2.0	Heard about the environmental effects of the dam or dam operations on downriver resources
	0.0	Both of the above
	89.8	Other comments
	8.2	Don't know
	(98)	

10. Have you ever visited Grand Canyon National Park? (CIRCLE ONE NUMBER)

59.4%	No/Don't recall----->	Have you ever visited any national parks in the United States? (CIRCLE ONE NUMBER)
	17.5%	No
	79.8	Yes
	2.6	Don't know
	(114)	
		(SKIP TO QUESTION 13)

40.6 Yes
(192)

11. Did you see the Colorado River while you were in Grand Canyon National Park? (CIRCLE ONE NUMBER)

7.7%	No/Don't recall----->	(SKIP TO QUESTION 13)
92.3	Yes	
(78)		

12. Did you go down to the Colorado River while you were at the Grand Canyon National Park? (CIRCLE ONE NUMBER)

86.1%	No
12.5	Yes
1.4	Don't recall
(72)	

13. How likely do you think it is that you will visit the Grand Canyon National Park in the future? Are you not at all likely, somewhat unlikely, somewhat likely, or very likely to visit the Grand Canyon in the future? (CIRCLE ONE NUMBER)

28.6%	Not at all likely
9.4	Somewhat unlikely
32.8	Somewhat likely
27.6	Very likely
1.6	Don't know
(192)	

Next, I'm going to read you some statements and ask you whether you agree or disagree with each statement. There are no right or wrong answers, we just want to know your opinion

14. People often have different views about environmental issues. On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about each statement I read. (READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)

	STRONGLY AGREE			STRONGLY DISAGREE		
	1	2	3	4	5	
a. When humans interfere with nature, it often produces disastrous consequences.	39.6%	18.2%	28.9%	5.9%	7.5%	(187)

On a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

b. Humans will eventually learn enough about how nature works to be able to control it.	18.6	12.8	22.9	20.7	25.0	(188)
c. The balance of nature is very delicate and easily upset.	55.6	17.5	15.9	7.4	3.7	(189)
d. Humans have the right to modify the natural environment to suit their needs.	15.4	13.3	24.5	15.4	31.4	(188)
e. If things continue on their present course, we will soon experience a major ecological catastrophe.	37.6	20.4	16.1	14.0	11.8	(186)

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

f. Humans were meant to rule the rest of nature.	12.9	9.7	11.8	19.4	46.2	(186)
g. Despite our special abilities, humans are still subject to the laws of nature.	62.1	23.2	9.5	2.1	3.2	(190)
h. Plants and animals have as much right as humans to exist.	53.4	16.9	13.8	8.5	7.4	(189)
i. Human ingenuity will ensure that we do not make the earth unlivable.	24.7	23.1	27.4	14.0	10.8	(186)
j. Humans are severely abusing the environment.	42.6	18.6	25.0	9.6	4.3	(188)

(Continued)

STRONGLY AGREE					STRONGLY DISAGREE	
1	2	3	4	5		

Again, on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree, please tell me how you feel about the following statement:

k.	The so-called ecological crisis facing humankind has been greatly exaggerated.	12.0%	23.5%	27.9%	20.2%	16.4%	(183)
l.	We are approaching the limit of the number of people the earth can support.	30.8	23.8	14.6	15.1	15.7	(185)
m.	The earth is like a spaceship with very limited room and resources.	32.4	24.3	26.5	7.0	9.7	(185)
n.	The earth has plenty of natural resources, if we just learn how to develop them.	45.7	27.1	17.0	6.4	3.7	(188)
o.	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	9.1	15.5	27.3	20.9	27.3	(187)

15. OK, the last few statements I am going to read to you discuss economic and environmental issues. On a scale of 1 to 5, where 1 means strongly agree and 5 means strongly disagree, please tell me how you feel about each statement I read. *(READ STATEMENT; CIRCLE ONE NUMBER FOR EACH STATEMENT)*

STRONGLY AGREE					STRONGLY DISAGREE	
1	2	3	4	5		

a.	Economic security and well-being should be considered first; then we can worry about environmental problems.	12.8%	13.4%	23.0%	21.4%	29.4%	(187)
b.	If business is forced to spend a lot of money on environmental protection, it won't be able to invest in research and development to keep us competitive in the international market	12.2	18.1	26.6	26.1	17.0	(188)
c.	Some pollution is inevitable if we are going to continue to improve our standard of living.	20.4	30.6	23.1	13.4	12.4	(186)
d.	The decision to develop resources should be based mostly on economic grounds rather than environmental or archeological grounds.	10.8	7.5	34.4	21.5	25.8	(186)

The last few questions I have are about your background. These questions will help us compare your answers with those of other people. All of your responses are strictly confidential.

16. How old are you? (FILL IN THE BLANK)

AVERAGE AGE

48.8 Years old
(189)

17. How many years of schooling have you completed? (READ LIST; CIRCLE ONE NUMBER)

4.2% Eight years or less
5.2 Some high school
28.3 High school graduate
30.9 Some college or technical school
18.3 College or technical school graduate
13.1 Post graduate work
(191)

18. Including yourself, how many people live in your household? How many of these people are less than 18 years old? (FILL IN ALL BLANKS)

AVERAGE NUMBER

0.98 People under the age of 18
(192)
1.93 People 18 years or older
(192)
2.94 Total number of people in the household
(193)

19. Which of the following categories comes closest to your total 1993 household income? (READ LIST; CIRCLE ONE NUMBER)

10.2%	Less than \$10,000	2.8%	\$45,000 to less than \$50,000
10.2	\$10,000 to less than \$15,000	9.7	\$50,000 to less than \$60,000
8.5	\$15,000 to less than \$20,000	6.8	\$60,000 to less than \$70,000
10.8	\$20,000 to less than \$25,000	2.3	\$70,000 to less than \$80,000
10.8	\$25,000 to less than \$30,000	2.3	\$80,000 to less than \$90,000
8.5	\$30,000 to less than \$35,000	0.6	\$90,000 to less than \$100,000
7.4	\$35,000 to less than \$40,000	2.8	Over \$100,000
6.3	\$40,000 to less than \$45,000	(176)	

[CHECK RESPONSE TO QUESTION 7. IF NO LONGER HAS SURVEY, SKIP TO QUESTION 19b.]

19a. Earlier, you said that you still have a copy of the questionnaire booklet. It would really help me out if you could spend a few minutes reading the background information materials and completing at least the first 9 questions in the survey booklet and mail it back to us in the envelope. Do you think you would be able to do that in the next few days? (CIRCLE ONE NUMBER)

1.8% No-----> OK, Thanks for your help.

98.2 Yes-----> I would really appreciate it if you could fill out at least the first 9 questions of the survey and put it in the mail in the next few days.

