INFORMATION COLLECTION REQUEST

EPA ICR No. 1914.01

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Valuing Inland Water Quality Improvements

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ATTACHMENTS

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1. Identification of the Information Collection

1(a) Title of the Information Collection

Valuing Inland Water Quality Improvements

1(b) Short Characterization (Abstract)

Researchers at Harvard and Duke Universities propose to develop economic benefit values for water quality improvements for lakes, rivers, and streams. These estimates are of substantial academic interest since past studies have been based on a water quality ladder, which is not a scientifically valid construct for assessing water quality. This project will explore how valuations are affected by use of the current EPA approach of specifying different dimensions of water quality such as swimming, fishing, and broader aquatic ecological effects. The findings will be pertinent to economists studying water quality changes, particularly with respect to the task of assessing benefit values for water quality policies.

We request approval from the Office of Management and Budget (OMB) to implement a computer assisted questionnaire. We will use data collected with the survey in determining the value of water quality improvements to households in the United States, to better understand the public's perceptions and attitudes about inland surface water quality, and to improve knowledge of water quality issues and survey methodology. We plan to recruit subjects randomly across the United States through telephone recruiting. Subjects will be asked to complete a computer survey from a disk, which will be mailed to them. Subjects without convenient access to a personal computer will be referred to a national commercial facility with computer access nearest their home for the purpose

of completing the survey. Subjects will return the survey disk by mail when completed. Participation in the survey is voluntary. We intend to administer the survey to 2,800 persons in a nationwide sample.

Data were collected in a pilot survey from households in North Carolina (Charlotte, Cary, and the Research Triangle Park areas) and Colorado (Denver and Colorado Springs areas). The survey established preliminary benefit values for improvements in water quality. These were calculated based on responses to paired comparisons involving water quality changes and cost-of-living levels for regions to which the respondent might move. Overall, 348 respondents averaged approximately a $20 value per unit increase in the water quality level. With a larger national sample, refinement of this calculation will be possible with respect to the regional and demographic differences of subjects.

The total national burden estimate for all parts of the questionnaire process is 3,150 hours. The burden estimates are based on administration of 2,800 questionnaires. The total respondent cost estimate is $41,517.

2. Need For and Use of the Collection

2(a) Need/Authority for the Collection

This project is being undertaken pursuant to Sections 104 and 105 of the Clean Water Act dealing with research. This research project is exploring how water quality valuations are affected by use of the current EPA approach of surveying lakes and streams for attainment of water quality levels and specifying different dimensions of water quality such as swimming, fishing, and broader aquatic ecological effects. Understanding how these levels of water quality, surveyed regularly and published in the EPA Water Quality Inventory, relate to the values of water quality held by the public will be useful in determining whether the benefits of government action to improve water quality or

to prevent water quality degradation are commensurate with the costs associated with such actions. Although the findings will be primarily of use to the research community and state and local regulatory agencies dealing with water quality, they are also expected to be useful to EPA in preparing improved estimates of the economic benefits of improved inland surface water quality as required under Executive Order 12866.

2(b) Practical Utility/Users of the Data

The findings of this project will be pertinent to economists and policy analysts studying water quality changes, particularly with respect to the task of assessing benefit values for water quality policies. These estimates are of substantial academic interest since past studies have been based on a water quality ladder, which is not a scientifically valid construct for assessing water quality, nor does it correspond with current government data collection methods. The methodology the researchers are developing should be useful to economists and regulators concerned with cost-benefit assessments. The innovative computer model they use will also be a benefit to future researchers undertaking surveys. Due to the innovative nature of the research, the researchers may need to incorporate information and make other adjustments to the survey instrument as a result of their proposed pre-testing to assure that the survey is as clear as possible to respondents and provides as accurate a measure of water quality benefits as possible.

3. Non-duplication, Consultations, and Other Collection Criteria

3(a) Non-duplication

There have been many surveys attempting to estimate values of various aspects of water quality preservation or improvement for various parts of the United States, but no previous work has determined values using both designated uses attainment goals and the measurement scheme used by the EPA's inventory of water quality attainment. Matching water quality values to the EPA's own

measurement methodology will better enable policy makers and academics to gauge the cost effectiveness of policies to improve water quality as well as allowing cost benefit analysis of aggregate water quality improvements on a year-by-year basis.

The most closely comparable study to what the survey authors propose is a survey by Mitchell and Carson (The Value of Clean Water: The Public's Willingness to Pay for Boatable, Fishable, and Swimmable Quality Water; *Water Resources Research*; July, 1993; pp2445-54), which estimates aggregate benefits of achieving swimmable water from a baseline of non-boatable water to be $29.2 billion per year (1990 dollars). Household willingness to pay is $280 per year (1983 dollars). However, this study's methodology can not be used with data available from the EPA which describes levels of water quality attainment and the improvements in water quality over time contained therein.

A study by Tay and McCarthy (Benefits of Improved Water Quality: A Discrete Choice Analysis of Freshwater Recreational Demands; *Environment and Planning A*; Oct. 1994; pp1625-38) estimate a per-trip welfare gain for a one percent reduction in all pollutants of 64.5 cents per trip (numbers from a 1985 study from Indiana). Again, this data is not useful in conjunction with available data on actual quality levels.

Other studies available have this same problem and are often done for a limited geographical area or a specific water body which impair their ability to be generalized to nationwide or even statewide effects, which again, is how government data is presented in the EPA's semi-annual Water Quality Inventory.

3(b) Public Notice Required Prior to ICR Submission to OMB

In accordance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq*.), EPA published a notice in the *Federal Register* on November 12, 1999 announcing that the water quality survey questionnaire was available for public comment. A copy of the *Federal Register* notice is attached

at the end of this document.

The survey authors and EPA received more than ten requests for the survey after the *Federal Register* notice was published. In addition to a general comment praising the survey design, EPA received two sets of comments to the survey design. Those comments and our responses are attached at the end of this document.

3(c) Consultations

We have engaged in consultations with reviewers from both academia and the EPA, as well as input from subjects at several points in the process of constructing this survey. After developing the survey methodology and constructing the first version of the pilot survey instrument, walk through pre-tests were conducted with about ten subjects at a marketing firm in Research Triangle Park, NC. Input from these subjects as well as comments solicited from peer reviewers and the EPA were used to refine the questionnaire for the first major pre-test on 106 subjects in RTP. After further work on the questionnaire and assuring that the instrument produced useable data, the full pilot was conducted on a sample of 300 more subjects in Cary, NC; Charlotte NC; Denver, CO; and Colorado Springs, CO. Using this sample plus the 106 RTP subjects, the survey authors compiled the pilot report (attached at the end of this document). Reviews of this report were solicited from three external reviewers plus two other reviewers solicited by EPA. These reviews prompted another walk through pre-test with about 20 subjects in RTP and further changes to the survey instrument before pre-testing of the national survey.

The following table shows the reviewers solicited to review the pilot survey report.

Table A1. Reviewers

Reviewer	Organization	Telephone
Richard Bishop	University of Wisconsin	(608) 262-8966
Jon A. Krosnick	Ohio State University	(614) 292-3496
David Schkade	University of Texas	(512) 471-5297
Elizabeth McClelland, Nicole	OP/OEE/EED	

Owens, and Elizabeth David		
External Review Solicited by EPA	Anonymous	

3(d) Effects of Less Frequent Collection

The questionnaire is a one-time data collection activity. Therefore, completion of this section is not necessary.

3(e) General Guidelines

The questionnaire does not violate any of the general guidelines described in the ICR Handbook.

3(f) Confidentiality

Personal identifying information is not recorded with survey data. Once a subject has completed the survey, it is not possible to link response data with information such as name or address. Thus confidentiality of subjects who agree to take the survey is assured.

3(g) Sensitive Questions

No sensitive questions pertaining to private or personal information, such as sexual behavior or religious beliefs, are being asked in the questionnaire. Therefore, completion of this section is unnecessary.

4. The Respondents and the Information Requested

4(a) Respondents

We will recruit subjects through a marketing firm. The firm recruits subjects by nationwide telephone recruiting. The household member over 18 years of age with the most recent birthday is recruited to take a computer survey either at home, at some other convenient location where the subject has access to a computer, or at a nationwide commercial facility which offers computer access, for which subjects will be compensated. The marketing firm will make clear that participation is voluntary and all subjects will be compensated.

4(b) Information Requested

(I) Data items, including record keeping requirements

The following screening questionnaire given to subjects when they are recruited by telephone is comprised of the following questions:

Good morning / afternoon I'm _____ from Consumer Pulse, calling on behalf of researchers at Harvard University Duke University and the United States Government. Today we are talking to a cross section of people in your area regarding their views about some important issues, and would like to include your household's opinions. I can assure you I am not selling anything, and this will only take about 3 minutes of your time. First of all … (GO RIGHT TO SCREENER QA.)

A. To make sure every member of your household has an equally likely chance of being asked to participate in our survey, may I please speak to the person in your household who is 18 years of age, or older and who has had the MOST RECENT birthday?

IF THIS PERSON IS NOT AVAILABLE, FIND OUT THEIR NAME (IF POSSIBLE), AND ARRANGE FOR A CALLBACK.

IF AVAILABLE NOW, REPEAT INTRODUCTION AND THEN, CONTINUE:
B. Into which of the following groups does your age fall?

1. 18-24
2. 25-34
3. 35-44
4. 45-54
5. 55-64
6. 65 and over

C. In general, how concerned would you say you are with issues impacting the environment, such as pollution, ozone depletion, and water quality? Would you say you are …

1. Very concerned
2. Somewhat concerned
3. Not very concerned
4. Not at all concerned

D. We are in the process of conducting a national marketing research study where we would ask you to complete an additional 30 minute interview, for which we will pay you for your time. Because we are seeking a certain number of responses in each region of the country, and your household has been selected to represent your area, it is very important to us that we include your opinion. Can we count on your input for this important research study?

IF REFUSED, THANK, TERMINATE, TALLY. OTHERWISE, CONTINUE:

Because we are trying to complete a large number of surveys in a very short time, we are using a computerized interview to assist us in collecting this information.

E. First of all, do you have access to a DOS or Windows based, IBM compatible PC at your work, or home?

1. Yes (SKIP TO H)
2. No

F. Do you have a neighbor/friend who owns an IBM compatible PC who would allow you use their computer for this interview? We would also send you a small gift to give to them if they would be willing.

1. Yes (TRY TO GET COMMITMENT & SKIP TO I)
2. No
3. Not sure (DO NOT READ, ARRANGE CB IF NECESSARY)

IF NO TO BOTH:

G. Don't worry, you can still help! We've have also made arrangements with Kinko's copy shops, to allow you to go to one of their locations in your area and conduct the interview on one of their PC's. So that I may determine the nearest location, what is your zip code? (INTERVIEWER: DETERMINE NEAREST STORES(s) There is a shop at: _____ would this be a convenient location for you?

1. Yes (SKIP TO J)
2. No (READ OFF OTHER LOCATIONS)

H. INVITE FOR PC OWNERS: We frequently conduct these types of surveys to get a better understanding of what people like yourself find important, and what issues may concern you. Your responses will allow us to gauge a general climate regarding environmental issues among persons all across the United States.

We would mail you a diskette to be used on your PC. You can complete the survey at your convenience and then return it to us in a postage paid envelope, which will be included in your packet.

The survey will take about 30 minutes. All your answers will be kept confidential and, as a small token of our appreciation, upon receipt of your completed survey diskette, we will mail you a check for $20.

Can we count on you to participate in our survey?

1. Yes (*GO TO VERIFICATION SCREEN)*
2. No (THANK, TALLY & TERMINATE)

I. INVITE FOR PC ACCESSORS: We frequently conduct these types of surveys to get a better understanding of what people like yourself find important, and what issues may concern you. Your responses will allow us to gauge a general climate regarding environmental issues among persons all across the United States.

We would mail you a diskette to be used on your friend/neighbor's PC. You can complete the survey at your convenience and then return it to us in a postage paid envelope, which will be included in your packet.

The survey will take about 30 minutes. All of your answers will be kept confidential and, as a small token of our appreciation, upon receipt of your completed survey diskette, we will mail you a check for $20 and also $10 for your friend, for lending you the PC.

Can we count on you to participate in our survey?

1. Yes (*GO TO VERIFICATION SCREEN)*
2. No (THANK, TALLY & TERMINATE)

J. INVITE FOR KINKO'S: We frequently conduct these types of surveys to get a better understanding of what people like yourself find important, and what issues may concern you. Your responses will allow us to gauge a general climate regarding environmental issues among persons all across the United States.

We would mail you a diskette and a certificate for free computer usage at the Kinko's location of your choice. The survey is simple to start and complete, and easy to use directions will be included in the packet. You can complete the survey at your convenience and then return it to us in a postage paid envelope, which will be included in your packet.

The survey will take about 30 minutes. All your answers will be kept confidential and, as a small token of our appreciation, upon receipt of your completed survey diskette, we will mail you a check for $40.

Can we count on you to participate in our survey?

1. Yes (*GO TO VERIFICATION SCREEN)*
2. No (THANK, TALLY & TERMINATE)

I'd like to mail you the survey diskette along with instructions on how to take the survey, as well as an 800 number to call if you have questions or problems.

May I please verify your name, address and phone number?

Name: _____

Address: _____
City: _____ ST: _____ Zip: _____

Thank you very much for your time and look for the materials to arrive within one week.

The following is an outline of the major sections of the computer survey.

1. Lake/river usage. This section of the survey ascertains whether the respondent has used lakes, rivers, and streams recently and also obtains information regarding the character of the use. For example, has the respondent engaged in fishing or swimming? If yes, how often? The primary purpose of these questions is to encourage the respondent to think about the value of these activities in such a way that will motivate the later choices.

2. Question format explanation. This section of the survey introduces the format of most survey questions that will follow. Thus, the intent of this section is to provide a general introduction to the character of the tradeoffs that will be faced, but will not include specific questions to ascertain the cost of living-water quality tradeoff values.

3. Cost of living versus water quality. This is the key section of the survey that is designed to ascertain the rate of tradeoff between increases in cost of living and water quality improvements. The structure of this section utilizes a sequence of paired comparisons until a point of indifference has been achieved.

4. Lake quality versus river quality. This section of the survey determines the individual's rate of tradeoff between lake and river water quality improvement. Using these results it will be possible to ascertain the relative benefit assessment for water quality improvements for these two different classes of water bodies. As in the case of the cost-of-living water quality tradeoffs, this section of the survey as well as subsequent sections will utilize a series of paired comparisons until a point of indifference has been achieved.

5. Water uses tradeoff. In this section, the respondent determines relative tradeoffs for swimming, aquatic environment, and fishing by choosing one of three sets of water quality levels for the three uses.

Aesthetic properties, smelliness and cloudiness. Even if water quality meets a particular level based on the EPA criteria, individuals may also be sensitive to other attributes. The two attributes considered were the smelliness and cloudiness of water. In each case, the survey determines the rate of tradeoff between cost of living and water quality improvements in regions that differ in smelliness and cloudiness. These results also may be instructive with respect to identifying different demographic groups who place greater weight on these aspects of water quality that are not currently part of EPA's criteria.

Source of pollution. Respondents may not care simply about the overall level of water quality as it has been affected by pollutants, but also about the nature of the pollution that causes the decrease in water quality. A pollution component of particular interest is industrial toxic wastes. Are people more fearful of the decreases in water quality caused by toxic waste as opposed to conventional pollutants? The section of the survey addresses this issue by assessing rates of tradeoff between pollution due to agricultural wastes and pollution due to industrial toxic wastes.

Cost of living versus water quality referendum. Previous tradeoffs considered thus far are based on a series of choices among paired alternatives. Here the survey authors adopt a referendum approach to assessing the value of water quality. In particular, individuals are asked to determine whether they support a policy referendum in which there will be some associated cost as well as an associated water quality improvement. Asking the water quality valuation question in this alternative way will provide a valuable consistency test on the results above for section three of this survey in which the cost of living versus water quality tradeoff has been elicited through paired comparisons. Non-use values are also determined in this section by describing to some subjects an improvement in their region and to others an improvement in two regions.

9. Demographics. This section of the survey obtains detailed information regarding the demographic characteristics of the respondents. These characteristics are of interest for a variety of reasons. First, analyzing the demographic characteristics is useful in testing whether the respondent group is representative of the population in the same area. Second, analyzing the characteristics of the respondents also is helpful in analyzing how various responses to questions, such as the valuation of water quality, vary with demographic characteristics. Based on a regression analysis of these

valuations in conjunction with information on demographic characteristics, one could project water quality valuation from a sampled population to a broader population.

The materials sent to the subjects by mail consist of:

The following greeting is sent with the survey diskette:

Hello, and welcome to our survey on water quality.

This survey was put together by researchers at Harvard University Duke University to help the United States Government understand your views on the quality of lakes and rivers in your region.

Thank you for taking part in this research. We hope that you will find this survey interesting.

For most of the questions in this survey, there are no right or wrong answers. We are just trying to get your opinions.

If you are unsure of what to do during a question, there will usually be some instructions at the bottom of the screen.

You should expect the survey to take about 30 minutes to complete.

How to start

If you are using Windows, you can start the survey this way:

1. Turn your computer on.
2. Place the survey diskette into the disk drive of your computer.
3. Push the "Start" button on the left side of the toolbar at the bottom of your screen, and select "Run" from the list of options provided.
4. Type "a:start" and press enter. The survey will start.

If you are using DOS, you can start the survey this way:

1. Turn your computer on.
2. Place the survey diskette into the disk drive of your computer.
3. Type "a:" and press enter.
4. Type "start" and press enter. The survey will start.

If you have problems

If you cannot get the survey program to work, or if you experience problems of any kind, do not hesitate to call. Our toll-free number is (800) 284-1245. Please ask for assistance with the Water Quality Survey.

When you have finished the survey:

When you have finished the survey, please remove the survey diskette from the disk drive of your computer and return it in the postage-paid diskette mailer provided.

Receiving your honorarium:

Please verify the name and address information as they appear on the enclosed address card. If all information is correct, it is not necessary to return the card. If any information needs to be changed, please do so on the card and return it along with the diskette in the mailer provided.

Thank you for your participation in this important research study and remember,

Y O U R O P I N I O N C O U N T S !!!

These instructions are sent if the subject does not have access to a computer:

If you plan to complete this survey at a Kinko's location near you, please take the enclosed check and give it to the Kinko's employee as payment for using their computer. Please also take the instruction page, in case you need to ask the employee for assistance with beginning the interview.

If perhaps you have thought of someone who would let you use their computer to complete this survey, and you no longer need to use the computer at Kinko's, please return this check in the postage-paid diskette mailer, when you return your completed survey diskette.

The following is the address confirmation card to ensure correct payment:

WATER QUALITY SURVEY

Unless you specify differently, we will mail your check to:

«newname»

«ADD»
«CITY», «ST» «ZIP»

«RESPID»

* IF THIS INFORMATION IS NOT CORRECT, PLEASE WRITE IN THE NEW INFORMATION AND RETURN THIS CARD WITH THE DISKETTE IN THE POSTAGE-PAID DISKETTE MAILER PROVIDED.

Diskette returned on: _____/_____ 1999

If you do not receive your check within 2 weeks from the date you mail the diskette back, please call (800) 284-1245.

The following is the script used for reminder calls if subjects are tardy in returning their survey diskette.

Basic Reminder Script for Water Quality Issues Study

Hello, may I please speak to (CONTACT NAME FROM CALL SHEET). This is _____ from Consumer Pulse and I'm calling regarding the Water Quality Survey for Harvard University, Duke University, and the United States Government that you agreed to participate in. We mailed you a diskette, and some other survey materials on (INSERT DATE FROM CALL SHEET) and have not yet received your completed interview. Could you take a few moments today to complete the survey and drop it in the mail?

(IF NOT): Your survey is vitally needed in order for the EPA to realize what concerns you and others like you may have with regard to Water Quality. When may we expect your completed survey?

ALSO OFFER:
If you any assistance with starting the interview or completing the survey please feel free to call us at 800 284-1245, just ask for assistance with the Water Quality computerized interview.

Thank you and have a nice day/evening (AS APPROPRIATE FOR THE TIME CALLED).

For an ANSWERING MACHINE:

Hello, this call is for (CONTACT NAME FROM CALL SHEET). This is _____ calling from Consumer Pulse on behalf of researchers at Harvard University, Duke University and the United States Government. I'm calling regarding the Water Quality Survey that you agreed to participate in. We mailed you a diskette, and some survey materials on (INSERT DATE FROM CALL SHEET) and have not yet received your completed interview. Your survey is vitally needed in order for the EPA to realize what concerns you and others like you may have with regard to Water Quality. I'd like to ask that you please take a few minutes today to answer the survey questions and drop the completed survey in the mail. If you need any assistance with starting the interview or completing the survey please feel free to call us at 800 284-1245, just ask for assistance with the Water Quality computerized interview.

Thank you and have a nice day/evening (AS APPROPRIATE FOR THE TIME CALLED).

The full text of the survey diskette is attached at the end of this document.

(II) Respondent activities

We expect respondents to engage in the following activities to complete the questionnaire and return it to EPA:

Review instructions

Travel to survey location if no computer in home

Take the computerized survey

Mail the completed questionnaire

A typical subject will be recruited by phone to take the survey (about 10 minutes). The subject will receive survey materials in the mail, including a survey diskette. If the subject does not have a computer in the home, the subject will travel to a location where a computer is available, either the home of a friend (about 15 minutes round trip) or a national commercial facility with computers available (about 30 to 60 minutes round trip). The subject will complete the survey (about 30

minutes) and mail the completed survey disk in a provided stamped and addressed envelope (about 10 minutes).

5. The Information Collected - Agency Activities, Collection, Methodology and Information Management

5(a) Agency Activities

This project is being undertaken by academic researchers at Harvard and Duke Universities, funded by an EPA grant to Harvard University for the purpose of carrying out and analyzing the results of the proposed survey. The purpose of the project is to undertake new research on the valuation of improvements in inland water quality. Earlier stages of the project were funded by an EPA cooperative agreement with Duke University.

5(b) Collection Methodology and Information Management

As stated previously, the targeted universe is members of households in the United States at least 18 years of age with the most recent birthday in their household. If pre-testing indicates that particular demographic groups are under-represented in the recruiting process, the survey authors will take measures to recruit those demographic groups more heavily to help ensure that the ultimate samples are representative of the diversity of households in the United States.

Upon receipt of completed questionnaires, the survey authors will compile responses into an analysis database as done in the pilot survey and, again as done in the pilot survey, develop a regression model for valuation of water quality based upon demographic and water use characteristics.

5(c) Small Entity Flexibility

The survey will be administered to individuals, who will be compensated for their time and effort, so completion of this section is not necessary.

5(d) Collection Schedule

Table A2. Duration of Questionnaire Activities

Activity	Duration of Each Activity (in days)	Total Elapsed Time Period for Project (in days) Following OMB Approval
Subjects Recruited	60	60
Questionnaire Mailed	3	63
Subjects Reminded if Necessary	14	77
Receive Questionnaire Responses	30	107
Data Entry of Questionnaire Responses	14	121

6. Estimating Respondent Burden and Cost of Collection

6(a) Estimating Respondent Burden

The questionnaire will require subjects to devote time in order to complete the survey task. The total national burden estimate for all parts of the questionnaire process is 3,150 hours. The burden estimates are based on administration of 2,800 questionnaires. The survey authors estimate that each subject will require, on average, 10 minutes to respond to the phone recruiting process, 30 minutes to complete the survey and another 10 minutes to mail the completed survey disk in a provided envelope. The survey authors estimate that as many as half of the sample may not have access to a personal computer in the home. For these subjects, an additional 15 minutes are estimated if using a neighbor's computer, or an additional 30 to 60 minutes round trip to a national commercial facility with computer access if necessary. Survey completion times are estimated from the pilot survey, but all numbers may be revised based upon information from pre-tests of the national survey. The burden estimates of the national survey reflect a one-time expenditure, so they are equal to annual expenditures during the single year that the survey is conducted.

6(b) Estimating Respondent Costs

For subjects who complete the survey on their own computer, the survey authors expect costs to subjects of about $11.00 per subject based on a total expected time of 50 minutes to complete the survey at an average wage of $13.18 per hour. If the subject must use the computer of a friend or neighbor, the survey authors expect additional costs of about $3.30 per subject. If the subject must use a national commercial facility with computer access, the survey authors expect additional costs of about $10.00 per subject.

6(c) Estimating Agency Burden and Costs

This project is being undertaken by academic researchers with support from an EPA grant to Harvard University of $589,183. The purpose of the project is to undertake new research on the valuation of improvements in inland water quality. EPA staff time will be minimal since it will be limited to that involved in handling the ICR and reviewing the draft final report by the EPA Project Officer and several staff reviewers.

6(d) Respondent Universe and Total Burden Costs

We expect respondent burden costs to total at $41,517.00 based upon the 3150 total hours described in 6(a) at a wage rate of $13.18 per hour.

6(e) Bottom Line Burden Hours and Costs

Table A3. Total Estimated Bottom Line Burden and Cost Summary

	Total Burden (in hours)	**Total Costs (in dollars)**
Respondents	3,150	41,517.00

6(f) Reasons For Change In Burden

The questionnaire is a one-time data collection activity. Therefore, completion of this section is not necessary.

6(g) Burden Statement

We estimate that the public reporting and record keeping burden of its questionnaire will average between 50 minutes and 110 minutes per respondent (i.e., a total of 3150 hours of burden divided among an anticipated 2800 respondents). Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB control numbers for EPA's regulations are listed in 40 *CFR* Part 9 and 48 *CFR* Chapter 15.

Send comments on the need form this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden, including through the use of automated collection, to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 401 M St., SW, Washington, D.C. 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW, Washington, DC 20503, Attention: Desk Officer for EPA.

PART B OF THE SUPPORTING STATEMENT

1. Survey Objectives, Key Variables, and Other Preliminaries

1(a) Survey Objectives

Questionnaire responses will provide estimates of economic benefits for water quality improvements for lakes, rivers, and streams to households in the United States. Secondary questions include how this valuation differs between lakes and rivers, depends on aesthetic properties of water, source of pollution, the relative valuation of individual uses of water, and how valuation estimates vary by demographic characteristics.

1(b) Key Variables

Key variables in the survey include a primary measure of water quality value; a second measure of water quality value late in the survey to confirm the value; a determination of lake vs. river preference; a measure of use preference for fishing, swimming, and aquatic environment; a measure of how the aesthetic properties of smelliness and cloudiness affect water quality value; a measure of how the primary source of pollution affects water quality value; variables describing how and whether subjects use recreational water; and various demographic variables.

1(c) Statistical Approach

A statistically designed sample survey is necessary to achieve the objectives, in particular, to ensure that the resulting inferences and analyses are as statistically unbiased and as precise as is practicable. A census approach is impractical for reasons of the enormous expense necessary to get a response from every household in the United States. On the other hand, an anecdotal approach is not rigorous enough to provide a useful estimate of national water quality value.

Consumer Pulse (725 South Adams, Suite 265, Birmingham, MI 48009), will conduct the recruiting, distribution and collection of survey materials, the set-up and operation of a help line, and reminder calls for tardy responses.

1(d) Feasibility

The survey instrument has been repeatedly pre-tested, undergone a pilot study, and been subject to review by reviewers in academia and government. The survey authors believe the survey instrument is capable of generating useful data, which the pilot report has already demonstrated.
We have expended considerable effort, with the help of external reviewers and subjects, to ensure that the questions in the survey are as simple and easy to understand as the survey task allows.

2. Survey Design

2(a) Target Population and Coverage

The target population for this survey is households in the United States. Subjects will be recruited from households in the top 150 Metropolitan Statistical Areas in the United States. If data show that certain demographics are under-represented as compared to the United States population overall, rural populations for example, the survey authors will return to the field and recruit additional subjects from those demographics.

2(b) Sampling Design

(I) Sampling Frames

The sampling design involves recruiting from households in the top 150 Metropolitan Statistical Areas in the United States, whose phone numbers will be acquired by the marketing firm that will

handle recruiting for the survey. Meeting the sample-size targets for the survey will require mailing questionnaires to about 3,000 households. Recruiting will be done from a single sample of households in the top 150 MSAs in the United States. Additional recruiting may be undertaken if pre-testing demonstrates under-representation of certain demographic groups.

(II) Sample Sizes

Intended sample sizes are 2800 households in the United States, of which 800 may be pretests. These sample sizes stem from funding constraints and the need for a sample large enough to achieve a stable regression model that includes demographic characteristics.

(III) Stratification Variables

The survey will get demographic variables from subjects in the survey including age, gender, income, and education, as well as information about whether and how often they recreate at lakes and rivers. In addition, it will take zip code information in order to identify whether subjects live in a region with plentiful or scarce surface water.

(IV) Sampling Method

Telephone recruiting of households in the 150 largest MSAs in the United States is the method used to sample the population of households in the United States. If the survey authors find that this method under-represents certain demographic groups, the survey authors will recruit again emphasizing those groups.

(V) Multi-Stage Sampling

We do not believe that multi-stage sampling will be necessary. If a demographic group, rural households for example, is under-represented, those carrying out the survey will recruit from telephone exchanges with higher concentrations of that demographic group, from rural areas in this example.

2(c) Precision Requirements

(I) Precision Targets

The researchers performed detailed statistical analyses to demonstrated the statistical significance of the estimates in their pilot report. However, their objective is not simply to estimate a particular set of parameters, rather to obtain reliable regression equations to project water quality benefits for a wide variety of regions and water quality situations. The survey authors believe that they have sufficient sample size to guarantee statistical significance at 95% confidence for their main variables of interest, however it is desirable to expand the sample as much as possible given the available budget. To obtain diverse regional info needed to have as refined a regression equation as possible. The following examples give a sense of the level of precision, assuming that there is a national sample of 2,000 and a total sample including pretests of 2,800. Consider first the estimates of the willingness to pay value per unit increase in water quality based on the EPA water quality ratings. The pretest results indicate a mean value of 22.36 and a standard deviation of 22.47 of the dollar value per unit increase in water quality. The 95% confidence interval based on a sample size of 2,000 with these parameter values will be 22.36 + or - 0.985. Thus, values will be estimated within + or - $1 dollar of the unit value, which is just under 5% of the total water quality unit value.

Suppose instead that it is desirable to estimate values for water quality by region and that there are 4 equally sized regions. With a sample size of 500 per region, the estimated water quality values will have a 95% confidence interval around the mean of 22.36 + or - 1.97. Thus, shrinking the

subsamples to one-fourth of the full sample size roughly doubles the size of the confidence interval around the mean.

Various other parameters in the study will also be of interest. For example, what is the relative value of improving water quality for lakes versus rivers and streams? Pretests suggest that a 2.10% in improved river quality would be equivalent to a 1% improvement in lake quality, with a standard deviation of 2.77. With a sample of 2,000 the 95% confidence interval will be 2.10 + or - 0.12, and for regional sample sizes of 500 that explore regional differences the 95% confidence interval will be 2.10 + or - 0.24.

Numerous other parameters are also of policy interest, but these illustrations indicate the type of precision that will be achieved with the proposed sample sizes.

(II) Non-Sampling Errors

Pre-testing will determine the extent to which non-response is a problem, but since the survey authors will construct a regression model using demographic characteristics as dependent variables, the survey authors will be able to test whether there are significant differences in responses for those who are "harder to interview" compared to those who are otherwise over-represented in the survey sample.

2(d) Questionnaire Design

The explanation of each section of the survey was discussed in section 4(b) of Part A of the Supporting Statement.

The question format of this survey is an iterative choice process. Subjects are presented with an initial tradeoff choice, then, based upon their choice, are asked progressively more difficult questions until the subject achieves an acceptable level of detail or until the subject reaches a point of indifference between the choices offered. The survey authors feel this method is the best way to

approach a difficult survey task which must ask subjects to determine the value non-market goods which they probably do not consider often.

3. Pretests and Pilot Tests

Several rounds of pre-tests were conducted leading up to a pilot survey and report. Limited pre-tests to the national survey are underway, with more extensive pre-tests expected after OMB approval of the ICR. Analysis of the pilot survey is attached at the end of this document.

4. Collection Methods and Follow-up

4(a) Collection Methods

The survey will be distributed with a postage paid return envelope in which the survey diskette may be returned upon completion. Subjects will be compensated for their time and effort, at a level determined on whether they must travel to a national commercial facility with computer access.

4(b) Survey Response and Follow-Up

The researchers expect a response rate of about 70%. Reminder calls will be placed to subjects who are tardy in returning their completed survey diskette. No follow-up to the survey will be undertaken due to their confidentiality measures. The cost estimates are based on an initial stipend to respondents of $20, which is the minimum amount that the survey authors envision. Thus, the estimates are for the maximum sample size and the maximum time burden that could occur for the population. This kind of survey breaks new ground in terms of its computer methodology, and part of the information to be generated by the study is how people respond to different levels of incentives. The pre-test phase of the study will include an analysis of how people respond to payments ranging from $20 to $100. The survey authors will analyze the responses in the pretest

phase to determine the extent to which the monetary incentive affects the demographic characteristics of the sample, the character of the water quality valuation responses, and the ability of the survey to reach their objective of a 70 percent response rate from the sample. Based on these findings and an assessment of the tradeoffs involving sample selection biases and cost, the researchers will then proceed with the national sample using the optimal payment mechanism approach, which will be selected by the researchers in consultation with reviewers and officials at the US EPA.

5. Analyzing and Reporting Survey Results

5(a) Data Preparation

Data from the survey diskettes will be transferred to a statistical analysis package for analysis. This process did not create any problems in the pilot survey, and the researchers will use the same personnel for this process in the national survey. The researchers have also preserved tests for irrational or inattentive responses that were used in the pilot survey.

5(b) Analysis

The data will follow roughly the same analysis as the pilot survey, which is contained in the pilot report at the end of this document.

5(c) Reporting Results

Survey results will be made available in the same way as the pilot, through a report describing analysis and results.

Attachment 1: Federal Register Notice

ENVIRONMENTAL PROTECTION AGENCY

Agency Information Collection Activities: Proposed Collection; Comment Request; Valuing Inland Water Quality Improvements

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: In compliance with the Paperwork Reduction Act (44 U.S.C. 3501 et seq.), this document announces that EPA is planning to submit the following proposed Information Collection Request (ICR) to the Office of Management and Budget (OMB):

Valuing Inland Water Quality Improvements (ICR number 1914.01). Before submitting the ICR to OMB for review and approval, EPA is soliciting comments on specific aspects of the proposed information collection as described below.

DATES: Comments must be submitted on or before January 11, 2000.

ADDRESSES: Dr. Alan Carlin, Office of Policy and Reinvention, Mail Code 2172, U.S. Environmental Protection Agency, Washington, DC 20460, e-mail Carlin.alan@epa.gov, phone 202-260-5499, FAX 202-260-7875. The survey as it will be received by subjects can be obtained without charge by mailing or e-mailing a request to Jason Bell listed below. Be sure to include name, address, telephone number, e-mail if available, and delivery preference (diskette by mail, or e-mail delivery of the survey). A file containing the survey can also be downloaded from the following Website under What=s New: http://www.epa.gov/economics.

FOR FURTHER INFORMATION CONTACT: Jason Bell, Fuqua School of Business, Duke University, Durham, NC 27708-0120, phone 919-681-4843, fax 919-684-8742, e-mail jbb@acpub.duke.edu.

SUPPLEMENTARY INFORMATION:

Affected entities: Entities potentially affected by this action are individuals who agree to participate in the survey. Participation is voluntary and subjects will be compensated for their time and effort. Recruiting will be done by Consumer Pulse, in a manner described in the abstract below.

Title: Valuing Inland Water Quality Improvements (EPA ICR number 1914.01)

Abstract: The purpose of this project is to develop economic benefit values for water quality improvements for lakes, rivers, and streams. These estimates are of substantial academic interest since past studies have been based on a water quality ladder, which is believed not to be as scientifically valid a construct for assessing water quality. The estimates may also be useful to the Agency in complying with the requirements of Executive Order 12866 requiring cost-benefit analysis of major Federal regulations. This project will explore how valuations are affected by use of the current EPA approach of specifying different dimensions of water quality such as swimming, fishing, and broader aquatic ecological effects. The findings will be pertinent to economists studying water quality changes, particularly with respect to the task of assessing benefit values for water quality policies. The researchers will use data collected with the survey in determining the value of water quality improvements to households in the United States. The researchers plan to recruit subjects randomly across the United States through telephone recruiting. Subjects will be asked to complete a computer survey from a disk, which will be mailed to them. Subjects without convenient access to a personal computer will be referred to a national commercial facility with computer access nearest their home for the purpose of completing the survey. Subjects will return the survey disk by mail when completed. Participation in the survey is voluntary. Respondents will have to expend time, effort, and in many cases travel expense to participate in the study. Avoiding bias in the sample towards individuals and groups who can more easily take the survey is an

important concern. As a result, the researchers will compensate subjects for their time (and travel if necessary) to avoid the selection bias that might otherwise result. This survey is innovative both in terms of the survey methodology and the substantive economic focus. On both of these dimensions the survey is breaking new ground. To maximize the research value of the survey, the researchers will proceed iteratively. The version of the survey available now will undergo at least two pre-tests after OMB approves the ICR. These pretests will be designed to identify programming complications arising from the nature of the survey, as well as survey questions that can be refined to promote greater clarity and convergence in the iterative choice process used. The final structure of the survey will depend on how people respond to the draft questions. For example, on any initial pairwise choice question, the researchers seek to present an initial tradeoff where half of subjects to choose each alternative, in order to maximize convergence on tradeoff rates in the least possible number of iterative questions. After the pre-tests are completed, recruiting will proceed as described above. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15. We solicit comment on all aspects of the questionnaire, and specifically solicit comment on the following issues:

(i) Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(ii) The accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;

(iii) The quality, utility, and clarity of the information to be collected; and

(iv) Minimization of the burden of the collection of information on those who are to respond, including through the use of appropriate automated electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Burden Statement: The total national burden estimate for all parts of the questionnaire process is 3170 hours. It should be emphasized, however, that this is extremely uncertain given the new proposed approach to be used and the highly experimental nature of the survey. The burden estimates are based on administration of 2800 completed questionnaires and an assumed response rate of 70 percent. The researchers estimate that each subject will require, on average, one minute to refuse to participate in the phone recruiting process, 10 minutes to respond favorably to the phone recruiting process, 30 minutes to complete the survey, and another 10 minutes to mail the completed survey disk in a provided envelope. The researchers estimate that as many as half of the sample may not have access to a personal computer in the home or at work. For these subjects, an additional 15 minutes are estimated if using a neighbor's computer (assumed to be one-sixth of the completed sample), or an additional 30 to 60 minutes round trip to a national commercial facility with computer access if necessary (assumed to be one-third of the completed sample). Given these assumptions, the total burden for the survey in terms of participant time (3170 hours) valued at $13.18 (the average hourly earnings for May 1999 according to the Bureau of Labor Statistics) is estimated to be $41,781 prior to the payment of the proposed compensation. We stress again that participation by subjects in the survey is voluntary and that subjects will be compensated for their time and effort. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and

utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

Dated: _____ _____

Brett Snyder , Director,
Economy and Environment Division

```
------------------------------------------------------------------------
pad1
------------------------------------------------------------------------
                        Press any key

                    to begin the survey
------------------------------------------------------------------------
hello
------------------------------------------------------------------------
      Hello, and welcome to our survey on the value of water quality.

      This survey was put together by researchers to help the

      government understand your views on the the value of

      water quality in the lakes and rivers of your region.

      Thanks for taking part in this research.  We hope that you

      will find this survey interesting.
------------------------------------------------------------------------
hello2
------------------------------------------------------------------------
      For most of the questions in this survey, there are no right

      or wrong answers.  We are just trying to get your opinions.


      If you are unsure of what to do during a question, there will

      usually be some instructions at the bottom of the screen.
------------------------------------------------------------------------
hello3
------------------------------------------------------------------------
      The questions in this survey will have a number of choices.

      To show what a typical question might look like, try answering

      this one.

      How is the weather today?
```

1. Good

2. Not so good

To answer a question, press the number on the keyboard that is the same as the number to the left of your choice.

Do not use the enter key, it is not necessary for most questions.

---

howdo3

If you answer a question and then decide that you would have rather given another answer, you can press the ESC key to back up to the previous question.

---

locale

Which of the following best describes where you live now?

1. City

2. Suburbs

3. Small Town

4. Country

---

fam1

How many members of your family (spouse, children, parents, or other relatives) currently live in your home, including yourself?

1. One

2. Two

3. Three

4. Four

5. Five

6. Six or more

---

fam2a (Only asked if fam1=1)

For the rest of this survey, when a question refers to your family or members of your family who live in your home, think of it as referring only to you.

---

fam2b (Only asked if fam1>1)

For the rest of this survey, when a question refers to you, think of it as referring to you and the members of your family who currently live in your home.

---

use0

This survey will deal only with fresh water bodies. Oceans or other salt water will not be included.

We will ask you questions about how you value lakes and rivers near where you live.

---

use1

When we say lake in this survey, we mean any standing body of fresh water, including natural lakes, ponds, and reservoirs created by damming rivers. A lake in your region is any lake within 125 miles of your home, that is, within a 2-hour drive or so.

---

use1x

When we say river in this survey, we mean any flowing body of water fed by runoff from rain or snow. This includes rivers, creeks, and any other streams. A river in your region is any

river within 125 miles of your home, that is, within a 2-hour drive or so.

Now we would like to ask you some questions about how you use lakes and rivers in your region.

---

use1a

Lake and River Use Questions

Have you (including family members who live in your home) visited a lake or river the last 12 months, in your region or elsewhere?

1. Yes
2. No

If use1a=2 then this next section is skipped, all the way to use1c

---

use1b1

Which of the following have you (including family members who live in your home) done in the last 12 months while visiting a lake or river?

Have you been fishing at a lake or river?

1. Yes 2. No

---

use1b2

Have you been swimming in a lake or river?

1. Yes 2. No

---

use1b3

Have you been hunting at a lake or river?

1. Yes 2. No

---

use1b4

Have you been hiking at a lake or river?

1. Yes 2. No

---

use1b5

Have you been camping at a lake or river?

1. Yes 2. No

---

use1b6

Have you been boating or rafting in a lake or river?

1. Yes 2. No

---

use1b7

Have you been picnicking at a lake or river

1. Yes 2. No

---

use1b8

Have you done any wildlife observation at a lake or river

1. Yes 2. No

---

use1c

How often in the last 12 months have you noticed a view

of a lake or river?

1. Never
2. Rarely
3. Sometimes
4. Often

---

ufish (Only if use1b1=1)

How many times in the last 12 months have you been fishing at a lake or river?

1. One time
2. Two times
3. Three times
4. Four times
5. Five or more times
6. Not Sure

---

ufish2 (Only if use1b1=1)

When you catch fish in a lake or river, how often do you eat the fish that are large enough to eat?

1. Never
2. Sometimes
3. Often
4. Always

---

uswim (Only if use1b2=1)

How many times in the last 12 months have you been swimming in a lake or river?

1. One time
2. Two times
3. Three times
4. Four times
5. Five or more times

6. Not Sure

---

learn1

Many of the questions in this survey will present information in a table, and then ask you a question about your preference between different choices.

Look at this table which describes two possible dinner choices and the prices of the dinners, then press any key and we will explain what the table is trying to say.

1. Dinner 1 2. Dinner 2 3. No Preference Between Dinners

Type of Restaurant	Sit Down Restaurant	Fast Food Restaurant
Price	$ 10	$ 5

---

learn2

The choices for this table are shown in columns. Each column describes a dinner. The first column describes Dinner 1, which would be eaten at a sit down restaurant and costs $ 10.

1. Dinner 1

Type of Restaurant	Sit Down Restaurant
Price	$ 10

---

learn3

The second column describes Dinner 2, which would be eaten at a fast food restaurant and costs $ 5.

2. Dinner 2

Type of Restaurant	Fast Food Restaurant
Price	$ 5

learn4

The third column does not describe any of the dinners.

This column is presented because for some questions you may like the choices offered equally well. In this case, you would not prefer one over the other.

3. No Preference Between Dinners

Type of Restaurant	
Price	

learn5

Let's look at the entire question again.

The choice offered is between a more expensive dinner at a sit down restaurant compared to a less expensive dinner at a fast food restaurant. The No Preference choice is offered if you would like either one.

Try answering the question by choosing one of the Dinners.

1. Dinner 1 2. Dinner 2 3. No Preference Between Dinners

Type of Restaurant	Sit Down Restaurant	Fast Food Restaurant
Price	$ 10	$ 5

learn6p (Only if learn5=1)

Your answer indicated that you would prefer the more expensive dinner at a sit down restaurant.

If that is not what you meant, you can press the ESC key to go back and answer the question the way you meant to.

If this was the dinner you preferred, press any other key to continue.

---

learn6a (Only if learn5=1)

Some questions will look similar to previous questions, but will have different values for one of the choices. For instance, in the previous question you chose between a $10 dinner at a sit down restaurant and a $5 dinner at a fast food restaurant. The next question will ask you to choose between a $15 sit down dinner and a $5 fast food dinner. Which dinner would you prefer?