(57)

19b. Earlier, you said you may not have a copy of the survey booklet. If we mailed you another copy, could you spend a few minutes reading the background information and completing at least the first 9 questions of the survey booklet? It would really help me out. (CIRCLE ONE NUMBER)

21.8% No----->OK, thanks for your help.

78.2 Yes----->OK, I will mail you another copy of the survey. (VERIFY ADDRESS IF NOT ALREADY DONE)

(133)

I'd like to verify your name and mailing address. (FILL IN BLANKS; VERIFY SPELLING)

First name: _____
Last name: _____
Street address: _____
City: _____
State: _____
ZIP Code: _____

Thank you for your time. I'd really like to encourage you to return your survey. Do you have any questions or comments? (FILL IN BLANK)

(INTERVIEWER -- IS RESPONDENT . . . ?) (CIRCLE ONE NUMBER)

53.4% Male
46.6 Female
(193)

APPENDIX G
NONRESPONDENT SUPPORT OF A CHANGE IN DAM OPERATIONS

The calculation of population average willingness-to-pay required an estimate of the percentage of nonrespondents who would support a change in dam operations at zero cost (\$0). This was accomplished by estimating separate logistic regression models for national and marketing area samples. Data from mail survey respondents was used to develop the models, where support was the dependent variable. Potential independent variables included the environmental attitude factor scores used in the logit models used to predict willingness-to-pay, income, and education (Reported and defined in Table 5-21). Tables G-1 and G-2 show the estimated parameters of the logit models for the national and marketing area samples, respectively. Variable definitions are shown in Table G-3.

These models predicted the percent of survey *respondents* who would support a change in dam operations. To predict the percent of *nonrespondents* who would support a change, the models were evaluated using the average values for independent variables from the telephone survey of nonrespondents. Average values used for national and marketing area models are reported in Table G-4, and the percent of nonrespondents predicted to support a change in dam operations is reported in Table G-5 for each survey version.

Table G-1
Estimated Logistic Regression Model Parameters for the National Sample to Predict
Support for a Change in Dam Operations at Zero Cost^a

Variable	Parameters
constant	-0.6774 (0.2774) P=0.015
factor1	-0.2877 (0.0732) P=0.000
factor2	0.5175 (0.0747) P=0.000
factor4	0.1470 (0.0716) P=0.040
school	0.3359 (0.0668) P=0.000
income	0.000006 (0.000003) P=0.080
D2	0.7372 (0.2020) P=0.000
D3	0.4862 (0.1933) P=0.012
D4	0.7876 (0.2002) P=0.000
-2* Log Likelihood	1,231.1486
Chi-squared	150.29 P=0.000
Number of observations	1,387

^a Standard errors are reported in parenthesis. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Table G-2
Estimated Logistic Regression Model Parameters for the Marketing Area Sample to
Predict Support for a Change in Dam Operations at Zero Cost^a

Variable	Parameters
constant	-0.1424 (0.3289) P=0.665
factor1	-0.3630 (0.0793) P=0.000
factor2	0.4604 (0.0860) P=0.000
school	0.2460 (0.0779) P=0.002
income	0.00001 (0.000004) P=0.003
D6	0.5774 (0.2040) P=0.005
D7	0.6114 (0.1995) P=0.002
-2* Log Likelihood	936.8278
Chi-squared	97.97 P=0.000
Number of observations	1,143

^a Standard errors are reported in parenthesis. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Table G-3
Definition of Variables Used in Models to Predict Support
of a Change in Dam Operations

Variable	Definition
constant	constant = 1
factor1	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 12 (nep scale), items 1,3,5,8, and 10. Labeled "Impacts of human intervention on nature." Expected sign: -
factor2	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 13 (economic/environmental issues), items 1,3,4, and 6. Labeled "Economic security." Expected sign: +
factor4	Factor score created from combined mail and telephone survey data. Heavy loading items include: question 12 (nep scale), items 2 and 9. Labeled "Human ingenuity will ensure balance." Expected sign: +
school	Question 26 in the mail survey and question 17 in the telephone survey. Respondent education, coded in categories where 1 = eight years or less and 6 = post graduate work.
income	Question 30 in the mail survey and question 19 in the telephone survey. House hold income. Recoded from categories to midpoint values.
D2	Dummy variable for national survey version. 1 = low fluctuating flow (Version 2), 0 = other
D3	Dummy variable for national survey version 1 = seasonally adjusted steady flow (Version 3), 0 = other
D4	Dummy variable for national survey version. 1 = seasonally adjusted steady flow with moderate flow price impacts (Version 4), 0 = other
D6	Dummy variable for marketing survey version. 1 = low fluctuating flow (Version 6), 0 = other
D7	Dummy variable for marketing survey version. 1 = seasonally adjusted steady flow (Version 7), 0 = other

Table G-4
Average Values of Independent Variables Used to Estimate Nonrespondent Support for
a Change in Dam Operations at Zero Cost^a

Variable	National Sample	Marketing Area Sample
factor1	-0.311 (208)	-0.162 (173)
factor2	-0.587 (208)	-0.531 (173)
factor4	-0.171 (208)	-- ^b --
school	3.811 (243)	3.932 (191)
income	\$41,797 (217)	\$36,918 (176)

^a Average values are reported for the data collected from the telephone survey of non-respondents.

^b Factor 4 was not included in this model.

() Numbers in parenthesis indicate the number of valid cases.

Table G-5
Predicted Support for a Change in Dam Operations at Zero Cost
for Mail Survey Nonrespondents

Water Release Alternative	Percent Who Would Favor a Change
National Sample	
Moderate Fluctuating Flow	65%
Low Fluctuating Flow	79%
Seasonally Adjusted Steady Flow	75%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	80%
Marketing Area Sample	
Moderate Fluctuating Flow	75%
Low Fluctuating Flow	84%
Seasonally Adjusted Steady Flow	85%

APPENDIX H
ADDITIONAL ANALYSES

The information presented in Chapter 5 represents what were considered to be the most important findings from the analysis performed. Additional analyses were performed to address issues raised by GCES Non-Use Value Committee members and by the peer reviewers. These issues include estimating econometric models using interaction terms, using the Turnbull estimation technique to calculate willingness-to-pay, and examining the data for outliers and influential data points. Each of these issues is addressed in this appendix.

H.1 MODELS WITH INTERACTION TERMS

Two sets of models were estimated to address concerns regarding possible interactions between key variables used in the logistic regression models reported in Chapter 5 (Tables 5-19 and 5-20). The two variables of concern are the "belief" variable (belief that taxes, taxincrease, or utility bills, utilityincrease, would increase with passage of the proposal) and the dollar amount used in the contingent valuation (CV) question. These additional models are discussed in order below.