1. Dinner 1 2. Dinner 2 3. No Preference Between Dinners

Type of Restaurant	Sit Down Restaurant	Fast Food Restaurant
Price	$ 10	$ 5
	$ 15 New	

---

learn7p (Only if learn5=2)

Your answer indicated that you would prefer the less expensive dinner at a fast food restaurant.

If that is not what you meant, you can press the ESC key to go back and answer the question the way you meant to.

If this was the dinner you preferred, press any other key to continue.

---

learn7a (Only if learn5=2)

Some questions will look similar to previous questions, but will have different values for one of the choices. For instance, in the previous question you chose between a $10 dinner at a sit down restaurant and a $5 dinner at a fast food restaurant. The next question will ask you to choose between a $10 sit down dinner and a $8 fast food dinner. Which dinner would you prefer?

1. Dinner 1 2. Dinner 2 3. No Preference Between Dinners

Type of Restaurant	Sit Down Restaurant	Fast Food Restaurant
Price	$ 10	$ 5
		$ 8 New

---

learn8p (Only if learn5=3)

Your answer indicated that you do not prefer either dinner over the other.

If that is not what you meant, you can press the ESC key to go back and answer the question the way you meant to.

If this was the dinner you preferred, press any other key to continue.

---

learn8a (Only if learn5=3)

Some questions will look similar to previous questions, but will

have different values for one of the choices. For instance, in the previous question you chose between a $10 dinner at a sit down restaurant and a $5 dinner at a fast food restaurant. The next question will ask you to choose between a $10 sit down dinner and a $8 fast food dinner. Which dinner would you prefer?

1. Dinner 1 2. Dinner 2 3. No Preference Between Dinners

Type of Restaurant	Sit Down Restaurant	Fast Food Restaurant
Price	$ 10	$ 5 $ 8 New

---

goodluck

The previous questions asked you what sort of dinner you might choose. Questions later in the survey will ask you to make choices based on concepts less familiar to you than dinner and restaurants.

Keep in mind the format of the questions you just answered, take your time to read the definitions, and remember that you can use the ESC key to go backwards in the survey.

---

imagine

Many of the questions which follow will ask you to imagine that you (including family members who live in your home) are planning to move to another region.

The regions where you might move differ from the one where you now live in only two ways:

* The cost of living in the region, and

* The quality of water in the region.

In all other ways, they are much like where you live now. For example, the regions have the same number of lakes and rivers as where you live now.

---

imag2

To help you answer the next questions, we will give you some information that will help you to understand what we mean by

* Cost of Living

and

* Water Quality.

Press any key to learn about Cost of Living

---

defcol

Cost of Living

For purposes of this survey, the cost of living is defined as the amount of money that your family spends each year for things like food, clothing, and rent or mortgage.

When we say that a region has a higher cost of living, we mean that each year you would have to spend more for these items overall.

---

col0

How concerned would you be if your family's cost of living went up $200 per year? (This would mean that items like food, clothing, and rent or mortgage would cost a total of $200 more each year than they do now.) This might mean an increase of $2 per week for food (or $104 per year) and $8 per month more for housing (or another $96 per year).

1. Not at all concerned
2. A little concerned
3. Somewhat concerned
4. Very concerned

---

col1

Try answering this sample question to make sure we explained Cost of Living clearly.

Imagine that you must move to another region of the country. You have narrowed your choices down to two. Both regions have a higher cost of living than where you live now, but are alike in all other ways.

Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase In Annual Cost of Living	$100 More Expensive	$350 More Expensive	

---

bad1 (Only if col1=2)

The question was not clear.

You chose to move to the region with a higher cost of living. You could have chosen a region with a lower cost of living that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

If you do not want to change your answer, press the '9' key.

---

good1 (Only if col1=1)

The Region you chose, Region 1, has a lower annual cost of living than Region 2.

Now we would like to explain what we mean by water quality.

---

bad2 (only if col1=3)

You indicated that you have no preference between two regions whose only difference is that it is more expensive to live in one of them.

Are you sure that you don't care whether you would move to a region where it is more expensive to live? After all, you could move to a region with a lower cost of living that is alike in all other ways.

1. Yes, I'm sure that I have no preference.
2. No, I'm not sure. Ask the cost of living question again.

---

defwat0

Water Quality

Some questions will ask you to choose between regions that differ in terms of the quality of the water in either lakes or rivers in the regions.

The government rates water quality as either

* Good or
* Not Good.

Water quality is Good if the water in a lake or river is safe for all uses.

Water quality is Not Good if a lake or river is polluted or unsafe to use.

---

defwat1

More specifically,

Water quality is Good if the lake or river

* Is a safe place to swim,
* Has fish that are safe to eat, and
* Supports many plants, fish, and other aquatic life.

Water quality is Not Good if the lake or river

* Is an unsafe place to swim due to pollution,
* Has fish that are unsafe to eat, or
* Supports only a small number of plants, fish and other aquatic life.

---

defwat1a

This survey will not ask you about drinking water.

Drinking water is treated by water treatment plants to ensure safety.

Water treatment cannot be done for the dimensions described on the previous screen, since these dimensions involve visiting a lake or river instead of treating a limited amount of water taken from the lake or river.

---

defwat2

We will talk about water quality for more than one lake or river.

The questions will include all the lakes or rivers in the region. This means all lakes and rivers within a 2-hour drive or so of your home, in other words, within 125 miles.

The entire country could be split into about 70 regions of this size.

---

defwat3

We define the quality of the water in the lakes and rivers of a region by the percent of the total acres of lakes or miles of rivers in the region which have good water quality.

For example, let's say a region has several rivers, running a total of 100 miles in the region.

If pollution causes 50 of those miles to have water quality that is not good, leaving 50 miles with good water quality, then we would call the water quality for rivers in that region 50% good.

---

defwat3b (Only half of the subjects are asked this question)

In the United States, the overall level of water quality for lakes and rivers is 65% Good.

What would you believe about the quality of lakes and rivers in your region?

1. Water Quality in my region is Lower than 65% Good.
2. Water Quality in my region is About the Same as the Nation Overall.
3. Water Quality in my region is Higher than 65% Good.

---

defwat4 (1/3 of subjects get a range of 50% to 65% Good Water Quality
1/3 of subjects get a range of 25% to 40% Good Water Quality
1/3 of subjects get a range of 75% to 90% Good Water Quality)

Try this sample question about water quality.

Imagine again that you must move to another region of the country. You have narrowed your choices down to two regions. They differ in only one way, the quality of the water in the regions. They even have the same number of acres of lakes and miles of rivers within 2 hours or so of where you would live. Which region would you prefer?

1. Region 1 2. Region 2 3. No Preference Between Regions

Percent of Lake Acres and River Miles With Good Water Quality	50%	65%

---

bad3 (Only if defwat4=1)

The question was not clear.

You chose to move to the region with worse water quality.

You could have chosen a region with better water quality that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

If you do not want to change your answer, press the '9' key.

---

good3 (Only if defwat4=2)

The Region you chose, Region 2, has better water quality than Region 1.

Next will be a sample question that combines water quality and cost of living.

---

bad4 (Only if defwat4=3)

You indicated that you have no preference between two regions whose only difference is that one has better water quality than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of lakes and rivers are safe and clean when you could move to a region with more rivers that are safe and clean that is alike in all other ways?

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the water quality question again

---

colrem

We would like to ask you one more sample question to make sure we explained both cost of living and water quality clearly.

Remember, the cost of living is the amount of money that your family spends each year for things like food, clothing, and rent or mortgage.

Also remember that water quality in a region is the percent of the total acres of lakes and miles of rivers in the region which are safe for swimming, fishing, and have a healthy environment.

---

lask

Cost of Living and Water Quality Questions

This sample question combines the two ideas explained earlier. Remember that these regions are the same in all other ways, including the number of lakes and rivers near your home.

Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$350 More Expensive	$100 More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

---

lbad (Only if lask=1)

The question was not clear.

You chose to move to the region with worse water quality and a

higher cost of living.

You could have chosen a region with better water quality and a lower cost of living that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

If you do not want to change your answer, press the '9' key.

---

lgood (Only if lask=2)

The Region you chose, Region 2, has better water quality and a lower annual cost of living than Region 1.

Now we would like to ask some more questions like these, but whose answers depend more on how you value water quality and cost of living differences.

---

lbad2 (Only if lask=3)

You indicated that you have no preference between two regions whose only difference is that one has a lower cost of living and better water quality than the other.

Are you sure that you don't care whether you would move to a region where it is more expensive to live and where a lower proportion of lakes and rivers are safe and clean? After all, you could move to a region with a lower cost of living and where more lakes and rivers are clean that is alike in all other ways.

1. Yes, I'm sure that I have no preference.

2. No, I'm not sure, ask the question again.

---

aska

We would like to ask you some more questions like these. However, in these questions, one region will have a lower annual cost of living and the other will have higher water quality.

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 More Expensive	$350 More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	50% Good Water Quality	65% Good Water Quality	

(If aska=3 then the survey skips to lrdef)

---

askb (Only if aska=1)

What if Region 1, the region with a lower cost of living, had an annual cost of living $200 higher instead of $100 higher.

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 $200 New	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

(If askb=3 then the survey skips to lrdef)

---

askc (Only if aska=2)

What if Region 2, the region with better water quality, had 60%

of lake acres and river miles with good water quality instead of

65% of lake acres and river miles with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65% 60% New	

(If askc=3 then the survey skips to lrdef)

---

askd (Only if askb=1)

What if Region 1, the region with a lower cost of living, had an

annual cost of living $250 higher instead of $200 higher.

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 $200 $250 New	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

(If askd=3 then the survey skips to lrdef)

---

aske (Only if askb=2)

What if Region 1, the region with a lower cost of living, had an annual cost of living $150 higher instead of $200 higher.

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 $200 $150 New	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

(If aske=3 then the survey skips to lrdef)

---

askf (Only if askc=1)

What if Region 2, the region with better water quality, had 62% of lake acres and river miles with good water quality instead of 60% of lake acres and river miles with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65% 60% 62% New	

(If askf=3 then the survey skips to lrdef)

---

askg (Only if askc=2)

What if Region 2, the region with better water quality, had 55%

of lake acres and river miles with good water quality instead of

60% of lake acres and river miles with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65% 60% 55% New	

(If askg=3 then the survey skips to lrdef)

---

askh (Only if askd=1)

What if Region 1, the region with a lower cost of living, had an

annual cost of living $300 higher instead of $250 higher.

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 $200 $250 $300 New	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

(If askh=3 then the survey skips to lrdef)

---

aski (Only if askh=1)

What if Region 1, the region with a lower cost of living, had an annual cost of living $350 higher instead of $300 higher.

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100	$350	
	$200		
	$250		
	$300		
	$350 New		
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

---

aibad1 (Only if aski=1)

You chose to move to the region with worse water quality.

You could have chosen a region with better water quality that is alike in all other ways.

Are you sure you would prefer a region with worse water quality when you could move to a region with better water quality?

1. Yes, I'm sure that I prefer the region with worse water quality
2. No, I'm not sure, ask the question again

---

aibad3 (Only if ask1=3)

You indicated that you have no preference between two regions

whose only difference is that one has better water quality than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of lakes and rivers are safe and clean when you could move to a region with more rivers that are safe and clean that is alike in all other ways?

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the question again

---

askj (Only if askg=2)

What if Region 2, the region with better water quality, had 50% of lake acres and river miles with good water quality instead of 55% of lake acres and river miles with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100	$350	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65% 60% 55% 50% New	

---

ajbad2 (Only if askj=2)

You chose to move to the region with a higher cost of living.

You could have chosen a region with a higher cost of living that is alike in all other ways.

Are you sure you would prefer a region with a higher cost of living when you could move to a region with a lower cost of living?

1. Yes, I'm sure that I prefer the region with higher cost of living
2. No, I'm not sure, ask the question again

---

ajbad3 (Only if askj=3)

You indicated that you have no preference between two regions whose only difference is that one has a lower cost of living than the other.

Are you sure that you don't care whether you would move to a region where it is more expensive to live when you could move to a region where it is less expensive to live that is alike in all other ways?

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the question again

---

lrdef

Differences in Water Quality Between Lakes and Rivers

Some questions in this survey have asked you to choose between regions based on water quality for both lakes and rivers.

Now, we would like to ask you some questions that ask you to choose between regions based upon water quality differences where lakes have a different level of water quality than rivers.

---

lrpref

Which is more important to you?

1. Good water quality for lakes

2. Good water quality for rivers

3. Both are equally important to me

---

lrask0

Which of the two regions below would you choose if you had to move to one of them? Remember that both regions are alike in all other ways to where you live now, including the number of lake acres and river miles in your region.

Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50% Good River Quality	75% Good River Quality	
Percent of lake Acres With Good Water Quality	75% Good Lake Quality	50% Good Lake Quality	

(If lrask0=3 then the survey skips to defuse1)

---

lrask1 (Only if lrask0=1)

What if the region with better water quality for lakes had a lower percentage of lakes with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75%	
Percent of lake Acres With Good Water Quality	75%	50%	

65% New

(If lrask1=3 then the survey skips to defuse1)

---

lrask2 (Only if lrask0=2)

What if the region with better water quality for rivers had a

lower percentage of rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75%	
Percent of lake Acres With Good Water Quality	75%	50%	

65% New

(If lrask2=3 then the survey skips to defuse1)

---

lrask3 (Only if lrask1=1)

What if the region with better water quality for lakes had a

lower percentage of lakes with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75%	
Percent of lake Acres With Good Water Quality	75% 65% 55% New	50%	

(If lrask3=3 then the survey skips to defuse1)

---

lrask4 (Only if lrask1=2)

What if the region with better water quality for lakes had a

higher percentage of lakes with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75%	
Percent of lake Acres With Good Water Quality	75% 65% 70% New	50%	

(If lrask4=3 then the survey skips to defuse1)

---

lrask5 (Only if lrask2=1)

What if the region with better water quality for rivers had a

higher percentage of rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river	50%	75%	
Miles With Good		65%	
Water Quality		70% New	
Percent of lake	75%	50%	
Acres With Good			
Good Quality			

(If lrask5=3 then the survey skips to defuse1)

---

lrask6 (Only if lrask2=2)

What if the region with better water quality for rivers had a

lower percentage of rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river	50%	75%	
Miles With Good		65%	
Water Quality		55% New	
Percent of lake	75%	50%	
Acres With Good			
Water Quality			

(If lrask6=3 then the survey skips to defuse1)

---

lrask7 (Only if lrask3=1)

What if the region with better water quality for lakes had a

lower percentage of lakes with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference

Between Regions

Percent of river Miles With Good Water Quality	50%	75%
Percent of lake Acres With Good Water Quality	75% 65% 55% 50% New	50%

---

lr7bad1 (Only if lrask7=1)

You chose to move to the region with worse water quality for lakes.

You could have chosen a region with better water quality for lakes that is alike in all other ways.

Are you sure that you would prefer a region where a lower proportion of lakes are safe and clean when you could move to a region with more lakes that are safe and clean that is alike in all other ways?

1. Yes, I'm sure that I prefer the region with worse lake quality
2. No, I'm not sure, ask the question again

---

lr7bad3 (Only if lrask7=3)

You indicated that you have no preference between two regions whose only difference is that one has better water quality for lakes than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of lakes are safe and clean? After all, you could move to a region with more lakes that are

safe and clean that is alike in all other ways.

1. Yes, I'm sure that I have no preference

2. No, I'm not sure, ask the question again

---

lrask8 (Only if lrask6=2)

What if the region with better water quality for rivers had a lower percentage of rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75% 65% 55% 50% New	
Percent of lake Acres With Good Water Quality	75%	50%	

---

lr8bad2 (Only if lrask8=2)

You chose to move to the region with worse water quality for rivers.

You could have chosen a region with better water quality for rivers that is alike in all other ways.

Are you sure that you would prefer a region where a lower proportion of rivers are safe and clean when you could move to a region with more rivers that are safe and clean that is alike in all other ways?

1. Yes, I'm sure that I prefer the region with worse river quality

2. No, I'm not sure, ask the question again

---

lr8bad3 (Only if lrask8=3)

You indicated that you have no preference between two regions whose only difference is that one has better water quality for rivers than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of rivers are safe and clean? After all, you could move to a region with more rivers that are safe and clean that is alike in all other ways.

1. Yes, I'm sure that I have no preference

2. No, I'm not sure, ask the question again

---

defuse1

Water Quality Uses

It is possible for a lake or river to have good quality for one use, but not for other uses. This means that a single region can have different levels of water quality for different uses or dimensions of water quality.

Some of the questions in this survey will ask you about three dimensions of the quality of lakes and rivers:

* Whether the lake or river has fish that are safe to eat,
* Whether the lake or river is a safe place to swim, and
* Whether the lake or river has a healthy aquatic environment.

Press any key to learn more about these categories

---

defuse2

Fish Consumption

A lake or river is good for fish consumption if fish caught in the lake or river are safe for you to eat.

A lake or river is not good for fish consumption if fish caught in the lake or river are not safe for you to eat.

How important is it to you that lakes and rivers in your region be good for fish consumption?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

---

defuse3

Swimming

A lake or river is good for swimming if prolonged contact with the water in the lake or river will not make you sick.

A lake or river is not good for swimming if prolonged contact with the water can make you sick.

How important is it to you that lakes and rivers in your region be good for swimming?

1. Not at all important
2. Somewhat important

3. Quite important

4. Very important

---

defuse4

Aquatic Environment

The aquatic environment is good if the lake or river supports many plants, fish, and other aquatic life.

The aquatic environment is not good if the lake or river supports only a small number plants, fish, and other aquatic life, or cannot support some kinds of aquatic life at all.

How important is it to you that lakes and rivers in your region have a good aquatic environment?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

---

defuse6

Because a region has more than one lake and river, these three dimensions of water quality will be described in terms of percent good.

For example, if all the acres of lakes and miles of rivers in a region are good for swimming and if half have a good aquatic environment, then that region could be described like this:

Percent of Water
With Good Quality:

Swimming: 100%

Aquatic Environment: 50%

---

ask1 (The survey is split into four groups, differing in the percentages presented in the questions)

Imagine again that you must move to another region of the country.

You have narrowed your choices to the regions below. They differ

only in the level of water quality for each of three uses of water.

Which region would you prefer?

	1. Region 1	2. Region 2	3. Region 3
Fish Safe to Eat	50% Good	25% Good	75% Good
Swimming	25% Good	75% Good	50% Good
Aquatic Environment	75% Good	50% Good	25% Good

---

ask2

Imagine again that you must move to another region of the country.

You have narrowed your choices to the regions below. They differ

only in the level of water quality for each of three uses of water.

Which region would you prefer?

	1. Region 1	2. Region 2	3. Region 3
Fish Safe to Eat	50% Good	75% Good	25% Good
Swimming	25% Good	50% Good	25% Good
Aquatic Environment	50% Good	25% Good	75% Good

---

ask3

Imagine again that you must move to another region of the country. You have narrowed your choices to the regions below. They differ only in the level of water quality for each of three uses of water. Which region would you prefer?

	1. Region 1	2. Region 2	3. Region 3
Fish Safe to Eat	50% Good	25% Good	75% Good
Swimming	50% Good	50% Good	25% Good
Aquatic Environment	50% Good	75% Good	25% Good

---

ask4

Imagine again that you must move to another region of the country. You have narrowed your choices to the regions below. They differ only in the level of water quality for each of three uses of water. Which region would you prefer?

	1. Region 1	2. Region 2	3. Region 3
Fish Safe to Eat	25% Good	75% Good	50% Good
Swimming	50% Good	25% Good	25% Good
Aquatic Environment	50% Good	25% Good	50% Good

---

aest0

Other aspects of water quality do not affect whether a lake or river is safe to use, but may affect your enjoyment of activities there.

Two such aspects are whether the water in the lake or river is:

* Smelly, meaning that the water in the lake or river has an unpleasant odor, even though it is otherwise good.

* Cloudy, meaning that the water in the lake or river is dark brown from sediment, green from algae, or is colored or murky for any other reason, even though it is otherwise good.

---

impsmell

How important is it to you that water in lakes and rivers not be smelly?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

---

impcldy

How important is it to you that water in lakes and rivers not be cloudy?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

---

aest1

Imagine again that you must move to another region of the country. You have narrowed your choice to two regions. They differ in cost

of living and whether water in the region is smelly and cloudy. Both regions have 50% Good Water Quality. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 Per Year	$100 Per Year	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest2 (Only if aest1=1)

What if Region 1, the region with water that is clear and not smelly, had a cost of living increase of $300 per year (rather than $200 in the previous question)? Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 $300	$100	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest3 (Only if aest1=2)

What if Region 1, the region with water that is clear and not smelly, had a cost of living increase of $150 per year (rather than $200 in the previous question)?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 $150	$100	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest4 (Only if aest2=1)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$400 per year (rather than $300 in the previous question)?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 $300 $400	$100	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest5 (Only if aest2=2)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$250 per year (rather than $300 in the previous question)?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 $300 $250	$100	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest6 (Only if aest3=1)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$175 per year (rather than $150 in the previous question)?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Cost of Living Increase	$200 $150 $175	$100	
Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy	

---

aest7 (Only if aest3=2)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$125 per year (rather than $150 in the previous question)?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions

Cost of Living Increase	$200 $150 $125	$100

Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy

---

aest8 (Only if aest4=1)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$500 per year (rather than $400 in the previous question)?

Now which region would you prefer?

1. Region 1 2. Region 2 3. No Preference Between Regions

Cost of Living Increase	$200 $300 $400 $500	$100

Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy

---

aest9 (Only if aest7=2)

What if Region 1, the region with water that is

clear and not smelly, had a cost of living increase of

$100 per year (rather than $125 in the previous question)?

Now which region would you prefer?

1. Region 1 2. Region 2 3. No Preference Between Regions

Cost of Living Increase	$200 $150 $125	$100

$100

Aesthetic Water Qualities	No Smell Clear	Smelly Cloudy

source0

Sources of Pollution

Pollution in lakes and rivers that hurts water quality can come from different sources. We will talk about two sources of pollution:

* Animal Wastes, where rain runoff from animal holding areas on farms can wash animal wastes into lakes and rivers.

* Industrial Toxic Wastes, where toxic chemicals from businesses pollute lakes and rivers.

source1 (Subjects are only asked either the source set or the sourceb set)

We would like to ask you some questions about how you feel about sources of pollution and water quality. Keep in mind that these regions are the same in all other ways, including the number of acres of lakes and miles of rivers near your home. The regions are not different in the types of industries in the regions, just the ones polluting lakes and rivers. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality:	75% Good Water Quality	75% Good Water Quality	
Source of	Animal	Industrial	

Pollution for Lakes and Rivers	Wastes	Toxic Wastes

(If source1=3 then the survey skips to opennew)

source2 (Only if source1=1)

What if the animal waste pollution in Region 1 caused a lower

percentage of lakes and rivers in that region to have good

water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75% 60% New	75%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source2=3 then the survey skips to dbag)

source3 (Only if source1=2)

What if the industrial toxic waste pollution in Region 2 caused

a lower percentage of lakes and rivers in that region to have good

water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75%	75% 60% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source3=3 then the survey skips to dbsrct)

source4 (Only if source2=1)

What if the animal waste pollution in Region 1 caused a lower

percentage of lakes and rivers in that region to have good

water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75% 60% 45% New	75%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source4=3 then the survey skips to dbag)

source5 (Only if source2=2)

What if the animal waste pollution in Region 1 caused a lower

percentage of lakes and rivers in that region to have good

water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75% 60% 65% New	75%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source5=3 then the survey skips to dbag)

source6 (Only if source3=1)

What if the industrial toxic waste pollution in Region 2 caused a lower percentage of lakes and rivers in that region to have good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75%	75% 60% 65% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source6=3 then the survey skips to dbsrct)

source7 (Only if source3=2)

What if the industrial toxic waste pollution in Region 2 did not cause such a low percentage of lakes and rivers in that region to have good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75%	75% 60% 45% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source7=3 then the survey skips to dbsrct)

source8 (Only if source4=1)

What if the animal waste pollution in Region 1 caused a lower percentage of lakes and rivers in that region to have good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	75% 60% 45% 30% New	75%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If source8=3 then the survey skips to dbag)

sourceb1 (Subjects are only asked either the source set or the sourceb set)

We would like to ask you some questions about how you feel about sources of pollution and water quality. Keep in mind that these regions are the same in all other ways, including the number of acres of lakes and miles of rivers near your home. The regions are not different in the types of industries in the regions, just the ones polluting lakes and rivers. Which region would you prefer?

1. Region 1	2. Region 2	3. No Preference Between Regions

Percent of Water With Good Quality:	50% Good Water Quality	50% Good Water Quality
Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb1=3 then the survey skips to opennew)

sourceb2 (Only if sourceb1=1)

What if the Region 2, the region with industrial toxic waste pollution, had a higher percentage of lakes and rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50%	50% 65% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb2=3 then the survey skips to dbag)

sourceb3 (Only if sourceb1=2)

What if the Region 1, the region with animal waste pollution, had a higher percentage of lakes and rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference

			Between Regions
Percent of Water With Good Quality	50%	50%	
	65%	New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb3=3 then the survey skips to dbsrct)

sourceb4 (Only if sourceb2=1)

What if the Region 2, the region with industrial toxic waste pollution, had a higher percentage of lakes and rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50%	50%	
		65%	
		80%	New

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb4=3 then the survey skips to dbag)

sourceb5 (Only if source2b=2)

What if the Region 2, the region with industrial toxic waste pollution, had a higher percentage of lakes and rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50%	50% 65% 60% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb5=3 then the survey skips to dbag)

sourceb6 (Only if source3b=1)

What if the Region 1, the region with animal waste

pollution, had a higher percentage of lakes and rivers with

good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50% 65% 60% New	50%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb6=3 then the survey skips to dbsrct)

sourceb7 (Only if sourceb3=2)

What if the Region 1, the region with animal waste

pollution, had a higher percentage of lakes and rivers with

good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50% 65% 80% New	50%	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb7=3 then the survey skips to dbsrct)

sourceb8 (Only if sourceb4=1)

What if the Region 2, the region with industrial toxic waste pollution, had a higher percentage of lakes and rivers with good water quality?

Now which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality	50%	50% 65% 80% 95% New	

Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes

(If sourceb8=3 then the survey skips to dbag)

dbsrct2

Your responses to the previous questions show that you place a higher value on reducing toxic chemical pollutants.

We would like to know why.

Do you believe that toxic chemical wastes pose a greater health

risk than agricultural wastes?

1. Yes 2. No

(Subjects who are asked the above question now skip to opennew)

---

dbag

Your responses to the previous questions show that you place a

higher value on reducing animal waste pollutants.

We would like to know why.

---

dbag2

Your responses to the previous questions show that you place a

higher value on reducing animal waste pollutants.

We would like to know why.

Do you believe that animal wastes pose a greater health

risk than toxic chemical wastes?

1. Yes 2. No

Open1 (1/3 of subjects get a range of 50% to 65% Good Water Quality
1/3 of subjects get a range of 25% to 40% Good Water Quality
1/3 of subjects get a range of 75% to 90% Good Water Quality)

Yes / No Policy Questions

Imagine again that you have recently moved to another region

of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would

increase water quality in your region from 50% Good to 65% Good.

The policy would also improve water in a region downstream from

you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $250 per year.

Would you be in favor of this policy?

1. Yes 2. No

Open2 (Only if Open1=1)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $350 per year (rather than $250 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open3 (Only if Open1=2)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good.

The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $150 per year (rather than $250 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open4 (Only if Open2=1)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $500 per year (rather than $350 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open5 (Only if Open2=2)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would

increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $300 per year (rather than $350 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open6 (Only if Open3=1)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $200 per year (rather than $150 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open7 (Only if Open3=2)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $100 per year (rather than $150 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open8 (Only if Open4=1)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $750 per year (rather than $500 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

Open9 (Only if Open7=2)

Let's consider this policy question again

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good. The policy would also improve water in a region downstream from you by 15%, though you do not think you will visit that region.

This policy, through additional taxes, would increase your cost of living by $50 per year (rather than $100 in the previous question). Would you be in favor of this policy?

1. Yes 2. No

---

demog0

That is all the questions we will ask you about water quality.

We would like to ask you some final questions about yourself.

---

demog1

Are you male or female?

1. Male
2. Female

---

demog2

Are you married?

1. Yes
2. No

---

demog3

Which racial or ethnic background best describes you?

1. White
2. African American
3. Hispanic
4. Asian or Pacific Islander
5. Other
6. I prefer not to answer this question

---

demog4

What is your age?

1. 18 - 25 years old
2. 26 - 35 years old
3. 36 - 45 years old
4. 46 - 55 years old
5. 56 - 65 years old
6. Over 65 years old

---

demog5

What is the highest level of education that you have completed?

1. 8th grade or less
2. 9th - 12th grade
3. High school graduate
4. 13 - 15 years (some post-high school education)
5. College graduate
6. Some post-college education

---
demog6a

We would like to ask you some questions about your employment status.

Are you currently employed?

1. Yes 2. No

---
demog6b (Only if demog6a=1)

Is that full or part time employment

1. Full time 2. Part time

---
demog6c

We would like to ask you some questions about your employment status.

Are you retired?

1. Yes 2. No

---
demog6d

Are you a full-time student?

1. Yes 2. No

---
demog6e

Are you a full-time homemaker?

1. Yes 2. No

---
demog7

What was your total family income last year?

1. $0 - $5,000

2. $5,000 - $10,000

3. $10,000 - $15,000

4. $15,000 - $20,000

5. $20,000 - $30,000

6. $30,000 - $50,000

7. $50,000 - $100,000

8. More than $100,000

9. I prefer not to answer this question

---

zipq

What is your five digit Zip Code?

Type your Zip Code then press the enter key

Envorg

Environmental Defense Fund

Greenpeace

National Audubon Society

National Wildlife Federation

Nature Conservancy

Natural Resources Defense Council

Sierra Club

Are you a member of any of the above organizations?

1. Yes 2. No

Pret1

Where did you take the survey?

1. On my own computer at home

2. On my work computer at work

3. On a neighbor's or friend's computer

4. At a Kinko's near my home

5. None of these

Pret2

Did you have any problems using the diskette to

run the survey program?

1. Yes

2. No

Pret3

How did you feel about the length of the survey?

1. Shorter than I expected

2. About the right length

3. Longer than I expected

4. Too long

Pret4

Did you have any problem understanding any of the

questions in the survey?

1. Many questions were unclear or confusing

2. A few questions were unclear or confusing

3. The questions were clear and understandable

4. Some questions seemed overly simple

---

endq

You have reached the end of the survey. Thank you for

participating in our survey on water quality. Your answers and the answers of other survey takers will be used to help the government understand how you and others value water quality.

Please remember to place the survey disk in the return envelope and put it in the mail.

Press any key to end the survey.

Press any key and the survey will end

Attachment 3: Pilot Study Report

DRAFT 28 May, 1998

THE VALUE OF CLEAN LAKES, RIVERS, AND STREAMS:

THE ITERATIVE CHOICE APPROACH[†]

by

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Preliminary Draft Report: DO NOT CITE

THE VALUE OF CLEAN LAKES, RIVERS, AND STREAMS:
THE ITERATIVE CHOICE APPROACH

EXECUTIVE SUMMARY

1. The purpose of this study was to establish benefit values for water quality improvements for lakes, rivers, and streams. These values were intended to be relevant to EPA policy evaluations. Results reported here are for a pre-test as a prelude to a larger national study.

2. Previous water quality benefits assessments have utilized the water quality ladder as the reference point. However, the hierarchical ranking that all water that is drinkable is swimmable, and that all water that is swimmable is fishable, is not valid. Moreover, it does not correspond to the water quality rating systems used in the National Water Quality Inventory, which is the framework used for this study.

3. The National Water Quality Inventory defines water quality in terms of the percent of water in a state that is good for fishing, swimming, or aquatic life.

4. The structure of the survey instrument that we developed involved the use of an interactive computer survey consequently requiring the use of in-person interviews. Two approaches were evaluated in this study. Phase 1 used a random telephone approach to contact potential survey participants, who then took the survey at a central location. Phase 2 utilized mall intercepts.

5. The pre-test site for the Phase 1 central location interviews was Research Triangle Park, North Carolina. For the mall intercepts the sites were Cary, NC; Charlotte, NC; Denver, CO; and Colorado Springs, CO.

6. The survey established benefit values for improvements in water quality. These were calculated based on responses to paired comparisons involving water quality changes and cost-of-living levels for regions to which the respondent might move. Overall, respondents averaged approximately a $20 value per unit increase in the water quality level. There is not a strong variation in this valuation by locale.

7. The water quality valuations also were linear with respect to the baseline water quality. Thus, they were not sensitive as to whether the initial water quality level was low, medium, or high.

8. As a cross check on the paired comparison approach, the survey also incorporated a referendum question near the end of the survey. The referendum responses yielded similar results. Analyses of the various quartiles of the paired comparison valuations indicate that the referendum values are strongly correlated with these amounts.

9. The survey also elicited the relative valuation of improvements in the water quality of lakes as opposed to rivers and streams. Lakes have the higher relative value among the respondents in terms of the mean effect.

10. Individuals may also value water quality attributes beyond simply the overall EPA water quality rating. The attributes for which the respondents were willing to pay an additional amount to reduce these attributes included whether

the water was smelly, cloudy, or polluted by toxic chemicals.

11. In addition to these use values, this survey also explored the non-use value that respondents attach to improvements in water quality in regions where they do not live. These values were quite substantial on the order of half of the value of the use benefit amount.

12. The survey also explored the relative valuations of water quality for different dimensions. Swimming had the highest value, followed by valuation of the aquatic environment, with the lowest valuation being water quality for fishing.

This report summarizes the research findings to date on our EPA supported research project directed at establishing the economic value of improvements in the water quality of lakes, rivers, and streams. This is a preliminary report on our results from the pilot project phase and does not report national estimates valid for benefit assessment. While the sample size is reasonably extensive, it is not a national random sample. Without a national study, we do not recommend that these results be used to place dollar values on water-quality benefits for policy purposes.

The sections in the report below outline the research task, the research approach, and the findings of our study. The general methodology used to obtain valuations is in the spirit of the literature on contingent valuation and environmental benefit surveys more generally. However, we believe that the approach we have devised is distinctive in that we construct individual preferences based on the individual attributes involved. Thus, our hope is that this research will be of methodological as well as substantive interest.

I. The Research Task

The overall focus of this study was on developing values for improvements in water quality for lakes, rivers, and streams. Thus, water quality changes for estuaries, oceans, groundwater, and other excluded categories are not part of the focus of the study.

The policy-oriented nature of our analysis dictated much of the overall structure of the research approach. The overall objective was to develop benefit values that could be used in conjunction with the water quality data used by the EPA to assess the benefits of changes in water quality. So that these results would be operational for the EPA it was important that the EPA data structure be used as the frame of reference.

Previous studies had used a water quality ladder as an index of different levels of water quality. Exhibit 1 presents a representative water quality ladder modeled after that used by Mitchell and Carson in their contingent valuation study of the quality of fresh water. Water quality rankings are on an ordinal scale from zero to ten. At the top of the scale is drinkable water that is safe to drink and for all other uses listed below. The components of the water quality hierarchy are: water that is swimmable, water that is fishable, water that is boatable, and water that is not safe for any of these

uses. This water quality hierarchy captured the previous EPA scientific understanding of different levels of water quality.

At this juncture it is also worth noting that this water quality ladder formulation also has attractive properties from a survey standpoint. By using a single ladder, gradations in water quality can be converted into a single dimension. The cognitive difficulties for respondents in terms of the thinking about water quality consequently will be less than if they have to consider a multi-dimensional good in which each of the attributes may change independently of one another. One drawback of using the water quality ladder are that the ordinal quality ranking may not have cardinal significance. However, even it that problem is avoided the ladder becomes strictly inappropriate if the implied hierarchical ranking may not in fact hold.

The basic assumption of the water quality ladder is that all water that is drinkable is also swimmable, that all water that is swimmable is also fishable, and that all water that is fishable is also boatable. Exhibit 2 shows that this relationship does not hold based on actual data pertaining to the water quality ladder reference points using water quality information from the U. S. EPA's Water Quality Inventory. These results are for the nation as a whole, and the statistics vary by state. Consider first the values for lakes. Overall, 85 percent of the water is drinkable but only 79 percent is swimmable, violating the ladder hierarchy. Similarly, 82 percent of the water is fishable, which is below the amount of water that is drinkable. The hierarchy also fails to hold for rivers, for which 87 percent of the water is boatable and 95 percent of the water is fishable.

The failure for the water quality rankings to adhere to the water quality ladder structure is even more pronounced when considering individual state data. Of the 28 states with lake data for both fishing and swimming, 18 of the states (or 64 percent) do not obey the hierarchy in the water quality ladder. Similarly, of the 29 states with river data for both fishing and swimming, 15 of them (or 52 percent) do not obey the water quality ladder. Adherence to the water quality ladder is consequently the exception rather than the rule.

In recognition of these and other deficiencies of the single dimensional ranking of water quality, EPA has developed several dimensions of water quality to reflect these different characteristics. Our survey design uses the following three dimensions of water quality:

1. Aquatic life support

   The water body supports many plants, fish, and other aquatic life.

2. Fish consumption

   Fish caught in the water body are safe to eat.

3. Primary contact recreation-swimming.

   Prolonged contact with the water in the water body will not cause illness.

Within these three categories, each state's water has a particular score that reflects the percentage of water that meets the water quality standards with respect to that particular dimension. Thus, the quality of the water with respect to fish consumption, aquatic life support, and swimming receive independent rankings with respect to each of these dimensions as opposed to combining the rankings in terms of a composite index of overall water quality.

Exhibit 3 illustrates a page of water quality inventory data for one particular state. EPA has similar information for other states that can be used in projecting benefit levels associated with changes in the water quality index values with respect to each of the quality dimensions. It is noteworthy that because the rating of each dimension is presented with respect to the percent of water that meets certain quality levels, the quantitative scores do in fact have quantitative significance and are not simply qualitative rankings. The valuation task requires, however, that some kind of metric be constructed to both establish tradeoffs across the water quality dimensions as well as tradeoffs between improved water quality and money. Thus, the cognitive task that will be posed in our survey will be much more complex than would be encountered using a single water quality metric. The advantage of this more complex structure is that it is related both to our current understanding of the scientific structure of the problem and to EPA's valuation needs.

II. General Survey Approach

As in contingent valuation studies, the survey approach that we use involves individual interviews regarding hypothetical choices involving economic and environmental commodities. However, the overall structure we utilize is more abstract than in traditional contingent valuation. Under the standard approach, the respondent considers a detailed

characterization of some environmental good for which the respondent is asked to pay some amount to improve its quality. Our approach instead is to determine individual preferences based on the valuation of underlying attributes. To reduce the cognitive demands of the task, the survey structure establishes a valuation of each of the component attributes of water quality, determines these tradeoff values, and also assesses the overall conversion of the water quality component improvements into a dollar valuation of water quality more generally. Although this analysis begins with an assumption of linearity in terms of the valuation of any particular attribute, we test this assumption in a variety of ways. The key aspect of the survey structure is that respondents will consider moves to a hypothetical location for which different components of the choice will be varied. This method contrasts with the need for elaborate detail required in a conventional contingent valuation approach

The key structure of this study is based on an interactive computer survey in which respondents considered a task in which they could move to one of two different locations. These locations differed in terms of water quality dimensions and cost of living. The computer then framed subsequent choices until the respondent reached the point of indifference. This approach established both their tradeoff rates across water quality dimensions as well as their tradeoff rate between improved water quality and money. The details of the survey will be considered much more extensively below.

A. Simplifying the Task

Our survey design considered three dimensions of water quality described in the National Water Quality Inventory. These dimensions are the ones most commonly reported in the water quality inventory state data. Because of the different aspects addressed by these attributes, subjects can understand that EPA can influence water quality in different ways by considering each of these dimensions in turn. The three dimensions of water quality included were aquatic life support, fish consumption, and primary contact recreation-swimming, while the excluded water quality category was drinking water supply. We explicitly excluded drinking water from the study because even though it is a use that is often considered when people think of water being safe or unsafe, it is outside the scope of our survey design. From a policy standpoint, drinking water is distinct since it can be removed from a lake or river and treated before consumption. Unlike other uses, it is also a more easily replaceable use (through bottled water) than the visit-related uses.

For each of these water quality dimensions, EPA rates the water quality along five different qualitative scales in terms of the level of water quality. For convenience, and to assist respondent understanding, we combine the highest two quality rating categories as indicating that the water is "*Good*." Under the EPA criteria, water meeting this standard is safe to use for the specified use. The three lower water quality categories we label as "*Not Good*." Under the EPA rating system, the water body is unsafe in some way if it is in this category. In terms of the state data table presented in Exhibit 3, *Good* combines the first two columns, and *Not Good* combines the remaining three columns of data.

Our survey design uses the National Water Quality Inventory data only as it pertains to lakes and rivers. In the first parts of the survey, we combine these water quality ratings by presenting lakes and rivers as having the same level of water quality in the survey questions. Later, we include a separate set of questions within the structure of the survey instrument to differentiate an individual's preferences between lake and river water quality.

B. Survey Design

Ideally a survey should elicit values of some standardized water quality improvement. This change in water quality should not be specific to the individual respondent in a way that cannot be generalized to obtain national water quality benefit values. In some respects, this approach is similar to placing all subjects within the context of John Rawls' original position. Each subject will be moving to a hypothetical new region without the specific water quality and availability attributes of the person's current residence.

To avoid the difficulties arising from very local water characteristics, our survey asks subjects to imagine that they are moving to a different region. Moving to another region prevents undue focus on individual local water bodies and permits subjects to consider improvements for a large, well-defined area rather than for their own specific neighborhood alone. Subjects may of course differ in terms of their valuation of water quality, and this valuation may also depend on their current availability of water. As a result, the survey instructs subjects that they will move to an area that has the same volume of lakes and rivers as where they live now. Thus, the valuations that are elicited should be reflective of any regional influences to the extent that they are consequential, but they will do so in a manner that is highly structured. Notice, it also should not elicit responses that relate to a personal circumstance-for example whether they currently live right next to a lake or a river.

The survey also defines what is meant by a region, which is the area within two hours' drive of the subject's home. To better envision what a region entails, and the extent of local lakes and rivers, each subject receives a map showing their state, the lakes and rivers in the state, with a circle defining the two-hour region (see Exhibits 5 and 6).

Exhibit 4 presents a representative cost-of-living water quality tradeoff question. Subjects considered two possible regions to which they could move, each of which is characterized by the increase in the annual cost of living and the percent of lake acres and river miles in that region with good water quality. Respondents then considered a series of such paired comparisons until they reach a point of indifference. This result of this exercise is that it establishes a value of water quality for each respondent in terms of the dollar increase in cost of living that they are willing to incur per one percent improvement in water quality. This value of increasing percent good by 1% will be the principal measure of water quality changes. The value can be derived using a straightforward calculation based on two equilibrating regions, each of which has an associated cost of living and percent of lake acres and river miles with good water quality. In the example shown in Exhibit 4, let us suppose that subjects are indifferent between these two regions. This means they are indifferent to incurring an additional $150 for a 15 percent improvement in water quality. Then each one percent improvement in water quality has a value of $10.

A noteworthy characteristic of the survey approach is that it involves a series of binary choices instead of an open-ended willingness-to-pay format. This iterative choice structure permits subjects to determine their value for water quality by choosing which of two options that they see as more reasonable. A more open-ended format would ask subjects to put a value on a good that has just been defined for them recently and would be a more formidable task.

Each survey question includes two different regional choices as well as a no preference option. The choices define a level of tradeoff between money and water quality. The subject's response demonstrates an upper or lower bound for the subject's value of water quality at the level of tradeoff.

The questions then iterate based on the subject's initial response to either increase or decrease the level of tradeoff between money and water quality. This iteration continues until the subject's answers provide both and upper and lower bounds on their value of water quality or until their answer reaches an extreme high or low value. If an extreme is reached, this survey tests the subject's understanding with a dominated choice question-where one alternative is better

on both cost of living and water quality. Subjects who fail this dominated choice question will be the focus of a separate analysis below as part of the consistency checks to ensure the reliability of the study data.

The features of this choice approach continue throughout the survey. Subjects always make choices that are restricted to two different dimensions. While one could envision multiple dimensions, and it would be valuable to ask questions about multiple dimensions, such questions would exceed individuals' cognitive capabilities. The study considers changes in cost of living, water quality for lakes and rivers, water quality for each of the three different uses, variations in water quality depending on whether the water is cloudy, smelly, or the result of toxic pollutants, as well as the role of nonuse value. In each case, to prevent the task from exceeding their cognitive limitations, the survey approach asks for choices among alternatives that differ on two dimensions. A noteworthy feature of the survey is that subjects also do not consider new domains of choice without extensive preparation. The survey defines new concepts with which the subjects may be unfamiliar. In addition, the survey includes training questions throughout the survey instrument to ensure that subjects understand the concepts being utilized in the survey.