H.1.1 Belief that Respondents Would Pay if the Proposal Passed

After completing the valuation question, survey respondents were asked if they believed they would experience higher taxes (in the national sample) or higher utility bills (in the marketing area sample) if the proposal they voted on actually passed. In the national sample, logistic regression models indicated that, all else equal, respondents who did not believe their taxes would increase were more likely to vote in favor of the proposal. A similar effect was observed in one of the market area logistic regressions. The analysis reported in Chapter 5 adjusted for this effect by evaluating models with this variable set at a level that indicated respondents believed they would have to pay if the proposal passed.

Concern was expressed during the review process about this adjustment. If significant interactions existed between respondents' belief they would have to pay and other factors in the logistic regression, the adjustment discussed above would not be appropriate. To assess this issue, logistic regression models were estimated in which the set of explanatory variables included variables to reflect interactions between each of the variables reported in Tables 5-19 and 5-20 and the belief that either taxes or utility bills would actually increase if the proposal passed. Interactive variables used in the national sample models were calculated by multiplying the variable "taxincrease" by each of the independent variables in the base model reported in Table 5-19. Interactive variables used in the market area sample models were calculated by multiplying the variable "utilityincrease" by each of the independent variables in the base model reported in Table 5-20. An interactive model was not estimated for the

“Definitely Yes” model in the marketing area, because “utilityincrease” was not a significant predictor in that model. Results are reported in Tables H-1 and H-2.

Table H-1
Estimated Logistic Regression Model Parameters for the
National Sample with Interactive Variables^a

Variable	Definitely Yes Model	Definitely / Probably Yes Model
constant	-4.6226 (1.9339) P=0.017	-1.4923 (1.2476) P=0.232
score	3.0848 (1.9631) P=0.116	2.2465 (1.1581) P=0.052
taxincrease	0.62167 (2.2330) P=0.781	-1.8647 (1.5209) P=0.220
userresults	.b - -	0.0061 (0.2791) P=0.983
futuregc	0.0579 (0.1540) P=0.707	0.1127 (0.1381) P=0.414
factor1	-0.2653 (0.2047) P=0.195	-0.4143 (0.1673) P=0.013
factor2	0.7097 (0.1912) P=0.000	0.4405 (0.1622) P=0.007
factor3	-0.2336 (0.1573) P=0.137	-0.0619 (0.1384) P=0.655
factor4	0.1752 (0.1710) P=0.305	- - -

(continued)

Table H-1
Estimated Logistic Regression Model Parameters for the
National Sample with Interactive Variables (*Continued*)

Variable	Definitely Yes Model	Definitely / Probably Yes Model
school	0.1277 (0.1381) P=0.355	- - -
income	- - -	0.00001 (0.000005) P=0.031
D2	0.3047 0.4235 P=0.472	-0.3686 (0.3968) P=0.353
D3	-0.3210 (0.4450) P=0.471	-0.2828 (0.3910) P=0.480
D4	0.2635 (0.4271) P=0.537	0.0429 (0.4081) P=0.916
annbid1	-0.0086 (0.0025) P=0.001	-0.0107 (0.0021) P=0.000
scoreint	-2.2844 (2.2502) P=0.310	0.4944 (1.4327) P=0.730
userresultsint	- - -	0.3215 (0.3286) P=0.328
futuregcint	0.1855 (0.1977) P=0.348	0.0646 (0.1664) P=0.698
factor1int	-0.0487 (0.2430) P=0.841	0.0744 (0.1928) P=0.700
factor2int	-0.0146 (0.2379) P=0.951	0.0791 (0.1918) P=0.680
factor3int	0.0979 (0.1932) P=0.612	-0.0731 (0.1650) P=0.658

(continued)

Table H-1
Estimated Logistic Regression Model Parameters for the
National Sample with Interactive Variables (*Continued*)

Variable	Definitely Yes Model	Definitely / Probably Yes Model
factor4int	0.0310 (0.2078) P=0.881	- - -
schoolint	0.0950 (0.1720) P=0.581	- - -
incomeint	- - -	0.000004 (0.000006) P=0.482
D2int	-0.1222 (0.5276) P=0.817	0.9501 (0.4639) P=0.041
D3int	0.9748 (0.5375) P=0.070	0.6954 (0.4662) P=0.136
D4int	0.2688 (0.5219) P=0.607	0.4406 (0.4709) P=0.349
annbid1int	-0.0024 (0.0031) P=0.435	-0.0006 (0.0025) P=0.801
-2 * Log likelihood	910.7486	1196.2988
Chi-squared	8.8595 P=0.635	7.1703 P=
Number of observations	1,094	1,039

- ^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.
- ^b Dashes indicate that the variable was not included in the model.

Table H-2
Estimated Logistic Regression Model Parameters for the
Marketing Area Sample with Interactive Variables^a

Variable	Definitely / Probably Yes Model
constant	-0.9827 (2.3372) P=0.674
score	0.4351 (2.0874) P=0.835
utilityincrease	-2.4375 (2.5014) P=0.330
userresults	-0.2365 (0.4618) P=0.609
futuregc	0.9234 (0.2807) P=0.001
factor1	-0.2813 (0.2396) P=0.240
factor2	0.4294 (0.2656) P=0.106
factor3	-0.4721 (0.2183) P=0.031
factor4	0.2600 (0.2302) P=0.259
D6	0.9154 (0.5523) P=0.097
D7	1.1136 (0.5441) P=0.041
annbid1	-0.0218 (0.0040) P=0.000
scoreint	1.6668 (2.2464) P=0.458

(continued)

Table H-2
Estimated Logistic Regression Model Parameters for the
Marketing Area Sample with Interactive Variables (*Continued*)

Variable	Definitely / Probably Yes Model
userresultsint	0.9750 (0.4951) P=0.049
futuregcint	-0.4386 (0.2985) P=0.142
factor1int	-0.0862 (0.2579) P=0.738
factor2int	0.1944 (0.2831) P=0.492
factor3int	0.1793 (0.2345) P=0.444
factor4int	-0.1013 (0.2506) P=0.686
D6int	-0.5094 (0.5945) P=0.392
D7int	-0.8915 (0.5827) P=0.126
annbid1int	0.0064 (0.0043) P=0.132
-2 * Log likelihood	950.0402
Chi-squared	12.2052 P=0.212
Number of observations	948

^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Like the models reported in Chapter 5, the models reported in Tables H-1 and H-2 estimate the probability that a respondent would vote in favor of a proposal, as a function of several explanatory variables. Explanatory variables include those originally included in the base models reported in Chapter 5, plus a set of interactive variables. Interactive variables are identified by the "int" extension to the variable names. A statistical test of the joint significance of the interaction terms was carried out using a log-likelihood ratio test. This test statistic, which has a chi-square distribution, is used to test the hypothesis that the interaction variables significantly improved the fit of the model. The chi-squared statistics reported Tables H-1 and H-2 are the test statistics for the hypothesis that the interaction terms represent a significant improvement relative to the appropriate base model as reported in Chapter 5. The values of the test do not allow rejection of the hypothesis that the interaction terms jointly improve the fit of the model.

H.1.2 Interaction Models Allowing Shifts in Coefficient on the Dollar Amount

The analysis reported in Chapter 5 constructs estimates of willingness-to-pay by evaluating logistic regression models at average values and setting the dummy variables that reflect each alternative (D2 through D7) at the appropriate level. This procedure allows only for a shift in the constant term. Some concern was expressed during the review process that significant interactions could exist between the dummy variable reflecting the alternative and the dollar amount. Thus, additional models explored the significance of interaction variables that allowed for changes in the coefficient on the dollar amount used in the CV question depending on the scenario being evaluated. To do this, interactive variables were created by multiplying the dollar amount (variable "annbid1") by the dummy variables identifying alternative survey versions (D2, D3, and D4 for the national sample, and D6 and D7 for the marketing area). Again, the analysis presented here is based on the models reported in Chapter 5 -- the "base" models; interactive variables are identified by the "int" extension. Results are reported in Tables H-3 and H-4 for the national sample and marketing area sample "Definitely Yes" models, respectively. The chi-squared statistic at the bottom of each table tests the joint significance of the interaction terms. The reported test statistics do not allow rejection of the hypothesis that the interaction terms significantly increase the explanatory power of the logistic regression models.

Table H-3
Estimated Logistic Regression Model Parameters for the
National Sample with Slope Interaction Variables^a

Variable	Definitely Yes Model
constant	-3.4912 (1.0393) P=0.001
score	1.5099 (0.9553) P=0.114
taxincrease	-0.3829 (0.1765) P=0.030
futuregc	0.1769 (0.0950) P=0.063
factor1	-0.2996 (0.1096) P=0.006
factor2	0.6955 (0.1128) P=0.000
factor3	-0.1501 (0.0903) P=0.097
factor4	0.1871 (0.0968) P=0.053
school	0.1998 (0.0818) P=0.015
D2	0.1104 (0.3739) P=0.768
D3	0.5241 (0.3686) P=0.155
D4	0.2567 (0.3616) P=0.478

(continued)

Table H-3
Estimated Logistic Regression Model Parameters for
the National Sample with Slope Interaction Variables ^a (Continued)

Variable	Definitely Yes Model
ambid1	-0.0108 (0.0033) P=0.001
D2bid	0.0019 (0.0043) P=0.657
D3bid	-0.0034 (0.0047) P=0.464
D4bid	0.0031 (0.0042) P=0.460
-2* Log likelihood	916.854
Chi Squared	2.7541 P=0.431
Number of observations	1,094

^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

Table H-4
Estimated Logistic Regression Model Parameters for
the Marketing Area Sample with Slope Interaction Variables^a

Variable	Definitely Yes Model
constant	-4.2050 (1.0169) P=0.000
score	1.3759 (0.9247) P=0.137
userresults	0.6834 (0.1922) P=0.000

(continued)

Table H-4
Estimated Logistic Regression Model Parameters for
the Marketing Area Sample with Slope Interaction Variables ^a (Continued)

Variable	Definitely Yes Model
futuregc	0.2574 (0.1212) P=0.034
factor1	-0.5599 (0.1146) P=0.000
factor2	0.5227 (0.1081) P=0.000
factor3	-0.2862 (0.0889) P=0.001
factor4	0.3946 (0.1038) P=0.000
income	0.000009 (0.000004) P=0.031
D6	0.1086 (0.3376) P=0.748
D7	0.3847 (0.3252) P=0.237
annbid1	-0.0135 (0.0030) P=0.000
D6bid	-0.0052 (0.0045) P=0.248
D7bid	-0.0032 (0.0040) P=0.422
-2* Log likelihood	764.457
Chi-Squared	1.3977 P=0.497
Number of observations	908

^a Standard errors are reported in parentheses. Reported probabilities are associated with a 2-tailed test. Appropriate probabilities for a 1-tailed test are calculated by dividing reported probabilities by 2.

H.2 TURNBULL ESTIMATION OF WILLINGNESS-TO-PAY

Results presented in Chapter 5 were developed using a willingness-to-pay model estimated using logistic regression procedures. In recent years, several economists (Kristrom, 1990, Carson et al., 1994, and Haab and McConnell, 1995) have proposed modifications of nonparametric techniques traditionally used in the estimation of hazard functions as an alternative to logistic regression analysis. The process of using nonparametric methods to estimate a cumulative density function for willingness-to-pay is known as Turnbull estimation.

Several members of the peer review panel who were familiar with Turnbull nonparametric estimation suggested that it would be useful to explore whether the results reported in Chapter 5 would be changed if estimates of mean willingness-to-pay were constructed using the Turnbull technique. The Turnbull estimation technique offers several potential advantages to parametric techniques such as logistic regression. First, the Turnbull estimation technique does not require any assumptions about the functional form of the underlying distribution of willingness-to-pay. Second, estimates of average willingness-to-pay can be constructed from the Turnbull estimated cumulative density function in a way that provides lower bound estimates of willingness-to-pay. One drawback of this procedure is that it is only readily applied to univariate models, and is difficult to apply to multivariate models.

The next section provides an overview of the Turnbull estimation procedure. The following section compares estimates of average willingness-to-pay based on the Turnbull procedure to the estimates derived using logistic regression.

H.2.1 Overview of Turnbull Estimation Procedures

Discrete choice contingent valuation questions are questions in which survey respondents are asked if they would agree to some environmental intervention if the intervention would cost them a specified amount of money. All analysis of discrete choice contingent valuation data centers around the process of constructing estimates of the cumulative density function (cdf) for willingness-to-pay and then recovering estimates of mean willingness-to-pay from it. In a parametric analysis, a functional form is assumed for the cdf and the observed data are used to estimate the parameters of the assumed functional form. In nonparametric methods, no assumptions are made about the form of the underlying cdf. Instead, an empirical cdf is constructed using the observed proportion of "No" responses to each of the dollar amounts. For example, Turnbull estimation produces a step function that represents the estimated cdf.