The regional exhibits considered by the survey respondents consisted of maps for the two states in which the interviews were held, North Carolina and Colorado. Exhibit 5 is the map showing one of the North Carolina regions of interest and Exhibit 6 is the map for one of the Colorado regions. Whereas the rest of the survey was undertaken entirely using an interactive computer program approach, the maps were hardcopy exhibits that were handed to the subjects as part of the survey task. These maps were considerably larger than is shown in Exhibits 5 and 6 and the maps were also in color, with blue indicating pertinent water bodies.

The manner in which respondents proceeded through the iterative series of choices is reflected in the decision tree presented in Exhibit 7. This tree indicates how respondents move through a series of questions based on their earlier answers to the survey questions. As can be seen, respondents who value water quality by more (or less) than is indicated by the initial valuation of subsequently pushed into situations in which there is a greater (or lower) valuation of water implied by the choice question. Once the respondent hits the extreme at either the high or low end, there is a dominated choice question included in the survey to ascertain whether the subject has become lax in attending to the survey task. People who fail this test we label as "inconsistent" and do not include them in the statistical analysis.

C. Survey Contents

The survey consisted of ten different sections. By subdividing the survey task into different substantive units, respondents could be engaged in a particular valuation task and their responses could be elicited with respect to a specific tradeoff, avoiding the complicating influences of multiple dimensions that otherwise might be at stake.

1. Lake/river usage. This section of the survey ascertains whether the respondent has used lakes, rivers, and streams recently and also obtains information regarding the character of the use. For example, has the respondent engaged in fishing or swimming? If yes, how often? The primary purpose of these questions is to encourage the respondent to think about the value of these activities in such a way that will motivate the later choices.

2. Question format explanation. This section of the survey introduces the format of most survey questions that will follow. Thus, the intent of this section is to provide a general introduction to the character of the tradeoffs that will be faced, but will not include specific questions to ascertain the cost of living-water quality tradeoff values.

3. Cost of living versus water quality. This is the key section of the survey that is designed to ascertain the rate of tradeoff between increases in cost of living and water quality improvements. The structure of this section utilizes a sequence of paired comparisons until a point of indifference has been achieved.

4. Lake quality versus river quality. This section of the survey determines the individual's rate of tradeoff between lake and river water quality improvement. Using these results it will be possible to ascertain the relative benefit assessment for water quality improvements for these two different classes of water bodies. As in the case of the cost-of-living water quality tradeoffs, this section of the survey as well as subsequent sections will utilize a series of paired comparisons until a point of indifference has been achieved.

5. Water uses tradeoff. In this section, the respondent determines relative tradeoffs for swimming, aquatic environment, and fishing in three paired comparisons, i.e., swimming versus aquatic environment, swimming versus fishing, and fishing versus aquatic environment.

6. Source of pollution. Respondents may not care simply about the overall level of water quality as it has been affected by pollutants, but also about the nature of the pollution that causes the decrease in water quality. A pollution component of particular interest is industrial toxic wastes. Are people more fearful of the decreases in water

quality caused by toxic waste as opposed to conventional pollutants? The section of the survey addresses this issue by assessing rates of tradeoff between pollution due to agricultural wastes and pollution due to industrial toxic wastes.

7. Nonuse values. A major and controversial benefit component in environmental policy areas is the nonuse value that should be placed on environmental improvements. If, for example, the respondent is never likely to visit a particular region in which a water quality improvement will occur, is there nevertheless an economic benefit to the individual from improving the water quality? To explore this issue this section examines the rate of tradeoff between water quality improvements in the person's own region versus water quality improvements in a region which the respondent will not visit. Moreover, this section also analyzes the potential for evaluation of water quality based on the probability that the respondent will visit another region, which can be viewed as a form of economic option value.

8. Aesthetic properties, smelliness and cloudiness. Even if water quality meets a particular level based on the EPA criteria, individuals may also be sensitive to other attributes. The two attributes considered were the smelliness and cloudiness of water. In each case, the survey determines the rate of tradeoff between that attribute and water quality improvements more generally. These results also may be instructive with respect to identifying different demographic groups who place greater weight on these aspects of water quality that are not currently part of EPA's criteria. .

9. Cost of living versus water quality referendum. All previous tradeoffs considered thus far are based on a series of choices among paired alternatives. Here we adopt a referendum approach to assessing the value of water quality. In particular, individuals are asked to determine whether they support a policy referendum in which there will be some associated cost as well as an associated water quality improvement. Asking the water quality valuation question in this alternative way will provide a valuable consistency test on the results above for section three of this survey in which the cost of living versus water quality tradeoff has been elicited through paired comparisons.

10. Demographics. This section of the survey obtains detailed information regarding the demographic characteristics of the respondents. These characteristics are of interest for a variety of reasons. First, analyzing the demographic characteristics is useful in testing whether the respondent group is representative of the population in the same area. Second, analyzing the characteristics of the respondents also is helpful in analyzing how various responses

to questions, such as the valuation of water quality, vary with demographic characteristics. Based on a regression analysis of these valuations in conjunction with information on demographic characteristics, one could project water quality valuation from a sampled population to a broader population.

D. Recruiting and Survey Format

The survey consisted of two different phases. Phase one of the survey involved bringing respondents to a central location after making phone contact with them. This phase is useful in obtaining insight into the potential limitations of this method of recruiting subjects. Phase two involves the use of a series of mall intercepts. This is a lower-cost method of recruiting subjects than paying respondents to come to a central location but one which, as it turned out, also yielded a much more representative sample and more reliable responses.

Exhibits 8 and 10 compare the demographics of the those who participated in Phase 1 to those of the area. As is clear, the process resulted in strong oversampling of highly educated people, older people, and non-minorities. The discussion of the sampling process will clarify how these biases occurred.

The implementation of the Phase 1 portion of the survey took place from August 13, 1997 to August 29, 1997. The incentive of $15 was offered to respondents for taking the survey at a central location. Four callers from a North Carolina marketing research firm recruited respondents using a list of 1,000 phone numbers from a 10 mile radius around the interview location. They placed 2,211 calls to these numbers, and 144 people agreed to take part in the survey. Of this group, 106 showed up to the survey location and completed the survey

The callers described a process by which about one-third of the calls placed actually reached a person. The remainder either reached answering machines, disconnected numbers, or there was no answer to the call. Of the one-third of the calls that were successful in reaching an individual, about one in five people answering the phone agreed to take the survey. Most people called accepted screening questions. Callers were of the opinion that since it was mentioned that the survey was for EPA, most people were agreeable to answer the questions.

The people who refused to take the survey gave a variety of reasons. The reasons most often mentioned were time conflicts, distance to the survey location, traffic in the central location area, or just a thank you saying that they were not interested. Time conflicts often included the fact that a school semester started around the pre-test period for

college-age people and parents of children. Presumably the time conflicts associated with the new school schedule, less free time, and for the college aged not knowing exactly what their schedule would be were reasons for many of the school-related conflicts. Some of the time conflicts were reduced by the availability of evening and weekend times to take the survey.

The central location used for the survey was at the marketing research firm, which is located in the Research Triangle Park area. This area is close to major arteries and centrally located with respect to Chapel Hill, Durham, Raleigh, and Cary, N.C. However, it is not in an urban location, and, as a result, is not as convenient to access as would be, for example, a shopping mall. Mentioning the Research Triangle Park location may have caused some people to decline because of the distance of the travel, but others felt that it added some legitimacy to the offer to participate in this study. It should be noted that the Research Triangle Park area includes many high technology corporate operations as well as research offices of the U. S. EPA. This mix may have in part contributed to the above-average education level of the respondents.

A possible problem in recruiting subjects is that people often refused to participate in the survey on the grounds that since they do not use recreational water they would not have any reason to take the survey. This difficulty may require a change in the call sheet and encouragement by callers for participation even if this is the case. If this difficulty were to occur for the main survey, not simply this pilot, the result would be that we would have a value for water quality that overstates the value for the nation overall to the extent that the non-respondents have a lower valuation.

The screening for participating in this study required that the subject be over age 18 and have a high school diploma. Very few people were disqualified by the screening questions. None of the callers recalled having disqualified anyone though data show that one person was disqualified for being under 18, and 7 more were disqualified for not having a high school diploma. There seem to be no major difficulties with respect to educational group in terms of the ability to take the survey, so that the high school diploma requirement may be removed in the main survey. A few respondents disqualified themselves as being EPA employees, and one disqualified himself because he was a state park ranger. Callers were unsure whether such facts should disqualify people, and there is a need for guidance to be given to the callers when undertaking the main survey. Also, it was apparently inconsistent on the call sheet whether the qualifying

age was 18 or 21. Other caller observations were that people in the sample seemed older than they had expected to reach, and this may reflect the types of people who were at home to answer phones during the calling hours of 6:00 p.m. to 9:00 p.m.

Once people agreed to be respondents, they scheduled a time to take the survey. The first week saw many no-shows, and the callers generally called back to reschedule. After the first week, the marketing firm sent confirmation letters with an enclosed map and this effort seemed to increase the response rate. Weekend times had a higher no-show rate than week-day times, which the marketing researchers did not find surprising.

There were a few cases of self-referrals, meaning that the respondents had someone else take the survey instead of themselves. When this happened, it was either a spouse or in one case a daughter, but in all cases from the same household. This happened a total of eight times out of 100 and was not a significant problem.

Phase two of the study utilized a series of mall intercepts in Cary, NC (49 interviews), Charlotte, NC (53 interviews), Denver, CO (100 interviews), and Colorado Springs, CO (101 interviews). These interviews took place from January 27, 1998 to February 6, 1998. The incentive provided to respondents was $10.

Obtaining a sample of respondents with mall intercepts posed much fewer difficulties than did the phone-central location approach. Respondents could be recruited at the time when they would take the survey so there was not the problem of no-shows, etc. In the discussion below we will compare detailed information concerning the demographic breakdown of the people at each of locations as well as for the central location, showing that the mall intercepts proved to be much more representative of the local population than did the phone-central location approach. Since the central location in the Phase 1 study was closely related to a population area with an extremely high density of, for example, Ph.D. scientists, the high education of the Phase 1 sample may be representative of the extremely localized survey area. However, it is not representative of the entire county or region more generally. Other researchers who have undertaken phone-central location surveys in North Carolina have had a similar experience in attracting respondents who have what appear to be above-average education levels. The cost per completed interview was considerably less for mall intercepts. Section III describes the sample characteristics in detail.

E. Survey Changes Between Phases

Shifting from Phase 1 to Phase 2 involved not only a shift in survey methodology but also a refinement in many of the survey questions. The most important change is that we attempted to alter the format of the first question in each set so that there would be closer to a 50-50 split in terms of the respondents taking either an increase or a decrease in, for example, the value of water quality. At the Research Triangle Park location, for example, 81 percent of the respondents chose a higher water quality given the cost of living increase in that area. After the initial tradeoff question was revised for Phase 2 the percentage of respondents choosing the higher water quality level after the first question was 59 percent. We adopted a similar approach throughout the survey, altering the initial set of choices used to derive the tradeoff in a manner so that roughly half the respondents will choose more of the good and half the respondents will choose less of it given the specified tradeoff level.

III. Sample Characteristics

The demographic breakdowns for the full sample as well as for each component of the sample appear in Exhibit 8. As was indicated above, the Research Triangle Park (RTP) sample tends to be much more highly educated than were the samples at the various mall intercept locations. Overall, the mall intercepts in particular appear to be more successful in recruiting a more diverse population group.

Some of the demographic characteristics vary in the expected fashion. There is greater representation among black respondents for the North Carolina samples, and more representation of Hispanic respondents in Colorado. The environmental membership and water usage responses also indicate that this sample does not include an overwhelming concentration of individuals who are active environmentalists.

Exhibit 9 presents the consistent sample, which consists of the people who give a dominated response once they hit such a corner position. The characteristics of the consistent sample closely parallel those of the full sample in Exhibit 8. We are presenting the consistent sample results here in detail, however, because they will be the focus of the subsequent analysis of the responses. The findings for the full sample are very similar.

Exhibit 10 presents the census demographics that will serve as the reference point for each of the areas. As can be seen, Cary and Raleigh have a much higher proportion of college-educated adults than North Carolina overall, as does Chapel

Hill (not shown). In the analysis below, we will use a dummy code to take out any effect of a particular location that is not accounted for by the demographic variables.

IV. Cost of Living versus Water Quality Tradeoffs

Summarizing, the key aspects of the methodology we are espousing, which will be described in detail below are:

1. Importance of getting respondents to think about the impact of the attributes on their lives
2. Iterative paired choices
3. Choices pit one attribute against another
4. Attributes are balanced in the sense that approximately half the respondents should choose either alternative in the first iteration
5. Include consistency tasks and delete those respondents who do not respond consistently

The main focus of the survey was to obtain an estimate of an individual's tradeoff between money and improvements in water quality. Although later questions are directed at nuances in this valuation, such as differences in the valuation of water quality improvements that affect swimming as opposed to fishing, the first overall tradeoff of concern-and the one that will drive any overall benefit-assessment-will be how respondents value water quality generally. The next sections detail how this valuation is achieved.

Exhibit 11 presents the text of a sample cost of living survey question. The survey defines what the term cost of living is and attempts to engage the respondent in thinking about the importance of cost of living within the context of their overall household expenditures. After establishing this framework, the survey then confronts the respondent with a regional choice in which there is clear dominance, as both regions are otherwise alike except for a difference in their cost of living. In the case that the respondent does choose the low cost of living area, the explanation included in Exhibit 11 is provided, and the dominated question is repeated. Otherwise, the respondent to the section defining water quality.

Exhibit 12 shifts the focus from defining what we mean by cost of living to defining water quality. This question indicates that water quality may differ across regions and that water quality may either be "*Good*" or "*Not Good*," where

the survey defines what it means for water quality to be *Good* or *Not Good*. This section of the survey also clarifies that drinking water is specifically excluded and defines what is meant by the size of the region and the percent change in water quality. The respondent then considers a simple regional choice question where the regions differ only in terms of water quality. Once again, the first choice is deliberately a dominated choice, and individuals failing to choose correctly will be given the explanation that corrects their error and then repeats the question. Exhibit 13 shows the question in which respondents now have to trade off both cost of living as well as water quality. Within the context of this sample question there is a clearcut dominant choice, as Region 2 is less expensive in terms of the increased cost of living and has a higher percentage of water that is of *Good* quality. Individuals failing to recognize the dominated choice and answer the question correctly will once again be taken through the loop that explains the error in their answers. These dominated questions serve both to give the respondents easy questions as they begin, and to give extra training to those who do not understand.

At the bottom of Exhibit 13 we present a tradeoff question that does not involve a dominant choice. Depending on the respondents answer to the question, the subsequent tradeoffs considered by the respondent will be either higher or lower than in the initial tradeoff situation.

Exhibit 14 presents the overall statistics summarizing the water quality cost-of-living tradeoffs. For all the samples as a group, respondents were willing to pay an additional $22.40 per one percent increase in the level of water quality. These amounts ranged from a low value of $20.10 for Colorado Springs to a high of $28.50 for Charlotte. The median responses were much more tightly clustered and lower than the values of the means. With the exception of Cary and Charlotte, the median values are ranged from $11.30 to $13.60 for each one percentage point increase. The fact that the mean values are roughly twice as high as the medians suggests that the distribution of the valuation of water quality is skewed by some respondents having extremely high values for water quality. At this overall simple statistic level, RTP does not appear to be an outlier even though the sample methodology used and the structure of the survey differed somewhat for that sample site.

The structure of the survey that was used to generate these valuation statistics is indicated in the decision tree sketched in Exhibit 15. That tree indicates the branching of the survey based on the individuals' responses to each of the cost-of-

living tradeoff questions. The three columns indicate the three potential answer choices. The top row indicates the implicit tradeoff value associated with the answer choice. The bottom row indicates the percentage of the sample choosing the answer choice. Bold values indicate endpoints of the decision tree. As is indicated, respondents who persistently undervalue or overvalue water quality based on the choice offered continually confront more extreme choices until ultimately they face a dominated decision at the tip of the tree. Respondents who pick the dominated choice are those who are not included in our consistent sample since they do not appear to be attending to the survey task with the desired level of diligence. Imposing this consistency test on the survey results represents a more stringent rationality test than is typically found in environmental valuation surveys.

The regression results that analyzed the determinants of the valuations of cost-of-living and water quality appear in Exhibit 16. The dependent variable is the total dollars of cost of living increase that the respondent is willing to incur in return for an increase in the water quality level of one percentage point. The first set of regression results in Exhibit 16 includes RTP respondents in the sample, and the second set of results excludes this sample group. In each case, separate dummy variables are included to reflect the particular survey location. The only such variable of consequence is that for RTP, which may reflect both the differences in the character of the sample as well as differences in the structure of the survey. Controlling for other factors, RTP respondents are willing to spend roughly $7 less per unit change in water quality than the other survey locations.

A noteworthy aspect of the results is that there is not strong variation in the responses based on region. However, the omitted category Colorado Springs, does not differ significantly in terms of the level of the response from any of the other cities. As indicated above, the only significant difference is that reflected by RTP. From the standpoint of subsequent survey design, this finding suggests that there may not be stark differences across regions in the valuation of water quality other than those that are reflected in the demographic variables included in the equation. If this lack of variation occurs more generally, then it implies that there need not be as many regional sites for the subsequent national survey as would be required if water quality valuations differed starkly from region to region.

Of the other variables in the equation, several are consequential, with the effects tending to be fairly consistent across the two different sets of results in Exhibit 16. For concreteness, let us focus on the findings in the sample excluding

the RTP respondents. Overall, the non-white, non-black minorities tend to have slightly lower valuations than did the other groups. Age is consequential, as the valuation of water quality rises with age but then declines with the square of age. This non-linearity implies that water quality valuation is strongly related to the respondent's age, which is an effect that will carry over to many of the other findings below.

The variables intended to capture the environmental orientation of the respondent were not particularly influential. An important variable that had a consistent impact on water valuation and was consistently significant was whether the respondent had visited a lake or river in the last twelve months. Respondents who met this test valued improvements in water quality at roughly $8 more per unit increase in the water quality level.

Analyzing the determinants of water quality valuation in terms of a value per unit of water quality may not be fully reflective of the character of individual preferences if these valuations differ depending on the level of water quality. If, for example, water quality has a higher value when it is very bad then do improvements in water quality when the value of water quality is quite high, then we would want to recognize this non-linearity when establishing benefit values. The survey can potentially incorporate such non-linearities into the analysis, though doing so would ultimately complicate any benefit assessment figures. As a result, it is important to test whether there are any statistically significant non-linearities in the value of water quality depending on the initial water quality level.

Exhibit 17 provides two panels of information pertaining to these non-linearity tests. Panel A presents overall mean statistics based on three different initial water quality levels. Respondents who considered low water quality levels were confronted with choices in which the initial levels of *Good* water quality ranged from 25 to 40 percent. A second group of respondents considered middle water quality levels ranging from 50 to 65 percent , and a final group saw water quality levels from 75 to 90 percent. The mean valuation per unit of water quality ranges from $20 to $25 across these categories, but the there is no clearcut pattern. For example, water quality valuation is not a steadily increasing function of the level of the initial water quality.

To test for such a possibility more explicitly, Panel B of Exhibit 17 includes a regression analysis in which the lower bound of the water quality level considered by a respondent is presented as a variable with a value of 25, 50, or 75. Once again, there is no evidence of any statistically significant non-linearity in the water quality valuation. Whether

the starting point, in terms of the water quality level is low, medium, or high does not seem to be consequential in terms of how it affects the overall valuation amount. This linearity is an advantage because it suggests that water quality can be evaluated by only testing one initial level. We caution against generalizing about this promising finding until it is replicated in a larger study.

Testing for such a starting point bias is not the norm in contingent valuation studies, though it is a desirable practice. If there had been significant variation, it would not necessarily be an indication of a flawed survey instrument, but it would indicate that attempts to use the results of the study for policy purposes would need to recognize the initial water quality level of the policy region in question before assigning benefit values.

V. Referendum Version of the Cost of Living-Water Quality Tradeoff

The last section of this survey, before eliciting the demographic information, included a referendum version of the cost of living-water quality tradeoff. The referendum question was asked only following around five minutes of questions that elaborated on the value of components of water quality. The purpose of separating the referendum from the paired comparison regional choice was to decrease the chance that respondents would attempt to simply mimic their answers to their earlier questions when answering the referendum version.

Exhibit 18 presents the initial referendum policy choice. In the referendum question , the respondent first moves to another region and is informed of the region's level of water quality. The respondent must then face a choice of whether a government policy will increase the quality of water by a certain amount, where this policy improvement would be paid for by additional taxes. The respondent then indicates whether he or she is in favor of this water quality improvement policy. If the answer is "Yes (No)" then the respondent considers subsequent pairwise comparisons that increase (decrease) the relative dollar value of water quality improvement.

The results of the referendum approach in many respects are quite similar to those found with the pairwise regional choice questions. Exhibit 19 summarizes the mean and median responses for each of the sample groups. The mean referendum response has a low value of $13 per unit increase in water quality for the RTP site, but otherwise is closely clustered in the $20.50 per unit to $27 per unit range. For the median responses, the RTP group once again tends to be

an outlier, though to less of an extent than for the mean responses. As in the earlier results, the distribution of the valuation of water quality is skewed, with some respondents having particularly high values for water quality, leading the mean value to exceed the median in every case. In some instances, however, the mean and median valuations are relatively close so that there is less of a disparity in the mean and median responses for the referendum version of the question than there was for the regional choice pairwise comparison.

Exhibit 20 reports the regression analysis using as the dependent variable water quality valuation based on the referendum questions. Results appear for both the sample including all survey locations as well as for the sample excluding RTP. These results only pertain to the sample of consistent respondents so that the findings in Exhibit 20 closely parallel in terms of their substantive content the results in Exhibit 16. Once again, the non-white, non-black minority members of the sample tend to have a lower value for water quality. Although the age variable is not significant, the squared valued of age is, indicating that the value of water quality tends to diminish with age. Unlike the cost-of-living tradeoff questions, there is no significant effect of visiting a lake or river on the referendum response.

While the respondents' answers to the cost of living and referendum questions were not identical, they were nevertheless related. Exhibit 21 presents different quartiles for the cost of living-water quality tradeoff valuation. For each tradeoff information is included with respect to the mean level of the valuation implied by the referendum question. As is indicated, this value is a steadily increasing function of the pairwise regional choice valuation response. The referendum value for the lowest cost-of living regional choice quartile was $12.89 per unit increase in water quality, and this amount increases to a high of $26.73 for the fourth quartile.