The Turnbull method only requires that the estimated cdf satisfies a monotonicity assumption. This assumption simply reflects the fact that a cdf must be non-decreasing. In

the context of contingent valuation, the monotonicity requirement means that the proportion of "No" responses must not decrease as the amount of the bid increases. In any particular data set, however, this assumption may be violated. For example, suppose that the CV study design included a total of m distinct dollar amounts, (in this study m would be 8). For each dollar amount, B_i , the proportion of respondents indicating they would not support the intervention at that amount is represented as $P_i = Z_i/N_i$, where Z_i is the number of respondents indicating they would not support the intervention at a cost of B_i , and N_i represents the number of respondents asked about B_i . The monotonicity requirement requires that $P_i < P_{i+1}$. If this condition is not satisfied for a particular pair of bids, the two dollar amounts are grouped and compared to the next highest bid. For example, if $P_i > P_{i+1}$, the Turnbull estimator would combine the responses to B_i and B_{i+1} and then compare $(Z_i + Z_{i+1})/(N_i + N_{i+1})$ to Z_{i+2}/N_{i+2} . If $(Z_i + Z_{i+1})/(N_i + N_{i+1}) > Z_{i+2}/N_{i+2}$, the process is continued until a monotonic increasing step function is obtained. This step function is a discrete approximation to the underlying cdf for willingness-to-pay. Estimates of mean willingness-to-pay can be constructed from the step function by recalling that for a discrete random variable, the expected value is simply the sum of the products of the possible values times the probability of the value. The Turnbull nonparametric lower bound estimate of mean willingness-to-pay is constructed by choosing the lower end of each step when constructing estimates of mean willingness-to-pay.

The Turnbull process can be illustrated using a simple example. Suppose that the experimental design for a contingent valuation study consisted of three dollar amounts \$5, \$10, and \$15 and that 10 percent of respondents voted "No" to \$5, 50 percent voted "No" to \$10, and 80 percent voted "No" at \$15. The three probabilities 0.1, 0.5, and 0.8 would provide estimates of the height of the step function approximation of the underlying cdf for willingness-to-pay.

A respondent is expected to vote "No" if their actual willingness-to-pay is less than the dollar amount they were asked about: since 10 percent of respondents voted "No" at \$5, it could be estimated that 10 percent of the population had a willingness-to-pay of less than \$5. Likewise, since 50 percent of respondents voted "No" at \$10, it could also be inferred that 50 percent of the population had a willingness-to-pay of less than \$10. These two facts allow us to estimate that 40 percent of the population had willingness-to-pay greater than \$5 but less than \$10. Following this logic, one can estimate the probability that willingness-to-pay falls within four distinct intervals: \$0 to \$5, \$5 to \$10, \$10 to \$15, and above \$15 (Table H-5).

Given that the expected value of a discrete random variable can be written as the sum of the products of each possible outcome times the probability of the outcome, the results in Table H-5 can be used to calculate an estimate of mean willingness-to-pay. Table H-5 shows the four possible outcomes and the probabilities associated with each. Construction of an expected value requires picking a value of the discrete random variables for each of the four possible outcomes. In constructing a Turnbull lower bound estimate of mean willingness-to-

pay, the probability associated with each interval is multiplied by the dollar value associated with the *lower* end of the interval. For example, Table H-5 shows 10 percent of willingness-to-pay estimates fall between \$0 and \$5. The Turnbull lower bound estimate assumes that all values in this step less than \$5 are equal to zero (\$0). Following this rule, the estimated mean willingness-to-pay would be $\$0 \cdot 0.1 + \$5 \cdot 0.4 + \$10 \cdot 0.3 + \$15 \cdot 0.2 = \$8$.

Table H-5
Illustration of Nonparametric Estimation Techniques

Raw Data	
Dollar Amount	Percent Voted No
\$5	10%
\$10	50%
\$15	80%
Inferred Probability of Willingness-to-Pay: Probability	
less than \$5	.10
less than \$10	.50
less than \$15	.80
Inferred Probability of Willingness-to-Pay Falling Between: Probability	
\$0 to \$5	.10
\$5 to \$10	.40
\$10 to \$15	.30
Greater than \$15	.20

H.2.2 Application to GCES Non-Use Value Final Study Data

The Turnbull procedure was applied to the observations used to develop the logistic regression models reported in Chapter 5. However, as noted above, the Turnbull procedure is not easily extended to permit a multivariate analysis. As a result, Turnbull nonparametric lower bound estimates of mean willingness-to-pay were calculated on a version-by-version basis. Furthermore, the Turnbull estimates can not be easily adjusted to reflect potential differences in characteristics of respondents to each version or belief that the respondent would really have to pay. Consequently, the Turnbull estimates can not be directly compared to the estimated mean willingness-to-pay reported in Chapter 5.

To provide a comparable set of estimates, the logistic models reported in Chapter 5 were used to produce an alternate set of mean willingness-to-pay estimates. For each survey version, mean willingness-to-pay was re-calculated from the logistic regression model by inserting average values of survey respondents to that version for all variables. Turnbull lower bound estimates and the alternate set of parametric estimates for the "Definitely Yes" models are presented in Table H-6. In the national sample, the Turnbull estimates tend to be less than the parametric estimates. In the marketing area sample, the Turnbull estimates are higher than the parametric estimates for two of the three versions. Differences between the Turnbull estimates and the parametric estimates would be unlikely to substantially alter the results presented in the body of the report.

Table H-6
Comparison of Turnbull Lower Bound and Parametric Estimates of Willingness-to-Pay

	Turnbull mean ^a	Sample size	Parametric mean ^b
National Sample			
Version 1	\$24.08	246	\$27.15
Version 2	\$31.85	282	\$33.49
Version 3	\$26.04	273	\$34.22
Version 4	\$34.14	293	\$37.75
Marketing Area Sample			
Version 5	\$33.37	282	\$31.48
Version 6	\$31.65	297	\$27.86
Version 7	\$33.02	329	\$34.97

^a The data set used to carry out the Turnbull analysis consisted of the same observations used to construct the logistic regression models reported in Tables 5-19 and 5-20.

^b Parametric estimates were calculated using the models reported in Tables 5-19 and 5-20. All variables were set equal to the average value observed for respondents to that version.

H.3 INFLUENTIAL DATA POINTS

The presence of influential data points was explored by examining the effect that the removal of each observation would have on the parameters of the "Definitely Yes" models reported in Tables 5-19 and 5-20. Three decision rules were followed to identify influential observations. Under the first decision rule, observations were identified as influential if deletion of the observation resulted in a change of 30 percent or more in any estimated parameter. Under this first decision rule, no observations in either the national or marketing areas samples were identified as influential. Under the second rule, observations were defined as influential if deletion of the observation changed any model parameter by more than 20 percent. A total of four observations were identified under this rule, two in the national sample and two in the marketing area sample. All four observations were identified because deletion of the observation would have resulted in a change of more than 20 percent in the value of the parameter associated with the quiz score. Deletion of any of these

increased the value of the parameter associated with the quiz score variable. Consequently, deletion of these observations would have resulted in slightly higher estimates of mean willingness-to-pay. Finally, under the third rule, observations were determined to be influential if deletion of the observation would change any parameter value by 10 percent or more. This third rule identified 45 observations in the national sample and 61 observations in the marketing area sample. The relatively large number of observations identified under this rule (4 percent of the national sample data, and 7 percent of the marketing area data) and the relatively small impact any one of these observations would have on parameters, raised concern about using a 10 percent criteria to identify influential observations. The results of this analysis suggest to us that the logistic regression parameters reported in Chapter 5 are not dramatically affected by the presence of a small number of highly influential data points.

H.4 TRENDS IN PERCENTAGE OF "YES" VOTES IN DEFINITELY YES MODELS

An identical set of dollar amounts was used in the contingent valuation questions for each of the seven survey versions implemented. While respondents in the national sample evaluated four alternatives and respondents in the marketing area sample evaluated three alternatives, it was expected that the overall percentage of "Yes" responses would decrease with increases in the dollar amount that would have to be paid if the proposal passed. This expected relationship is generally exhibited over the range from \$5 to \$120 (Table H-7). An apparent anomaly to this pattern is observed in both the national and marketing area sample for the dollar amounts of \$150 and \$200. Disaggregation by the gender of the respondent reveals that this anomaly is very striking for females. For male respondents in the national sample, the percentage of "Yes" responses decreases from 43.2 percent at \$5 to 27.5 percent at \$30 and then remains in the 12 to 15 percent range for the remaining dollar amounts. For female respondents in the national sample, the percentage of "Yes" responses decreases from 33.9 percent at \$5 to 13.1 percent at \$120, drops to 1.4 percent at \$150 and then increases to 13.5 percent at \$200. A very similar pattern is observed in the marketing area. Given prior expectations, it seems clear that the percentage of "Yes" responses by female respondents at either \$150 or \$200 dollars presents an anomaly. If the response at \$120 is accepted as valid, then the percent of females voting "Yes" at \$200 appears too high. On the other hand, if the response at \$200 is accepted as valid, then the percentage of females voting "Yes" at \$150 appears to be too low.

In an attempt to further examine this anomaly, data from female respondents was disaggregated by survey version (Table H-8). When disaggregated to this level, sample sizes per dollar amount are very small (10 to 15 observations per dollar amount per version), however, the relative lack of "Yes" responses at \$150 is still quite noticeable.

In the absence of further data it is difficult, if not impossible, to determine whether the response, the \$150 amount, or the \$200 amount represents the anomaly.

Table H-7
Overall Percentage "Yes" in Definitely Yes Models^a

Dollar Amount	National Sample			Marketing Area Sample		
	Overall	Males	Females	Overall	Males	Females
\$5	39.1%	43.2%	33.9%	50.8%	45.8%	58.0%
\$15	30.2	31.8	27.5	37.3	34.4	40.7
\$30	24.1	27.5	21.1	25.7	31.1	14.3
\$60	15.3	12.5	18.5	22.3	26.2	17.6
\$90	13.3	13.5	13.0	17.1	15.2	20.0
\$120	14.5	15.5	13.1	12.6	9.4	17.0
\$150	6.3	11.4	1.4	5.4	8.3	1.9
\$200	12.9	12.5	13.5	9.7	4.7	16.3
	(1,094)	(611)	(483)	(908)	(525)	(383)

^a The percentage of "Yes" responses is aggregated across all versions in the national sample and across all versions in the marketing area sample to illustrate the general trend of "Yes" and "No" responses.
() Number in parentheses indicate the number of valid cases.

Table H-8
Percentage of “Yes” Votes in Definitely Yes Models,
Female Respondents Disaggregated by Survey Version

Dollar Amount	Version 1	Version 2	Version 3	Version 4	Version 5	Version 6	Version 7
\$5	31.3%	21.4%	46.2%	37.5%	58.3%	66.7%	50.0%
\$15	15.4	27.3	35.7	30.8	50.0	41.2	31.6
\$30	36.8	18.2	15.0	13.3	10.0	16.7	15.4
\$60	16.7	29.4	17.6	10.5	15.0	17.6	21.4
\$90	14.3	9.1	8.3	22.2	16.7	33.3	11.1
\$120	7.1	33.3	7.1	5.6	21.4	17.6	12.5
\$150	0.0	0.0	5.9	0.0	5.6	0.0	0.0
\$200	0.0	15.0	27.3	11.1	13.3	6.7	26.3
	(113)	(128)	(118)	(124)	(119)	(123)	(141)

() Number in parentheses indicates number of valid cases.

APPENDIX I
SENSITIVITY ANALYSIS

The results presented in Chapter 5 represent point estimates of average willingness-to-pay for alternative dam operations. These point estimates are subject to several sources of variability. Statistical variability arises from the procedure used to estimate the parameters reported in Tables 5-19 and 5-20. Statistical uncertainty about these parameters results in statistical uncertainty about the estimates of mean willingness-to-pay. This, in turn, is reflected in the range of value estimates reported in Tables 5-31 and 5-32.

A second source of uncertainty arises from the assumptions that were used in the calculation of population average willingness-to-pay. Changes in assumptions would result in changes in estimated willingness-to-pay. This appendix presents the results of sensitivity analyses performed to determine how estimates of willingness-to-pay would change as a result of changes in the key assumptions on which the results in Chapter 5 are based. Each of the following sections examines a key assumption and presents estimates of mean willingness-to-pay if that assumption were changed.

I.1 TREATMENT OF NONRESPONDENTS

The results in Chapter 5 are based on the assumption that at least some of the nonrespondents to the mail survey would have expressed positive values if they had completed and returned the mail survey. Values for nonrespondents were imputed by first estimating the *proportion* of nonrespondents that would have supported the proposal at zero cost. This was accomplished using the logistic regression model discussed in Appendix G. The logistic regression model reported in Tables 5-19 and 5-20 was then used to impute average willingness-to-pay values for the nonrespondents, by using data collected on nonrespondents during the telephone survey.

An alternative assumption would have been to assume that *all* nonrespondents to the mail survey had a zero value for changes in dam operations. Making this assumption decreases population-weighted average willingness-to-pay by about 20 percent for alternatives in the national sample, and by about 17 percent in the market area versions (Table I-1).

I.2 USE OF A "DEFINITELY YES" MODEL

Recent research suggests that data from respondents with a high degree of certainty in their contingent valuation responses may have a higher degree of criterion validity compared with data from less certain respondents. However, the use of discrete choice models based on polychotomous choice response categories (used in the final study) is not widespread. Results from the pilot test suggested that at least a portion of the respondents who voted yes in a dichotomous choice CV question would have chosen the "Probably Yes" response category if polychotomous response categories had been available. Furthermore, in the pilot test, WTP estimates calculated using a "Definitely or Probably Yes" model were substantially closer to

(but still lower than) results that were based on a standard dichotomous choice question (see Appendix C for a discussion of pilot test results). Therefore, it is likely that the valuation results based on the “Definitely Yes” models reported in Chapter 5 are substantially lower than the results that would have been obtained if the study had used a more traditional dichotomous choice format categories for the contingent valuation question.