VI. Other Choice Dimensions

The survey distinguished not only the valuation of overall water quality, but also sought to assess how these valuations depended on the particular water body whose quality was affected as well as the character of the change. The four different aspects of water and its quality that were analyzed were the following: lakes versus rivers, cloudy versus not cloudy, smelly versus not smelly, and toxic pollutants versus agricultural wastes. These dimensions of choice should

be distinguished from water quality uses, e.g., swimming, which are separate dimensions of water quality that will be discussed below.

Exhibit 22 presents the survey text for the comparison between lakes and rivers. Subjects first considered general questions to engage them in thinking about the water quality for lakes and rivers. They then considered a sample question dealing with lake and river quality in which one region was dominant. After completing this dominance question, they then considered a series of actual choices between regions, where the regions differed in their relative quality of lakes and rivers. For example, for the case in Exhibit 22 Region 2 has a higher percentage of river miles with *Good* water quality, whereas Region 1 has a higher percentage of lake acres with *Good* water quality.

Exhibit 23 summarizes the aesthetic properties of the water that will be explored, notably whether the water is smelly or cloudy. The questions ask the respondent how important these dimension are and then poses the kind of tradeoff that will be explored in further detail throughout the analysis of aesthetic water quality attributes. In particular, how much of a tradeoff are people willing to make between the percent of *Good* water quality which is smelly and the percent of *Good* water quality without smell. Respondents similarly will consider tradeoffs involving whether the water is cloudy, where once again whether the water is cloudy or smelly does not affect the water quality rating, only the aesthetic characteristics of the water.

To assess whether the source of the pollution is consequential in affecting individuals' valuations, a series of questions explored whether respondents valued pollution stemming from agricultural waste differently from pollution from industrial toxic wastes. Exhibit 24 describes the different sources of pollution and presents the initial tradeoff question. The overall EPA rating of water quality begins as the same irrespective of the source of the pollution. The task for the respondent is whether pollution arising from toxic chemicals that gives rise to the same percent of water with *Good* quality is as valuable as to clean up as pollution arising from agricultural wastes from farms. Once again, respondents faced a series of tradeoffs designed to ascertain their point of indifference between the two types of pollution.

The tradeoff results for the different aspects of water quality indicate that the various dimensions of choice regarding water quality improvements are often influential in determining the overall benefit value. Exhibit 25 presents the overall valuation of lake water quality relative to river water quality. Although the median respondent viewed water

quality improvements in lakes and rivers as being equivalent, the mean valuation was that lake water quality was roughly twice as valuable as improvements in river water quality. These mean responses range from a low value of 1.7 in Cary, NC to a high of 2.41 in Colorado Springs, CO.

The character of the water in terms of its aesthetic characteristics are also influential. For the full sample as is shown in Exhibit 26, respondents are indifferent to a 1.0 percent increase in the percentage of water with *Good* quality that is not smelly and a 3.6 percent improvement in water quality that is smelly. Similarly, respondents shown in Exhibit 27 believe that a 1.0 percent increase in the percentage of water with *Good* quality that is not cloudy is equivalent to a 2.79 percent improvement in water quality that is cloudy. The source of the pollution is particularly influential, as it is shown in Exhibit 28. At the initial water quality levels faced by respondents, individuals in the sample are willing to have a water quality level that is 17 percent lower if the pollution is caused by agricultural wastes rather than by industrial toxic wastes.

Although there is no strong theoretical basis for believing that any particular demographic factors should be influential in affecting these preferences for water quality dimensions, some systematic effects are observed. As is indicated in the regression results in Exhibit 29 for lake water quality versus river water quality, women and non-white, non-black minority respondents value lakes more highly, as do the very old respondents and the more affluent respondents. The analysis of smelly water quality in Exhibit 30 similarly indicates that the female and non-white, non-black minority respondents value smelly water quality more highly. It is noteworthy that members of environmental organizations are significantly less concerned about smelly water quality than good water quality overall. This result is consistent with their more fundamental concern with the overall quality of the environment rather than more superficial aesthetic properties. In the case of the cloudy water analysis in Exhibit 31, however, the environmental organization membership effect falls just short of statistical significance. The main influences are that the two categories of minority respondents value reductions in the cloudiness of water more highly than improvements in water quality overall, which may indicate a distrust of scientific assessments of the water quality levels, compared with that which they can see. The analysis of the greater concern for producers of industrial toxic wastes is shown in Exhibit 32. Concern for industrial toxic wastes

more likely to be held by black respondents and more likely to be held by those who have visited lakes or rivers in the last twelve months (regression analyses for the sample excluding RTP).

VII. Non-Use Benefit Values

The benefits that individuals derive from improvements in water quality stem from the fact that water quality affects how they might use the water, for example, for recreational purposes such as fishing. There may also be a benefit that people derive from improvements in water quality even if they will not use the water. Non-use benefit values have been among the most controversial topics in the literature on contingent valuation. One of the fundamental difficulties in ascertaining the non-use benefit value is developing a survey structure that does in fact isolate true non-use, as opposed to some probabilistic possibility of use or option value that the resource might have. Our survey approach in which individuals move from a region where water quality is improved or some other hypothetical regions where they do not live might experience a water quality improvement potentially overcomes many of the traditional shortcomings in the way in which this issue has been approached. Nevertheless, we regard this examination of non-use benefits as very much exploratory in nature given the difficulty of capturing this benefit component.

Exhibit 33 presents a policy choice question in which individuals can improve water quality in their region or a region of the same size, but which they will never visit. The tradeoff question is consequently posed in terms of what water quality improvement in their current region is equivalent to a water quality improvement in this region they will not visit. Subsequent questions alter the choice by permitting the potential for probabilistic use. In the version of the survey question appearing in this exhibit, the respondent will be making one out of every ten trips that might be taken to a lake or river using this water in the other region. Exhibit 34 shows a question that half respondents saw that suggests the respondent will use this other region for one out of three visits.

Exhibit 35 summarizes the valuation results. In the situations in which there is either no chance of visiting the other region or a small probability, such as 10 percent, respondents need a 0.51 percent improvement in the water quality in their own region to be equivalent to a 1.0 percent improvement in the water quality in the other region. However, if the

probability rises to a 33 percent chance of using the other region, then improvements in the water quality in the other region rise to 59 percent as valuable as improvements in their home region. Indeed, even in the extreme case in which there is no prospect of use of the water in the other region, subjects are willing to sacrifice substantial improvements in the water quality in their home region to make the environment better elsewhere.

Exhibit 36 presents regression results for non-use benefits when there is no chance for visiting the other region. In all cases the demographic factors were not particularly influential, with the exception of household income. The more affluent respondents are more willing to support water quality in another region as compared to improvements in water quality for their home region.

VIII. Uses-Dimensions of Water Quality

The final aspect of the study is an exploration of the valuation of the different uses of the water quality-swimming, aquatic uses, and fishing. In this case the task was to establish relative values for each of these uses. For example, do respondents value improvements in the water quality index for fishing more highly than improvements in aquatic water quality measures?

Exhibit 37 summarizes the different uses of water and their characteristics. In it the survey text informs the respondent of what we mean by these different categories. For example, water that is good for fishing is rated *Good* "if fish caught in the lake or river are safe to eat," whereas a *Good* aquatic environment implies that "the lake or river supports many plants, fish, and other aquatic life." The survey then introduces how each of these components of water quality is rated, which is in terms of its percent *Good* in the region. Since the respondents have already dealt with percent *Good* ratings in detail by the time they consider these tradeoffs, they should be better able to handle the additional dimensions of choice. The structure of the survey considers a sequence of pairwise comparisons in which respondents trade off swimming versus aquatic water quality improvements, swimming versus fishing water quality improvements, and aquatic versus fishing. Because of the nature in which the series of pairwise comparisons are chained, it is possible to determine whether respondents display the appropriate transitivity with respect to their water quality valuation responses. Overall, only 46 of the 348 respondents-or 13.2 percent-displayed inconsistent responses to the different

sets of pairwise comparison valuations. If the subjects had been answering the survey randomly, one would have expected 52 percent of the respondents to be inconsistent for the three uses in some way.

To convey the implications of the relative valuations of water quality, a useful index is the percent of overall water quality improvement that should be allocated to each of the three dimensions. These statistics clearly indicate the relative quantitative importance of the water quality uses. As is shown in Exhibit 39, swimmable water quality accounts for 35 percent of the overall benefit value, aquatic water quality is the second most highly valued at 31.8 percent, and fishable water quality has the lowest valuation-28.4 percent of water quality.

In terms of the demographic factors affecting these valuations, Exhibit 13 reporting of the regression results indicates that swimmable water quality is less highly valued by environmental group members and by people who have visited lakes and rivers in the last twelve months. However, large households tend to value swimming more highly, as one would expect for families with children. The aquatic and the fishable water quality valuations were not strongly influenced by any of the demographic characteristics.

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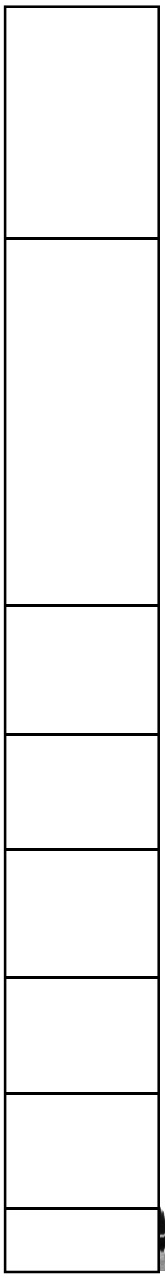
Attachment 4: Pilot Study Report Exhibits

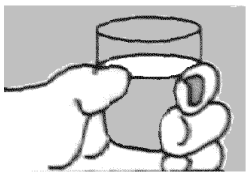
Exhibit 1: The Water Quality Ladder

Best PossibleWater Quality



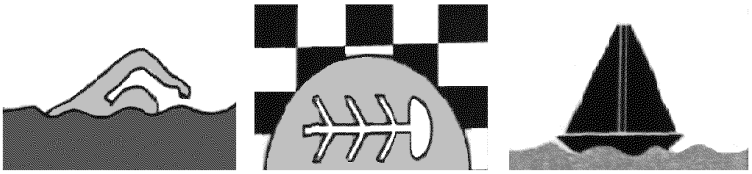
Drinkable

Water is Suitable for Drinking



Swimmable

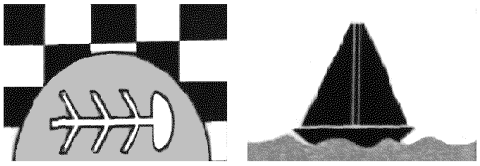
Water is Suitable for Swimming



5

Fishable

Water is Suitable for Fishing



Boatable

Water is Suitable for Boating

0

Water is Not Suitable for Any Use

Worst Possible
Water Quality

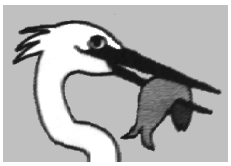
Exhibit 2: Water Quality Ratings Pertinent to the Water Quality Ladder

Water Quality Ladder Feature	National Value for Lakes	National Value for Rivers
Drinkable	**85%**	69%
Swimmable	79%	73%
Fishable	82%	**95%**
Boatable	86%	87%

Exhibit 3: Water Quality Inventory State Page

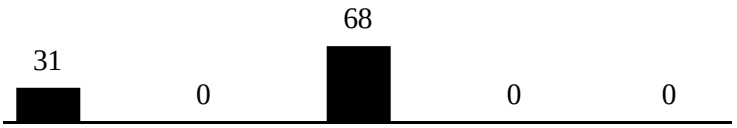
Individual Use Support in California

Designated Use	**Good** Fully Supporting	**Good** Threatened	**Fair** Partially Supporting	**Poor** Not Supporting	**Poor** Not Attainable
Rivers and Streams (Total Miles = 211,513)					
Miles Assessed	12,567				
Aquatic Environment	30	2	66	2	0
Edible Fish	63	6	27	4	0
Swimming	52	5	41	2	0
Lakes (Total Acres = 1,672,684)					

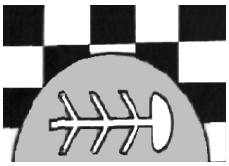


Acres Assessed

489,982



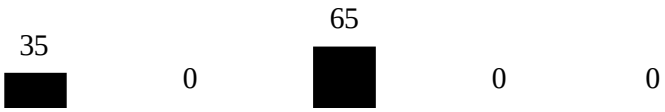
Aquatic Environment



239,194

Edible Fish

328,517



Swimming

Exhibit 4: Representative Cost of Living Water Quality Tradeoff Task

The basic measure we use for the value of water quality is $ per 1% improvement in water quality. This is calculated by offering subjects two choices which differ in the level of water quality and cost of living.

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 More Expensive	$250 More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

Exhibit 5: Map of North Carolina

Map 1: The Region Around This Location

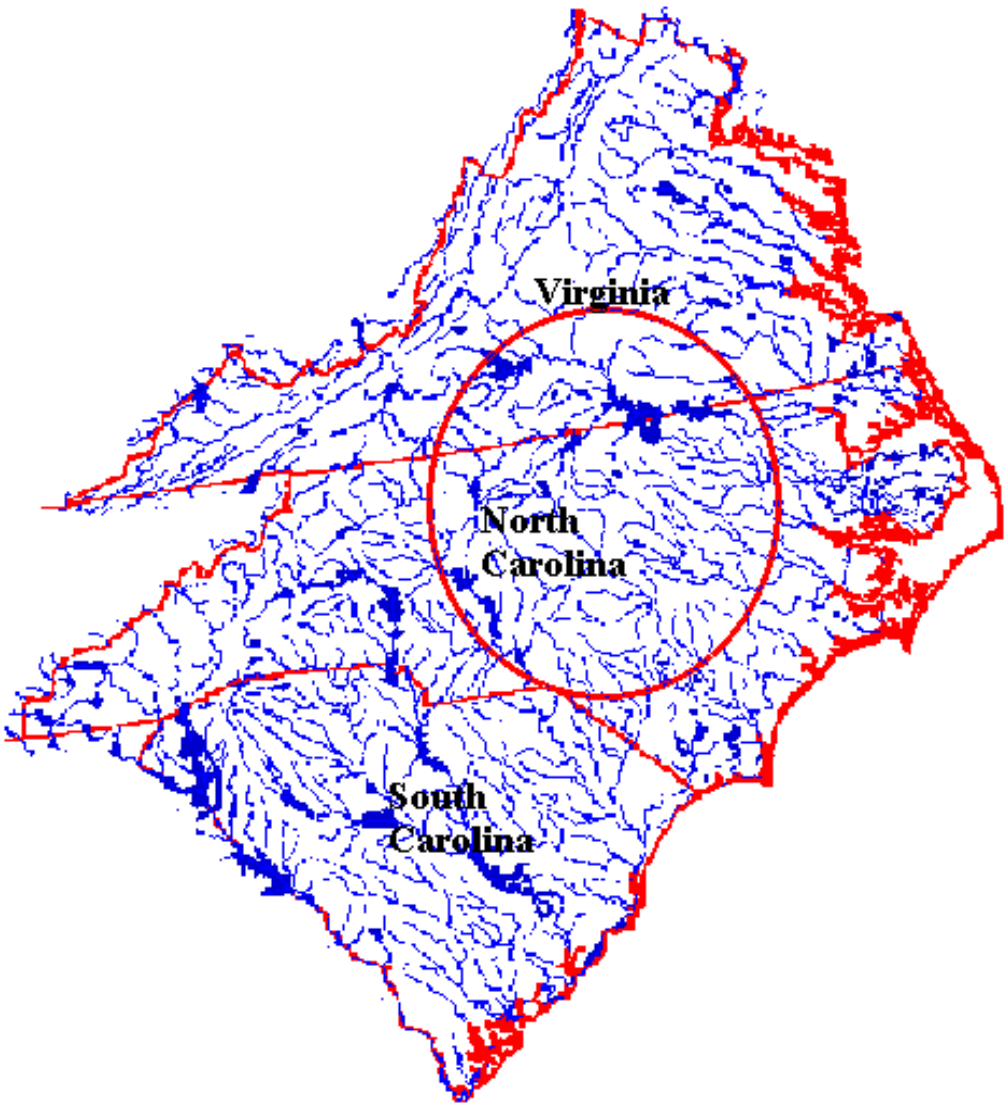


Exhibit 6: Map of Colorado

Map 1: The Region Around This Location

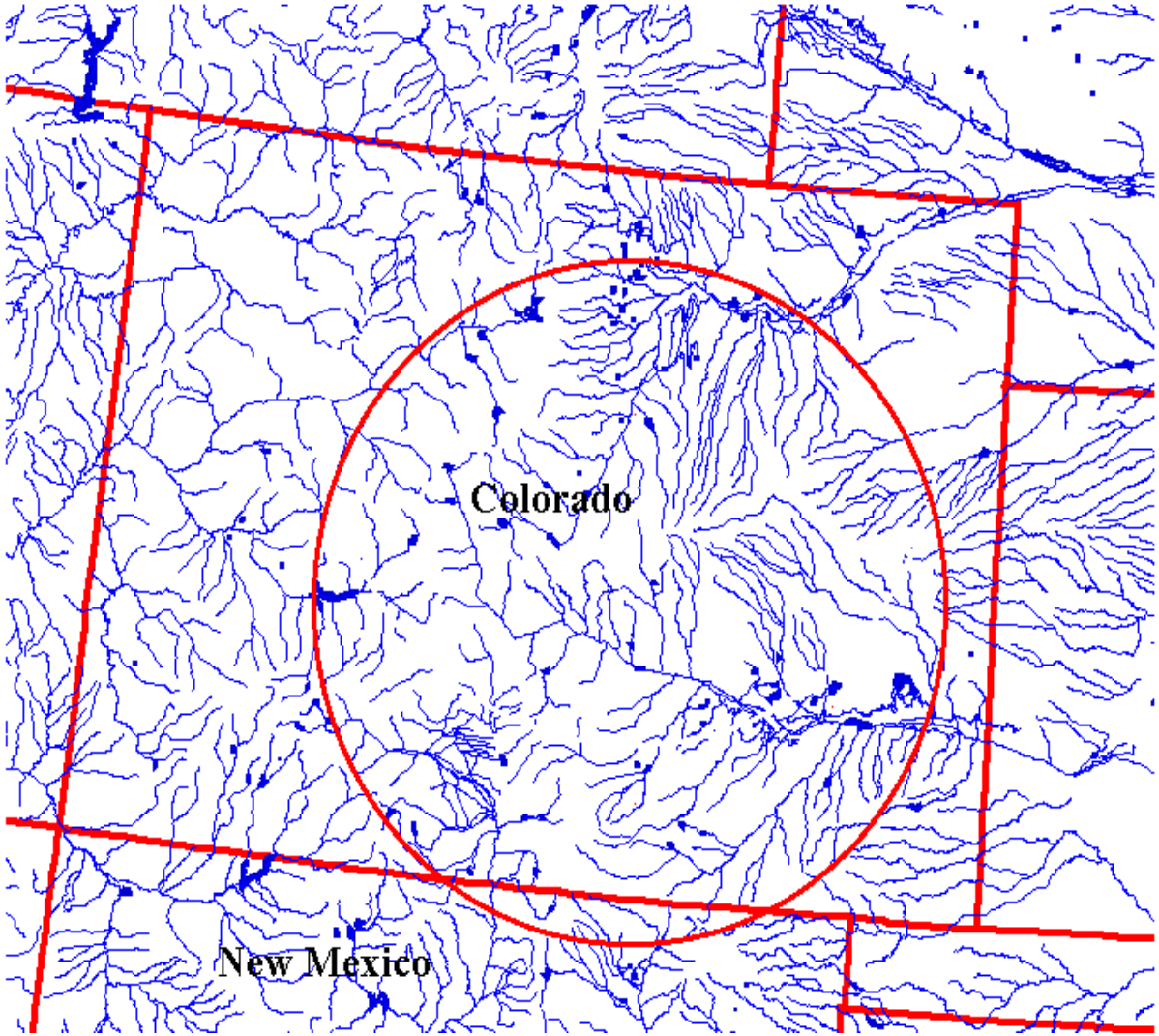


Exhibit 7: Study Decision Tree

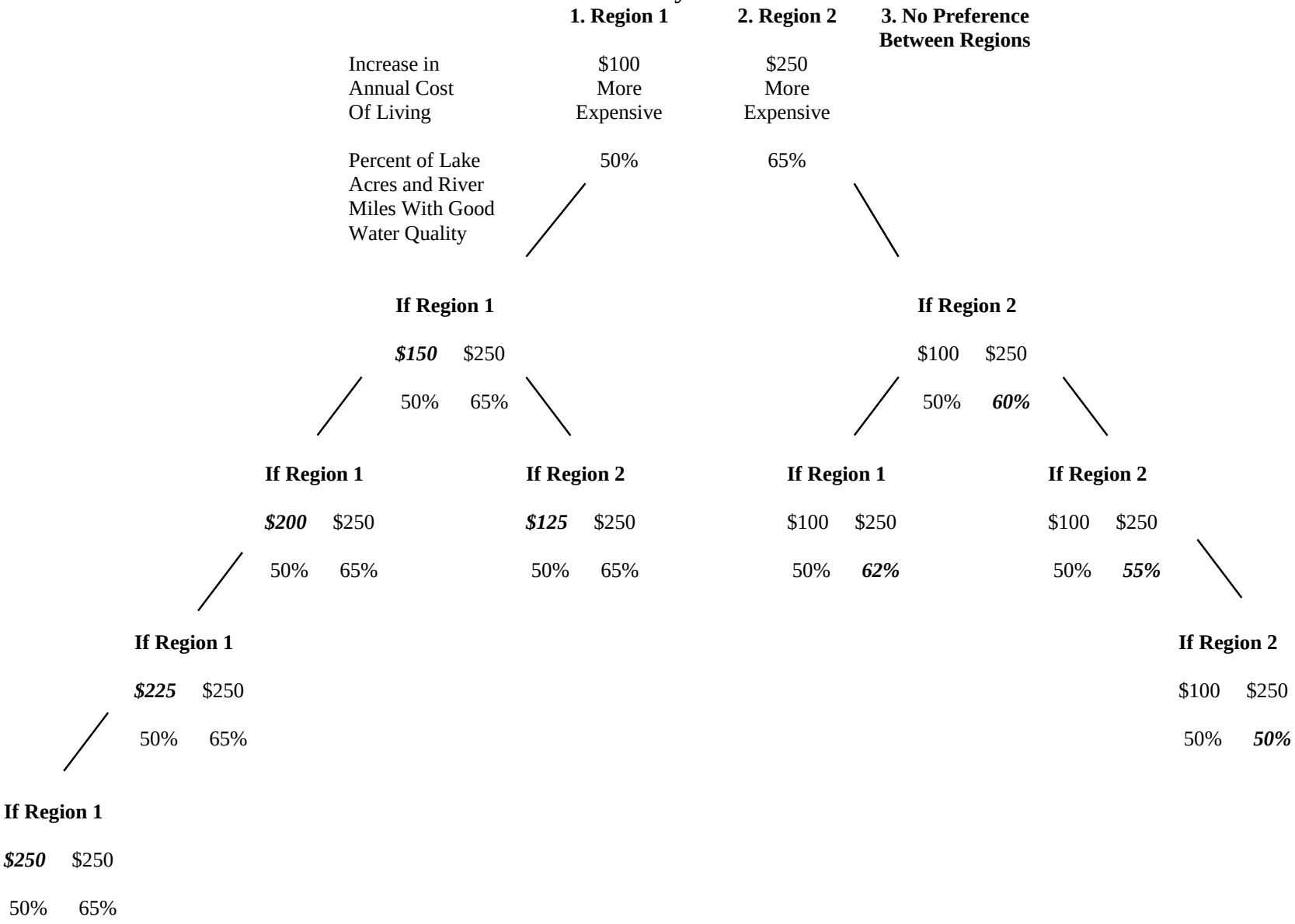


Exhibit 9: Sample Characteristics, The Full Sample

	Colorado Springs N=101		Denver N=100		Cary N=49		Charlotte N=53		RTP N=106	
	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)
Race: White	68.3		61		65.3		79.2		73.6	
Race: Black	8.9		22		18.4		13.2		11.3	
Race: Nonwhite, Nonblack	22.8		17		16.3		7.5		15.1	
High School Diploma	93.1		84		98		92.5		98.2	
College Diploma	26.7		23		42.9		33.9		75.5	
Employed	71.3		76		73.5		90.6		71.7	
Employed Full time	57.4		62		61.2		79.2		54.7	
Retired	11.9		14		6.1		5.7		16	
Full time Student	6.9		2		12.2		3.8		9.4	
Full time Homemaker	17.8		18		14.3		7.5		14.2	
Live in Urban Area	74.3		57		48		64.2		36.8	
Live in Suburban Area	16.8		39		34		22.6		58.5	
Live in Rural Area	8.9		4		16		13.2		4.7	
Member of an Environmental Organization	5		8		6.1		9.4		17.9	
Live in State of Study Site	98		99		95.9		94.3		100	
Gender, Female	39.6		49		71.4		52.8		52.8	
Married	41.6		37		32		50.9		63.2	
Age	34.15	13.46	36.91	14.18	30.91	10.79	37.78	14.36	43.06	13.59
Years of Education	13.94	2.26	13.5	2.1	14.8	1.9	14	2.2	16.24	2.1
Household Family Income	28,620	23,110	32,194	24,926	42,955	29,136	35,700	24,908	54,475	27,509
Time to Complete Study, in Minutes	28.3	9.79	22.82	10.57	24.03	7.69	26.06	13.42	32.58	11.01

Number of Family Members in Household	2.51	1.47	2.66	1.48	2.38	1.32	2.58	1.28	2.54	1.24

Exhibit 10: Sample Characteristics, The Consistent Sample

	Colorado Springs N=74		Denver N=80		Cary N=44		Charlotte N=44		RTP N=106	
	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)	Mean	(Std Dev)
Race: White	68.9		63.8		65.9		81.8		73.6	
Race: Black	6.8		18.8		15.9		11.4		11.3	
Race: Nonwhite, Nonblack	24.3		17.5		18.2		6.8		15.1	
High School Diploma	93.2		88.7		97.7		97.7		98.2	
College Diploma	23		27.6		40.9		38.6		75.5	
Employed	68.9		73.8		72.7		93.2		71.7	
Employed Full time	58.1		62.5		61.4		79.5		54.7	
Retired	9.5		13.8		4.5		4.5		16	
Full time Student	4.1		2.5		13.6		2.3		9.4	
Full time Homemaker	18.9		20		13.6		6.8		14.2	
Live in Urban Area	75.7		58.8		50		65.9		36.8	
Live in Suburban Area	13.5		36.3		38.6		25		58.5	
Live in Rural Area	10.8		5		11.4		9.1		4.7	
Member of an Environmental Organization	4.1		10		6.8		11.4		17.9	
Live in State of Study Site	98.6		100		97.7		95.5		100	
Gender, Female	36.5		55		72.7		54.5		52.8	
Married	44.6		36.3		27.3		52.3		63.2	
Age	33.31	13.28	36.99	14.32	30.41	10.42	37.86	15.24	43.06	13.59
Years of Education	13.88	2.12	13.74	2.11	14.7	1.82	14.34	2.16	16.24	2.1
Household Family Income	28,204	21,104	34,810	25,791	40,385	28,380	38,110	25,136	54,475	27,509

Time to Complete Study, in Minutes	28.2	10.12	23.25	10.1	23.97	7.59	25.17	13.83	32.58	11.01
Number of Family Members in Household	2.55	1.42	2.66	1.53	2.34	1.33	2.59	1.23	2.55	1.24

Exhibit 11: Census Demographics

	USA	Colorado	North Carolina	Colorado Springs	Denver	Cary	Charlotte	Raleigh
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Race, White	80.29	88.19	75.56	85.9	72.11	89.78	65.51	69.18
Race, Black	12.06	4.04	21.97	7.02	12.84	5.51	31.78	27.58
Race, Nonwhite, Nonblack	7.65	7.77	2.47	7.08	15.05	4.71	2.61	3.24
High School Diploma	75.2	84.4	70	87.8	79.2	94.9	81	86.6
College Diploma	20.3	27	17.4	27.5	29	48.8	28.4	40.6
Unemployment Rate	6.7	5	5.8	5.9	5.4	2.4	5	4.1
Gender, Female	51.3	50.5	51.5	51	51.3	50.6	52.5	51.5
Age (Median)				31.1	33.9	31.2	32.1	30.3
Income (Median)	30,056	30,140	26,647	28,928	25,106	46,259	31,873	32,451
Family Size	2.63	2.51	2.54	2.49	2.17	2.59	2.45	2.26

Exhibit 12: Cost of Living Task Text

```
==========================================================================
                        Cost of Living

      For purposes of this survey, the cost of living is defined as
      the amount of money that your family spends each year for
      things like food, clothing, and rent or mortgage.

      When we say that a region has a higher cost of living, we mean
      that each year you would have to spend more for these items
      overall.
==========================================================================
      How concerned would you be if your family's cost of living suddenly
      went up $200 per year? (This would mean that items like food,
      clothing, and rent or mortgage would cost a total of $200 more each
      year than they do now.)  This might mean an increase of $2 per week
      for food (or $104 per year) and $8 per month more for housing
      (or another $96 per year).

                  1.  Not at all concerned
                  2.  A little concerned
                  3.  Somewhat concerned
                  4.  Very concerned
==========================================================================
      Try answering this sample question to make sure we explained
      Cost of Living clearly.

      Imagine that you must move to another region of the country.
      You have narrowed your choices down to two.  Both regions have
      a higher cost of living than where you live now, but are alike
      in all other ways.

      Which region would you prefer?
                       1. Region 1 2. Region 2 3. No Preference
                                                  Between Regions
     Increase          $100        $250
     In Annual         More        More
     Cost of Living    Expensive   Expensive
==========================================================================
      The question was not clear.

      You chose to move to the region with a higher cost of living.
      You could have chosen a region with a lower cost of living that
      is alike in all other ways.

      To change your answer, press any key and we will ask the question
      again.

      Otherwise, please tell the interviewer you do not want to change
      your answer.
==========================================================================
      You indicated that you have no preference between two regions
```

whose only difference is that it is more expensive to live in one of them.

Are you sure that you don't care whether you would move to a region where it is more expensive to live? After all, you could move to a region with a lower cost of living that is alike in all other ways.

1. Yes, I'm sure that I have no preference.
2. No, I'm not sure. Ask the cost of living question again.

==========

The Region you chose, Region 1, has a lower annual cost of living than Region 2.

Exhibit 13: Water Quality Task Text

==========

Water Quality

Some questions will ask you to choose between regions that differ in terms of the quality of the water in either lakes or rivers in the regions.
The government rates water quality as either

* Good or
* Not Good.

Water quality is Good if the water in a lake or river is safe for all uses.
Water quality is Not Good if a lake or river is polluted or unsafe to use.

==========

More specifically,
Water quality is Good if the lake or river

* Is a safe place to swim,
* Has fish that are safe to eat, and
* Supports many plants, fish, and other aquatic life.

Water quality is Not Good if the lake or river

* Is an unsafe place to swim due to pollution,
* Has fish that are unsafe to eat, and
* Supports only a small number of plants, fish and other aquatic life.

==========

This survey will not ask you about drinking water.

Drinking water is treated by water treatment plants to ensure safety.

Water treatment cannot be done for the dimensions described on the previous screen, since these dimensions involve visiting a lake or river instead of treating a limited amount of water taken from the lake or river.

==========

We will talk about water quality for more than one lake or river.

The questions will include all the lakes or rivers in the region. This means all lakes and rivers within a 2-hour drive or so of your home, in other words, within 125 miles.

==========

We define the quality of the water in the lakes and rivers of a region by the percent of the total acres of lakes or miles of rivers in the region which have good water quality.

For example, let's say a region has several rivers, running a total of 100 miles in the region.

If pollution causes 50 of those miles to have water quality that is not good, leaving 50 miles with good water quality, then we would

call the water quality for rivers in that region 50% good.

==========

Try this sample question about water quality.
Imagine again that you must move to another region of the country. You have narrowed your choices down to two regions. They differ in only one way, the quality of the water in the regions. They even have the same number of acres of lakes and miles of rivers within 2 hours or so of where you would live. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

==========

The question was not clear.

You chose to move to the region with worse water quality.

You could have chosen a region with better water quality that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

Otherwise, please tell the interviewer you do not want to change your answer.

==========

The Region you chose, Region 2, has better water quality than Region 1.

Next will be a sample question that combines water quality and cost of living.

==========

You indicated that you have no preference between two regions whose only difference is that one has better water quality than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of lakes and rivers are safe and clean when you could move to a region with more rivers that are safe and clean that is alike in all other ways?

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the water quality question again

==========

Exhibit 14: Water Quality - Cost of Living Sample Task

We would like to ask you one more sample question to make sure we explained both cost of living and water quality clearly.

Remember, the cost of living is the amount of money that your family spends each year for things like food, clothing, and rent or mortgage.

Also remember that water quality in a region is the percent of the total acres of lakes and miles of rivers in the region which are safe for swimming, fishing, and have a healthy environment.

Cost of Living and Water Quality Questions

This sample question combines the two ideas explained earlier. Now how would you choose between regions that differ in both the quality of the water in the regions and their annual cost of living? Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$250 More Expensive	$100 More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

The question was not clear.

You chose to move to the region with worse water quality and a higher cost of living.

You could have chosen a region with better water quality and a lower cost of living that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

Otherwise, please tell the interviewer you do not want to change your answer.

The Region you chose, Region 2, has better water quality and a lower annual cost of living than Region 1.

Now we would like to ask some more questions like these, but whose answers depend more on how you value water quality and cost of living differences.

You indicated that you have no preference between two regions whose only difference is that one has a lower cost of living

and better water quality than the other.

Are you sure that you don't care whether you would move to a region where it is more expensive to live and where a lower proportion of lakes and rivers are safe and clean? After all, you could move to a region with a lower cost of living and where more lakes and rivers are clean that is alike in all other ways.

1. Yes, I'm sure that I have no preference.
2. No, I'm not sure, ask the question again.

We would like to ask you some more questions like these. However, in these questions, one region will have higher water quality and the other will have a lower annual cost of living. Remember that these regions are the same in all other ways, including the number of lakes and rivers near your home. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Increase in Annual Cost Of Living	$100 More Expensive	$250 More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	50%	65%	

Exhibit 15: Overall Cost of Living - Water Quality Tradeoff Values

Cost of Living vs. Water Quality Level.
(Units are $ per 1% Improvement in Water Quality)

	N	Mean	StDev	Median
All	348	22.4	22.5	13.3
Cary	44	24.0	20.8	18.8
Charlotte	44	28.5	23.9	22.5
Colorado Spr.	74	20.1	20.0	11.3
Denver	80	22.4	22.1	13.6
RTP	106	20.7	24.2	13.3
RTP Excluded	242	23.1	21.7	13.6

Exhibit 16: Regression Estimates for Cost of Living Value for Water Quality

Dependent Variable:
Cost of Living vs. Water Quality Level.
(Units are $ per 1% Improvement in Water Quality)

Higher value means willing to pay more for water quality improvement

	Variable	Parameter Estimate	Standard Error
	INTERCEP	-2.42	6.76
*	Gender: Female	4.33	2.43
*	Race: Black	-6.07	3.70
***	Race: Nonwhite, Nonblack	-8.45	3.25
***	Age	0.46	0.12
***	Age Squared - Mean Age	-0.02	0.006
	Household Family Income x 10,000	0.54	0.51
	Income Data Missing	-3.23	5.72
	Employment: Full Time	0.857	2.62
	Member of an Environmental Organization	-2.25	3.83
*	Visited Lake or River in Last 12 Months	7.44	3.88
	Number of Family Members in Household	-0.37	0.92
	Survey Location: Denver	0.58	3.60
	Survey Location: Charlotte	5.17	4.21
	Survey Location: Cary	3.28	4.28
*	Survey Location: Research Triangle Park	-6.88	3.62
	Time in Minutes to Complete Conjoint Study	0.15	0.12

N 348 F Value 3.435 R-square 0.1424

Dependent Variable:
Cost of Living vs. Water Quality Level.
(Units are $ per 1% Improvement in Water Quality)

Higher value means willing to pay more for water quality improvement

	Variable	Parameter Estimate	Standard Error
	INTERCEP	-8.16	7.51
	Gender: Female	4.39	2.79
	Race: Black	-2.93	4.10
***	Race: Nonwhite, Nonblack	-8.95	3.61
***	Age	0.38	0.13
**	Age Squared - Mean Age	-0.01	0.01
**	Household Family Income x 10,000	1.3	0.59
	Income Data Missing	-3.64	6.48
	Employment: Full Time	3.20	3.00
	Member of an Environmental Organization	-2.58	5.05
**	Visited Lake or River in Last 12 Months	7.86	3.93
	Number of Family Members in Household	0.04	0.99
	Survey Location: Denver	0.20	3.43

	Survey Location: Charlotte	4.37	4.02
	Survey Location: Cary	2.55	4.12
*	Time in Minutes to Complete Survey	0.25	0.14

N	242	F Value	3.692	R-square	0.1968

Exhibit 17: Cost of Living Valuation of Water Quality Linearity Tests

A. Simple Statistics

Cost of Living vs. Water Quality Level.

	N	Mean	StDev	Median
Low Water Quality Levels (25%-40%)	82	24.79	22.11	13.64
Middle Water Quality Levels (50%-65%, RTP)	106	20.70	24.24	13.33
Middle Water Quality Levels (50%-65%)	79	24.13	21.07	22.5
High Water Quality Levels (75%-90%)	81	20.36	21.77	10

This test indicates that willingness to pay is higher when water quality is low (25-40), and lower when water quality is high (75-90)

B. Regression Results

Dependent Variable:
Cost of Living vs. Water Quality Level.
(Units are $ per 1% Improvement in Water Quality)

Higher value means willing to pay more for water quality improvement

Value for Variable *Low, Middle, or High Water Quality* reflects the lower bound of water quality in the tradeoff questions. Values are either 25%, 50% or 75%.

	Variable	Parameter Estimate	Standard Error
	INTERCEP	1.87	7.52
	Low, Middle, or High Water Quality	-0.087	0.067
*	Gender: Female	4.25	2.43
	Race: Black	-5.97	3.70
***	Race: Nonwhite, Nonblack	-8.45	3.25
***	Age	0.45	0.12
***	Age Squared - Mean Age	-0.02	0.006
	Household Family Income x 10,000	0.56	0.51
	Income Data Missing	-2.89	5.72
	Employment: Full Time	0.84	2.62
	Member of an Environmental Organization	-2.05	3.83
**	Visited Lake or River in Last 12 Months	7.62	3.88
	Number of Family Members in Household	-0.36	0.92
	Survey Location: Denver	0.75	3.60
	Survey Location: Charlotte	5.10	4.21
	Survey Location: Cary	3.24	4.28
*	Survey Location: Research Triangle Park	-6.87	3.62
	Time in Minutes to Complete Survey	0.14	0.12

N 348 F Value 3.339 R-square 0.1468

Dependent Variable:
Cost of Living vs. Water Quality Level.
Higher value means willing to pay more for water quality improvement
(Units are $ per 1% Improvement in Water Quality)

Value for Variable *Low, Middle, or High Water Quality* reflects the lower bound of water quality in the tradeoff questions. Values are either 25%, 50% or 75%.

	Variable	Parameter Estimate	Standard Error
	INTERCEP	-3.61	8.13
	Low, Medium, or High Water Quality	-0.09	0.06
	Gender: Female	4.23	2.79
	Race: Black	-2.82	4.09
***	Race: Nonwhite, Nonblack	-9.16	3.60
***	Age	0.38	0.13
**	Age Squared - Mean Age	-0.015	0.007
**	Household Family Income x 10,000	1.37	0.59
	Income Data Missing	-3.15	6.47
	Employment: Full Time	3.18	2.99
	Member of an Environmental Organization	-2.18	5.05
**	Visited Lake or River in Last 12 Months	8.07	3.92
	Number of Family Members in Household	0.06	0.99
	Survey Location: Denver	0.36	3.42
	Survey Location: Charlotte	4.26	4.01
	Survey Location: Cary	2.51	4.11
*	Time in Minutes to Complete Survey	0.24	0.14

N	242	F Value	3.609	R-square	0.2042

Exhibit 18: Sample Referendum Water Quality Task

==========

Yes / No Policy Questions

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good.

This policy, through additional taxes, would increase your cost of living by $150 per year.

==========

Imagine again that you have recently moved to another region of the country, where water quality is 50% Good.

Imagine that the government is considering a policy that would increase water quality in your region from 50% Good to 65% Good.

This policy, through additional taxes, would increase your cost of living by $150 per year.

Would you be in favor of this policy?

1. Yes 2. No

==========

Exhibit 19: Overall Referendum Water Quality Tradeoff Values

Cost of Living vs. Water Quality Level, policy choice question
(Units are $ per 1% Improvement in Water Quality)

Sample	N	Mean	StDev	Median
All	348	20.5	18.0	18.6
Cary	44	27.0	20.8	22.5
Charlotte	44	22.5	20.4	15.0
Colorado Spr.	74	22.0	19.8	18.3
Denver	80	24.2	20.9	22.5
RTP	106	13.0	5.7	12.0
RTP Excluded	242	23.7	20.4	22.5

Exhibit 20: Regression Estimates for Referendum Water Quality Values

Dependent Variable:
Cost of Living vs. Water Quality Level, policy choice question
(Units are $ per 1% Improvement in Water Quality)

Higher value means willing to pay more for water quality improvement

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	20.02	5.43
	Gender: Female	0.06	1.95
	Race: Black	-2.47	2.97
*	Race: Nonwhite, Nonblack	-4.65	2.61
	Age	0.03	0.10
**	Age Squared - Mean Age	-0.011	0.0049
	Household Family Income x 10,000	0.17	0.41
	Income Data Missing	-1.32	4.59
	Employment: Full Time	0.85	2.10
	Member of an Environmental Organization	2.47	3.08
	Visited Lake or River in Last 12 Months	0.09	3.12
**	Number of Family Members in Household	-1.45	0.74
	Survey Location: Denver	3.23	2.89
	Survey Location: Charlotte	0.33	3.38
	Survey Location: Cary	5.17	3.44
***	Survey Location: Research Triangle Park	-11.13	2.91
***	Time in Minutes to Complete Study	0.25	0.10

N 348 F Value 3.238 R-square 0.1353

Dependent Variable:
Cost of Living vs. Water Quality Level, policy choice question
(Units are $ per 1% Improvement in Water Quality)

Higher value means willing to pay more for water quality improvement

	Variable	Parameter Estimate	Standard Error
**	INTERCEP	15.80	7.54
	Gender: Female	0.32	2.81
	Race: Black	-2.41	4.12
*	Race: Nonwhite, Nonblack	-6.15	3.62
	Age	0.06	0.13
**	Age Squared - Mean Age	-0.014	0.0070
	Household Family Income x 10,000	0.19	0.60
	Income Data Missing	0.41	6.51
	Employment: Full Time	2.71	3.01
	Member of an Environmental Organization	6.63	5.07
	Visited Lake or River in Last 12 Months	-1.09	3.94
	Number of Family Members in Household	-1.35	0.99
	Survey Location: Denver	3.31	3.44

	Survey Location: Charlotte	-0.42	4.04
	Survey Location: Cary	5.20	4.14
***	Time in Minutes to Complete Study	0.37	0.14

N	242	F Value	1.439	R-square	0.0872

Exhibit 21: Comparison of Cost of Living Tradeoff and Referendum Values

Cost of Living vs. Water Quality Level.
(Units are $ per 1% Improvement in Water Quality)

	N	Mean	StDev	Median
All	348	22.4	22.5	13.3
Cary	44	24.0	20.8	18.8
Charlotte	44	28.5	23.9	22.5
Colorado Spr.	74	20.1	20.0	11.3
Denver	80	22.4	22.1	13.6
RTP	106	20.7	24.2	13.3
RTP Excluded	242	23.1	21.7	13.6

Cost of Living vs. Water Quality Level, policy choice question
(Units are $ per 1% Improvement in Water Quality)

	N	Mean	StDev	Median
All	348	20.5	18.0	18.6
Cary	44	27.0	20.8	22.5
Charlotte	44	22.5	20.4	15.0
Colorado Spr.	74	22.0	19.8	18.3
Denver	80	24.2	20.9	22.5
RTP	106	13.0	5.7	12.0
RTP Excluded	242	23.7	20.4	22.5

The values for Cost of Living vs. Water Quality Level were sorted by ascending value, and split into four quartiles. Each of these quartiles were then compared to the corresponding Cost of Living vs. Water Quality Level, policy choice question for the observations within that quartile.