An indication of the possible magnitude the consequence of using polychotomous response categories and basing the results on a “Definitely Yes” model is obtained by comparing the results of the “Definitely Yes” models to the results obtained from the “Definitely/Probably Yes” models (Table I-2). In the national sample, use of a “Definitely/Probably Yes” model increases the estimates of mean willingness-to-pay by 300 percent to 400 percent depending on the alternative evaluated. In the marketing area sample, use of a “Definitely/Probably Yes” model increases mean willingness-to-pay by about 200 percent for the moderate fluctuating and seasonally adjusted steady flow alternatives and about 350 percent for the low fluctuating flow alternative. Given that the “Definitely/Probably Yes” model produced values lower than the dichotomous choice model estimated in the pilot test (pilot test survey Version 7), the results reported in Table I-2 are likely to underestimate the actual impact of having used a “Definitely Yes” model as opposed to a traditional, dichotomous choice model.

I.3 TREATMENT OF OUT-OF-SCOPE SAMPLE POINTS

Some concerns were expressed about the procedures used for calculating population average willingness-to-pay. Recall that survey response rates were calculated as a percentage of deliverable questionnaires. This method of calculation effectively reduces the total valid sample size used to calculate the response rate, by subtracting cases classified as “out-of-scope.” Sample points categorized as out-of-scope represent cases for which the respondent could not be reached at the listed address. Examples of out-of-scope sample points include sample points for which:

- ▶ Surveys are returned with an indication that the respondent had moved and no forwarding address was available;
- ▶ Surveys returned with an indication that no such address existed; and
- ▶ Surveys returned with an indication that the recipient had died.

Thus, response rates reflect the percent of survey respondents (those who return completed questionnaires) and nonrespondents (those for whom we had no indication that the address was invalid but had not returned a questionnaires). These two percentages sum to 100 percent. When population average willingness-to-pay estimates were calculated, the weights were calculated so the survey data represented the proportion of these two groups in the sample. (See Tables 5-25 and 5-26 for the “Definitely Yes” models, and Tables 5-27 and 5-

28 for the “Definitely/Probably Yes” models in Section 5.9). This procedure is equivalent to the assumption that the respondents and nonrespondents to the mail survey present an accurate representation of the out-of-scope sample points. This treatment seems to be a rather standard practice in contingent valuation studies. However, some members of the GCES Non-Use Value Committee suggested that out-of-scope sample points might systematically differ from the mail and telephone survey respondents. To assess the potential magnitude of this issue, population-weighted average willingness-to-pay was calculated under the alternative assumption that all out-of-scope sample points had a willingness-to-pay of zero (Table I-3). Under this assumption, population-weighted average willingness-to-pay decreased by 22 to 23 percent in the national sample, and by 23 to 27 percent in the marketing area sample, depending on the survey version.

Table I-1
 Percent Change in Mean Willingness-to-Pay between Definitely Yes Models with Values Imputed for Nonrespondents and
 Models with Zero Values Assumed for Nonrespondents

	Values Imputed for Nonrespondents	Zero Values Assumed for Nonrespondents	Percent Change from Base
National Sample			
Moderate Fluctuating Flow	\$13.65	\$10.95	-19.78%
Low Fluctuating Flow	\$20.15	\$16.26	-19.30%
Seasonally Adjusted Steady Flow	\$20.55	\$16.60	-19.22%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	\$23.79	\$18.83	-20.85%
Market Area Sample			
Moderate Fluctuating Flow	\$22.06	\$18.24	-17.27%
Low Fluctuating Flow	\$21.45	\$17.90	-16.41%
Seasonally Adjusted Steady Flow	\$28.87	\$24.04	-16.73%

Table I-2
 Percent Change in Mean Willingness-to-Pay between Definitely Yes and
 Definitely/Probably Yes Models with Values Imputed for Nonrespondents

	Definitely Yes	Definitely/ Probably Yes	Percent Change from Base
National Sample			
Moderate Fluctuating Flow	\$13.65	\$67.56	+394.94%
Low Fluctuating Flow	\$20.15	\$97.33	+383.03%
Seasonally Adjusted Steady Flow	\$20.55	\$86.18	+319.37%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	\$23.79	\$98.77	+315.17%
Market Area Sample			
Moderate Fluctuating Flow	\$22.06	\$69.49	+215.00%
Low Fluctuating Flow	\$21.45	\$98.29	+358.23%
Seasonally Adjusted Steady Flow	\$28.87	\$90.91	+214.89%

Table I-3
 Percent Change in Mean Willingness-to-Pay between Definitely Yes Models with Values Imputed for Nonrespondents and Models with Zero Values Assumed for Out-of-Scope Sample Points

	Values Imputed for Nonrespondents	Zero Values Assumed for Out-of-Scope	Percent Change from Base
National Sample			
Moderate Fluctuating Flow	\$13.65	\$10.63	-22.12%
Low Fluctuating Flow	\$20.15	\$15.36	-23.77%
Seasonally Adjusted Steady Flow	\$20.55	\$15.81	-23.07%
Seasonally Adjusted Steady Flow with Moderate Flow Price Impacts	\$23.79	\$18.47	-22.36%
Market Area Sample			
Moderate Fluctuating Flow	\$22.06	\$16.37	-25.79%
Low Fluctuating Flow	\$21.45	\$15.75	-26.57%
Seasonally Adjusted Steady Flow	\$28.87	\$22.08	-23.52%

REFERENCES

- Bishop, R.C. and D.W. McCollum. 1995. "Assessing the Content Validity of Contingent Valuation Studies." Presented at W-133, Benefits and Costs Transfer in Natural Resource Planning. Monterey, CA, March 13, 1995.
- Bishop, R.C., P.A. Champ, T.C. Brown, and D.W. McCollum. "Measuring Non-Use Values: Theory and Empirical Applications." Proceedings from the Conference on Determining the Value of Non-Market Goods: Economics, Psychological, and Policy Relevant Aspects of Contingent Valuation Methods, Werner Rieners Stiftung, Bad Hamburg, Germany. (July 1994).
- Bishop, R.C. and M.P. Welsh. 1992. "Strategy for Estimating Total Value: A Case Study Involving Grand Canyon Resources." In R.B. Rettig, compiler. *W-133, Benefits and Costs in Natural Resource Planning: Fifth Interim Report*. Corvallis: Oregon State University, Department of Agricultural and Resource Economics.
- Bishop, R.C., M.P. Welsh, and T.A. Heberlein. 1991. *Assessing the Potential for a Total Valuation Study of Colorado River Resources*. Glen Canyon Environmental Studies. Final Report. July 10, 1991.
- Bishop, R.C., K.J. Boyle, M.P. Welsh, R.M. Baumgartner, and P.C. Rathbun. 1987. *Glen Canyon Dam Releases and Downstream Recreation: An Analysis of User Preferences and Economic Values*. Glen Canyon Environmental Studies Report No. 27/87. Springfield, VA: National Technical Information Service (PB88-183546/AS).
- Bohrstedt, G.W. 1983. "Measurement." In *Handbook of Survey Research*. Eds. P.H. Rossi, J.D. Wright, and A.B. Anderson. New York: Academic Press, Inc.
- Carson, R.T., N.E. Flores, K.M. Martin, and J.L. Wright. Forthcoming. Contingent Valuation and Revealed Preference Methodologies Comparing the Estimates for Quasi-Public Goods. (An earlier version of this paper was presented at the Annual U.S. Department of Agriculture W-133 Meeting on Benefits and Costs in Natural Resources Planning, Tuscon, Arizona.)
- Carson, R.T., W.M. Hanemann, R.J. Kopp, J. A. Krosnick, R.C. Mitchell, S. Presser, P.A. Ruud, and V.K. Smith. 1994. "Prospective Interim Lost Use Value Due to DDT and PCB Contamination in the Southern California Bight." NOAA contract no. -DGNC-1-00007.
- Champ, P.A., R.C. Bishop, T.C. Brown, and D.W. McCollum. 1995. "A Comparison of Contingent Values and Actual Willingness to Pay Using a Donation Provision Mechanism with Implications for Calibration." U.S.D.A. Forest Service, Fort Collins, CO. Manuscript.

- Champ, P.A. 1994. *Nonmarket Valuation of Natural Resource Amenities: A Validity Test of the Contingent Valuation Method*. Dissertation, Department of Agricultural Economics, University of Wisconsin-Madison.
- Diamond, P., J.A. Hausman, G. Leonard, and M. Denning, 1993. "Does Contingent Valuation Measure Preferences? Experimental Evidence." *In Contingent Valuation: A Critical Assessment*. J.A. Hausman, editor. Amsterdam; New York: North Holland.
- Dillman, D.A. 1978. *Mail and Telephone Surveys - The Total Design Method*. (New York, Wiley).
- Energy Information Administration. 1991. *Electric Sales and Revenue*. Office of Coal, Nuclear, Electric, and Alternative Fuels. U.S. Department of Energy. Washington, D.C. Tables 5 and 8.
- Fischhoff, B. and L. Furby. 1988. "Measuring Values: A Conceptual Framework for Interpreting Transactions with Specific Reference to Contingent Valuation of Visibility." *Journal of Risk and Uncertainty*. 1:147-184.
- Freeman III, M. 1993. *The Measurement of Environmental and Resource Values*. (Washington, D.C.: Resources for the Future).
- Glen Canyon Environmental Studies Power Resources Committee. 1995. *Power System Impacts of Potential Changes in Glen Canyon Power Plant Operations. Phase III Final Report*. Prepared by the Glen Canyon Environmental Studies Power Resources Committee. July.
- Haab, T.C. and K.E. McConnell. 1995. "Referendum Models and Negative Willingness to Pay: Alternative Solutions." Department of Agricultural and Resource Economics. University of Maryland, College Park, MD. Manuscript.
- Hanemann, W. Michael. 1994. "Valuing the Environment Through Contingent Valuation." *Journal of Economic Perspectives* 8(4):19-44.
- Hausman, Jerry A., Ed. *Contingent Valuation: An Assessment*. Amsterdam: North-Holland Publishing. 1993.
- Hoehn, J. P. and A. Randall. 1987. "A Satisfactory Benefit Cost Indicator from Contingent Valuation." *Journal of Environmental Economics and Management*. 14(3):226-247.

- Krinsky, I. and A.L. Robb. 1986. "On Approximating the Statistical Properties of Elasticities". *Review of Economics and Statistics*. 16(11):715-719.
- Kristrom B. 1990. "A Non-Parametric Approach to the Estimation of Welfare Measures in Discrete Response Valuation Studies." *Land Economics*. 66:135-139
- Krutilla, J.V. 1967. "Conservation Reconsidered." *American Economic Review*. 57:787-796.
- McFadden, D. 1994. "Contingent Valuation and Social Choice." *American Journal of Agricultural Economics*. 76:689-708.
- Mitchell, R.C. and R.T. Carson. 1989. *Using Surveys to Value Public Goods, The Contingent Valuation Method*. (Resources for the Future, Washington, D.C.).
- Piekarski, L.B. 1989. "Choosing Between Directory Listed and Random Digit Sampling in Light of New Demographic Findings." Presented at AAPOR Conference. May 19, 1989.
- Samuelson, P. 1954. "The Pure Theory of Public Expenditure," *Review of Economics and Statistics*. 36:387-389.
- Smith, V. Kerry. 1993. "Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal." *Land Economics*. 69(1):1-26.
- Survey Sampling, Inc. 1992. SSI Information Sheet. Fairfield, CT.
- U.S. Bureau of Reclamation. 1995. *Operation of Glen Canyon Dam: Environmental Impact Statement*. Denver, CO: Bureau of Reclamation, U.S. Department of the Interior.
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 1994. Natural Resource Damage Assessment Under the Oil Pollution Act of 1990. *Federal Register*. 59(5):1062-1191.
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 1993. Natural Resource Damage Assessments Under the Oil Pollution Act of 1990. *Federal Register*. 58(10):4601-4614.
- U.S. Department of the Interior. 1994. Natural Resource Damage Assessments: Final Rule. *Federal Register* 59(58):14262-14288.

~~RECORD~~ ~~FILE~~ ~~ARMS~~

1995 Report
PRJ-2.00
Recreation
Reports

Official File Copy	
File Code	(1995) 2
Project	PRJ 5.10 GCE
Folder I.D.	

Extra Copy

MEMORANDUM

To: GCES Non-Use Value Committee
 FROM: Mike Welsh ^{HPW}
 DATE: September 13, 1995
 SUBJECT: Final GCES Non-Use Value Report *Glen Canyon Environmental Studie*

I have enclosed a copy of the final report on the GCES Non-Use Value Study. I believe this final report reflects the agreements that were reached at the final GCES Non-Use Value Committee meeting in Phoenix.

I would like to thank each member of the committee for their efforts on this study. Your insights regarding survey materials and experimental design greatly enhanced the quality of this study. Please feel free to call me if you have any questions about the final report.

GLEN CANYON ENVIRONMENTAL STUDIES OFFICE

SEP 18 1995

RECEIVED
FLAGSTAFF, AZ

810.00
w771-3.00
G558
23566
23567

ecof771-fnl

-falsen

G2

RECEIVED	
SEP 15 1995	