Cost of Living vs. Water Quality Level, policy choice question
(Units are $ per 1% Improvement in Water Quality)

	N	Policy Choice Mean	Std Dev	Min	Max
Cost of Living vs. Water Quality Level, 1st Quartile	87	12.89	10.57	0.83	80
Cost of Living vs. Water Quality Level, 2nd Quartile	87	20.08	18.49	0.83	80
Cost of Living vs. Water Quality Level, 3rd Quartile	87	22.24	15.18	0.83	80
Cost of Living vs. Water Quality Level, 4th Quartile	87	26.73	22.78	0.83	80

Exhibit 22: Sample Lakes and Rivers Task

```
==========================================================================
        Differences in Water Quality Between Lakes and Rivers

      Some questions in this survey have asked you to choose between
      regions based on water quality for both lakes and rivers.

      Now, we would like to ask you some questions that ask you to
      choose between regions based upon water quality differences
      where lakes have a different level of water quality than rivers.

==========================================================================
      Which is more important to you?

        1.  Good water quality for lakes
        2.  Good water quality for rivers
        3.  Both are equally important to me

==========================================================================
      Try this sample question about lake and river water quality.
      Which of the two regions below would you choose if you had to move
      to one of them?  Remember that both regions are alike in all
      other ways to where you live now, including the number of lake acres
      and river miles in your region.  Which region would you prefer?

                         1. Region 1 2. Region 2 3. No Preference
                                                    Between Regions
    Percent of river
    Miles With Good      50%         75%
    Water Quality

    Percent of lake
    Acres With Good      50%         75%
    Water Quality
==========================================================================
      The question was not clear.

      You chose to move to the region with worse water quality for
      both lakes and rivers.

      You could have chosen a region with better water quality for
      both lakes and rivers that is alike in all other ways.

      To change your answer, press any key and we will ask the question
      again.

      Otherwise, please tell the interviewer you do not want to change
      your answer.
==========================================================================
      The Region you chose, Region 2, has better water quality than
      Region 1 for both lakes and rivers.
```

Now we would like to ask some more questions like these, but whose answers depend more on how you value water quality differences between lakes and rivers.

==========

You indicated that you have no preference between two regions whose only difference is that one has better water quality for both lakes and rivers than the other.

Are you sure that you don't care whether you would move to a region where a lower proportion of lakes and rivers are safe and clean. After all, you could move to a region with more lakes and rivers that are safe and clean that is alike in all other ways.

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the question again

==========

Now we would like to ask you some more questions like these. However, in the next questions, one region will have a higher level of water quality for rivers, and the other will have a higher level of water quality for lakes.
Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of river Miles With Good Water Quality	50%	75%	
Percent of lake Acres With Good Water Quality	75%	50%	

==========

Exhibit 23: Sample Aesthetic Properties Task

==========

Aesthetic Properties

Other aspects of water quality for lakes and rivers do not affect whether the water is safe to use, but may affect your enjoyment of activities at a lake or river.

Two such aspects are whether the water in the lake or river is:

* Smelly, meaning that the water in the lake or river has an unpleasant odor, even though it is otherwise good.

* Cloudy, meaning that the water in the lake or river is dark brown from sediment, green from algae, or is colored or murky for any other reason, even though it is otherwise good.

==========

How important is it to you that water in lakes and rivers not be smelly?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

==========

Imagine that you have moved to a region where 50% of lakes acres and river miles have Good Quality and are not Smelly, and the other 50% do not have Good Quality and are Smelly.
Suppose you had to decide between two government policies that improve the quality of the 50% of water that does not have Good Quality and is Smelly.

* Policy 1 increases the percent of water with Good Quality, but the water improved remains Smelly.

* Policy 2 increases the percent of water with Good Quality and removes any Smell, but does so on fewer lakes and rivers than Policy 1.

==========

Imagine that you have moved to a region where 50% of lakes acres and river miles have Good Quality and are not Smelly, and the other 50% do not have Good Quality and are Smelly. Which policy would you prefer?

Aspect of Water Improved	1. Policy 1	2. Policy 2	3. No Preference Between Policies
% Good Quality	25% Improvement	15% Improvement	

% Without Smell	0% Improvement	15% Improvement	

==========

Those are all the questions we will ask about smelly water.

Now the questions will ask you about how you feel about cloudy water and water quality for lakes and rivers.

==========

How important is it to you that water in lakes and rivers not be cloudy?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

==========

Imagine that you have moved to a region where 50% of lakes acres and river miles have Good Quality and are not Cloudy, and the other 50% do not have Good Quality and are Cloudy.
Suppose you had to decide between two government policies that would improve the quality of the 50% of water that does not have Good Quality and is Cloudy.

* Policy 1 increases the percent of water with Good Quality, but the water improved remains Cloudy.

* Policy 2 increases the percent of water with Good Quality and removes any Cloudiness, but does so on fewer lakes and rivers than Policy 1.

==========

Imagine that you have moved to a region where 50% of lakes acres and river miles have Good Quality and are not Cloudy, and the other 50% do not have Good Quality and are Cloudy. Which policy would you prefer?

Aspect of Water Improved	1. Policy 1	2. Policy 2	3. No Preference Between Policies
% Good Quality	25% Improvement	15% Improvement	
% With Clear Water	0% Improvement	15% Improvement	

==========

Exhibit 24: Sample Sources of Pollution Task

==========

Sources of Pollution

Pollution in lakes and rivers that hurts water quality can come from different sources. We will talk about two sources of pollution:

* Animal Wastes, where rain runoff from animal holding areas on farms can wash animal wastes into lakes and rivers.

* Industrial Toxic Wastes, where toxic chemicals from businesses pollute lakes and rivers.

==========

We would like to ask you some questions about how you feel about sources of pollution and water quality. Keep in mind that these regions are the same in all other ways, including the number of acres of lakes and miles of rivers near your home. The regions are not different in the types of industries in the regions, just the ones polluting lakes and rivers. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality:	75%	75%	
Source of Pollution for Lakes and Rivers	Animal Wastes	Industrial Toxic Wastes	

==========

Exhibit 25: Lake Quality Versus River Quality Summary Statistics

Lake Water Quality vs. River Water Quality.
(Units are % Improvement in River Quality necessary to forego 1% Improvement in Lake Quality)

	N	Mean	StDev	Median
All	346	2.10	2.77	1
Cary	44	1.70	2.44	1
Charlotte	44	1.96	2.77	1
Colorado Spr.	74	2.41	3.36	1
Denver	80	2.16	2.88	1
RTP	104	2.05	2.34	1
RTP Excluded	242	2.12	2.94	1

Exhibit 26: Smelly Water Quality Summary Statistics

Smelly Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Smelly necessary to forego 1% Improvement in Water Quality that is Not Smelly)

	N	Mean	StDev	Median
All	348	3.66	3.23	2.14
Cary	44	3.74	3.19	2.17
Charlotte	44	4.75	3.83	3.75
Colorado Spr.	74	3.60	3.42	1.85
Denver	80	4.51	3.76	3.13
RTP	106	2.58	1.85	1.92
RTP Excluded	242	4.14	3.58	2.17

Exhibit 27: Cloudy Water Quality Summary Statistics

Cloudy Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Cloudy necessary to forego 1% Improvement in Water Quality that is Not Cloudy)

	N	Mean	StDev	Median
All	348	2.79	2.89	1.67
Cary	44	2.67	2.55	1.67
Charlotte	44	3.34	3.34	1.73
Colorado Spr.	74	3.06	2.98	1.67
Denver	80	3.97	3.56	2.05
RTP	106	1.82	1.58	1
RTP Excluded	242	3.34	3.20	1.79

Exhibit 28: Toxic Water Quality Summary Statistics

Source of Water Pollution.
(Units are % Difference in Water Quality at which Subjects are indifferent between Agricultural Waste or Industrial Toxic Waste as the source of pollution in their region.
A Negative number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Agricultural Waste instead of Industrial Toxic Waste.
A Positive number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Industrial Toxic Waste instead of Agricultural Waste.)

	N	Mean	StDev	Median
All	348	-17.0	20.9	-13.0
Cary	44	-16.7	20.6	-11.5
Charlotte	44	-22.9	21.9	-23.0
Colorado Spr.	74	-22.1	20.1	-23.0
Denver	80	-18.1	22.0	-23.0
RTP	106	-10.2	18.6	0
RTP Excluded	242	-19.9	21.2	-23.0

Exhibit 29: Lake Versus River Quality Regression Results

Dependent Variable:
Lake Water Quality vs. River Water Quality.
(Units are % Improvement in River Quality necessary to forego 1% Improvement in Lake Quality)
Higher value means greater preference for lake water quality

	Variable	Parameter Estimate	Standard Error
	INTERCEP	0.39	0.87
***	Gender: Female	0.78	0.31
	Race: Black	0.37	0.48
**	Race: Nonwhite, Nonblack	0.81	0.42
	Age	0.01	0.02
**	Age Squared - Mean Age	0.0018	0.00078
**	Household Family Income x 10,000	0.14	0.065
	Income Data Missing	0.48	0.75
	Employment: Full Time	0.01	0.34
	Member of an Environmental Organization	-0.15	0.49
*	Visited Lake or River in Last 12 Months	0.87	0.50
	Number of Family Members in Household	0.03	0.12
	Survey Location: Denver	-0.58	0.46
	Survey Location: Charlotte	-0.72	0.54
**	Survey Location: Cary	-1.11	0.55
**	Survey Location: Research Triangle Park	-0.93	0.46
	Time in Minutes to Complete Survey	-0.01	0.015

N 346 F Value 1.805 R-square 0.0807

Dependent Variable:
Lake Water Quality vs. River Water Quality.
(Units are % Improvement in River Quality necessary to forego 1% Improvement in Lake Quality)
Higher value means greater preference for lake water quality

	Variable	Parameter Estimate	Standard Error
	INTERCEP	-0.25	1.07
**	Gender: Female	0.94	0.40
	Race: Black	0.63	0.59
	Race: Nonwhite, Nonblack	0.70	0.52
	Age	0.01	0.02
**	Age Squared - Mean Age	0.0024	0.0010
***	Household Family Income x 10,000	0.22	0.085
	Income Data Missing	0.74	0.93
	Employment: Full Time	0.15	0.43
	Member of an Environmental Organization	-0.09	0.72
	Visited Lake or River in Last 12 Months	0.85	0.56
	Number of Family Members in Household	0.04	0.14
	Survey Location: Denver	-0.72	0.49
	Survey Location: Charlotte	-0.91	0.57
**	Survey Location: Cary	-1.25	0.59

Time in Minutes to Complete Survey				-0.01		0.02
N	242	F Value	1.846		R-square	0.1092

Exhibit 30: Smelly Water Quality Regression Results

Dependent Variable:
Smelly Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Smelly necessary to forego 1% Improvement in Water Quality that is Not Smelly)
Higher value means more willing to give up overall water quality for water that is Not smelly

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	3.06	0.98
**	Gender: Female	0.69	0.35
	Race: Black	0.83	0.54
*	Race: Nonwhite, Nonblack	0.82	0.47
	Age	0.003	0.02
	Age Squared - Mean Age	-0.00017	0.00089
	Household Family Income x 10,000	0.017	0.074
	Income Data Missing	0.91	0.83
	Employment: Full Time	0.34	0.38
**	Member of an Environmental Organization	-1.15	0.56
	Visited Lake or River in Last 12 Months	-0.12	0.57
	Number of Family Members in Household	0.19	0.13
	Survey Location: Denver	0.66	0.52
*	Survey Location: Charlotte	1.01	0.61
	Survey Location: Cary	-0.26	0.62
*	Survey Location: Research Triangle Park	-0.90	0.53
	Time in Minutes to Complete Survey	-0.02	0.02

N 348 F Value 2.872 R-square 0.1219

Dependent Variable:
Smelly Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Smelly necessary to forego 1% Improvement in Water Quality that is Not Smelly)
Higher value means more willing to give up overall water quality for water that is Not smelly

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	3.37	1.32
*	Gender: Female	0.90	0.49
	Race: Black	0.72	0.72
	Race: Nonwhite, Nonblack	0.81	0.64
	Age	-0.002	0.02
	Age Squared - Mean Age	0.000049	0.0012
	Household Family Income x 10,000	0.033	0.10
	Income Data Missing	1.75	1.14
	Employment: Full Time	0.14	0.53
**	Member of an Environmental Organization	-2.02	0.89
	Visited Lake or River in Last 12 Months	-0.10	0.69
	Number of Family Members in Household	0.19	0.17
	Survey Location: Denver	0.69	0.60

Survey Location: Charlotte			1.05		0.71
Survey Location: Cary			-0.40		0.73
Time in Minutes to Complete Survey			-0.03		0.02
N	242	F Value	1.453	R-square	0.0880

Exhibit 31: Cloudy Water Quality Regression Results

Dependent Variable:
Cloudy Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Cloudy necessary to forego 1% Improvement in Water Quality that is not Cloudy)
Higher value means more willing to give up overall water quality for water that is not cloudy

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	2.42	0.86
	Gender: Female	0.03	0.31
***	Race: Black	2.17	0.47
***	Race: Nonwhite, Nonblack	1.13	0.41
	Age	0.02	0.02
	Age Squared - Mean Age	-0.0010	0.00078
	Household Family Income x 10,000	-0.0098	0.065
	Income Data Missing	-0.07	0.73
	Employment: Full Time	0.06	0.33
	Member of an Environmental Organization	-0.72	0.49
	Visited Lake or River in Last 12 Months	0.15	0.49
	Number of Family Members in Household	0.05	0.12
	Survey Location: Denver	0.62	0.46
	Survey Location: Charlotte	0.32	0.53
	Survey Location: Cary	-0.55	0.54
***	Survey Location: Research Triangle Park	-1.21	0.46
	Time in Minutes to Complete Survey	-0.02	0.02

N 348 F Value 4.089 R-square 0.1650

Dependent Variable:
Cloudy Water vs. Overall Water Quality Level.
(Units are % Improvement in Water Quality for water that is Cloudy necessary to forego 1% Improvement in Water Quality that is not Cloudy)
Higher value means more willing to give up overall water quality for water that is not cloudy

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	2.95	1.17
	Gender: Female	-0.09	0.43
***	Race: Black	2.23	0.64
*	Race: Nonwhite, Nonblack	0.98	0.56
	Age	0.03	0.02
	Age Squared - Mean Age	-0.0010	0.0011
	Household Family Income x 10,000	-0.046	0.092
	Income Data Missing	0.16	1.01
	Employment: Full Time	-0.10	0.47
	Member of an Environmental Organization	-1.06	0.78
	Visited Lake or River in Last 12 Months	0.22	0.61
	Number of Family Members in Household	0.08	0.15
	Survey Location: Denver	0.56	0.53

	Survey Location: Charlotte	0.31	0.62
	Survey Location: Cary	-0.55	0.64
*	Time in Minutes to Complete Survey	-0.04	0.02

N	242	F Value	1.893	R-square	0.1116

Exhibit 32: Toxic Source Water Quality Regression Results

Dependent Variable:
Source of Water Pollution.
(Units are % Difference in Water Quality at which Subjects are indifferent between Agricultural Waste or Industrial Toxic Waste as the source of pollution in their region.
A Negative number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Agricultural Waste instead of Industrial Toxic Waste.
A Positive number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Industrial Toxic Waste instead of Agricultural Waste.)
Higher value means greater preference for industrial toxic waste rather than agricultural waste

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	-23.40	6.49
*	Gender: Female	-3.80	2.33
	Race: Black	4.59	3.55
	Race: Nonwhite, Nonblack	-0.87	3.12
*	Age	0.21	0.11
	Age Squared - Mean Age	-0.0037	0.0059
	Household Family Income x 10,000	-0.70	0.49
	Income Data Missing	-2.97	5.49
	Employment: Full Time	-2.26	2.51
	Member of an Environmental Organization	2.86	3.68
	Visited Lake or River in Last 12 Months	4.24	3.72
	Number of Family Members in Household	-0.19	0.88
	Survey Location: Denver	3.07	3.45
	Survey Location: Charlotte	-0.73	4.04
*	Survey Location: Cary	6.86	4.11
***	Survey Location: Research Triangle Park	11.69	3.48
	Time in Minutes to Complete Survey	-0.13	0.11

N	348	F Value	2.008	R-square	0.0885

Dependent Variable:
Source of Water Pollution.
(Units are % Difference in Water Quality at which Subjects are indifferent between Agricultural Waste or Industrial Toxic Waste as the source of pollution in their region.
A Negative number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Agricultural Waste instead of Industrial Toxic Waste.
A Positive number indicates the subject is willing to incur a decrease in overall water quality to have pollution caused by Industrial Toxic Waste instead of Agricultural Waste.)
Higher value means greater preference for industrial toxic waste rather than agricultural waste

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	-29.28	7.92
	Gender: Female	-1.91	2.95
**	Race: Black	10.49	4.32
	Race: Nonwhite, Nonblack	3.34	3.80
	Age	0.16	0.13

	Age Squared - Mean Age	-0.0018	0.0074
*	Household Family Income x 10,000	-1.0	0.63
	Income Data Missing	-3.11	6.84
	Employment: Full Time	-1.93	3.17
	Member of an Environmental Organization	0.84	5.33
*	Visited Lake or River in Last 12 Months	6.82	4.14
	Number of Family Members in Household	0.34	1.04
	Survey Location: Denver	3.23	3.62
	Survey Location: Charlotte	0.26	4.24
	Survey Location: Cary	6.59	4.35
	Time in Minutes to Complete Survey	-0.04	0.14

N	242	F Value	1.092	R-square	0.0676

Exhibit 33: Sample Nonuse Valuation Task

==========

Policy Choice Questions

For the next questions, imagine that you have recently moved to another region as suggested in previous questions, and that the government is considering two policies to improve water quality.

One policy would improve the water quality of lakes and rivers in the region where you have moved.

The other would improve the water quality of lakes and rivers in another region of the country, about the same size as your region. (There are about 70 regions of this size in the country)

==========

Imagine also that you will never visit any lake or river in the other region.

The policies will differ in that:

* Policy 1 will improve water quality in your region by 10%, but will not improve the other region at all, while

* Policy 2 will improve water quality in the other region by 25%, but will not improve your region at all.

==========

Here are the two policies.

Which policy would you prefer?

	1. Policy 1	2. Policy 2	3. No Preference Between Policies
Change in Percent of Water With Good Quality:			
Your Region (All Visits to Lakes and Rivers)	+ 10% Improvement	No Change	
Other Region (Will Never Visit Lakes or Rivers)	No Change	+ 25% Improvement	

==========

Exhibit 34: Sample Probabilistic Use Valuation Task

==========

Now imagine that, instead of having no chance of ever visiting a lake or river in the other region, imagine that for one of every ten trips you might take to a lake or river, you would visit a lake or river in the other region.

We would like to ask you the same types of questions as we did before, with this one difference.

==========

Imagine that you have recently moved to another region of the country, and that the government is considering policies to improve water quality in your region or in another region. Which policy would you prefer?

Change in Percent of Water With Good Quality:	1. Policy 1	2. Policy 2	3. No Preference Between Policies
Your Region (9 of 10 Visits to Lakes and Rivers)	+ 10% Improvement	No Change	
Other Region (1 of 10 Visits to Lakes and Rivers)	No Change	+ 25% Improvement	

==========

Now imagine that, instead of having no chance of ever visiting a lake or river in the other region, imagine that for one out of three trips you might take to a lake or river, you would visit a lake or river in the other region.

We would like to ask you the same types of questions as we did before, with this one difference.

==========

Imagine that you have recently moved to another region of the country, and that the government is considering policies to improve water quality in your region or in another region. Which policy would you prefer?

Change in Percent of Water With Good Quality:	1. Policy 1	2. Policy 2	3. No Preference Between Policies

Your Region (2 of 3 Visits to Lakes and Rivers)	+ 10% Improvement	No Change
Other Region (1 of 3 Visits to Lakes and Rivers)	No Change	+ 25% Improvement

Exhibit 35: Summary Nonuse Valuation Summary Statistics

A. Home Region Water Quality vs. Other Region Water Quality, (Never Visit)

(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)

	N	Mean	StDev	Median
All	348	0.50	0.46	0.40
Cary	44	0.45	0.30	0.40
Charlotte	44	0.49	0.60	0.26
Colorado Spr.	74	0.57	0.55	0.40
Denver	80	0.48	0.57	0.36
RTP	106	0.50	0.26	0.46
RTP Excluded	242	0.51	0.53	0.38

B. Home Region Water Quality vs. Other Region Water Quality (10% of Visits)

(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)

	N	Mean	StDev	Median
All	173	0.51	0.45	0.40
Cary	21	0.54	0.27	0.45
Charlotte	21	0.42	0.56	0.20
Colorado Spr.	37	0.58	0.52	0.58
Denver	42	0.48	0.55	0.31
RTP	52	0.51	0.27	0.54
RTP Excluded	121	0.51	0.51	0.40

C. Home Region Water Quality vs. Other Region Water Quality (30% of Visits)

(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)

	N	Mean	StDev	Median
All	121	0.59	0.49	0.45
Cary	23	0.57	0.27	0.58
Charlotte	23	0.55	0.54	0.40
Colorado Spr.	37	0.58	0.56	0.40
Denver	38	0.62	0.51	0.52

D. Home Region Water Quality vs. Other Region Water Quality (1% of Visits)

(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)

	N	Mean	StDev	Median
RTP	54	0.55	0.31	0.54

Exhibit 36: Nonuse Valuation Regression Results

Dependent Variable:
Home Region Water Quality vs. Other Region Water Quality, 0% Chance Visit.
(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)
Higher value means more willing to improve water quality in other region rather than home region

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	0.45	0.15
	Gender: Female	0.03	0.05
	Race: Black	-0.08	0.08
	Race: Nonwhite, Nonblack	-0.03	0.07
	Age	0.004	0.003
	Age Squared - Mean Age	-0.00017	0.00013
***	Household Family Income x 10,000	-0.028	0.011
	Income Data Missing	-0.07	0.12
	Employment: Full Time	-0.03	0.06
	Member of an Environmental Organization	0.07	0.08
	Visited Lake or River in Last 12 Months	0.12	0.08
	Number of Family Members in Household	0.01	0.02
	Survey Location: Denver	-0.08	0.08
	Survey Location: Charlotte	-0.06	0.09
	Survey Location: Cary	-0.10	0.09
	Survey Location: Research Triangle Park	-0.06	0.08
	Time in Minutes to Complete Survey	0.00002	0.003

N 348 F Value 0.898 R-square 0.0416

Dependent Variable:
Home Region Water Quality vs. Other Region Water Quality, 0% Chance Visit.
(Units are % Improvement in Home Region Water Quality necessary to forego 1% Improvement in Other Region Water Quality)
Higher value means more willing to improve water quality in other region rather than home region

	Variable	Parameter Estimate	Standard Error
**	INTERCEP	0.41	0.20
	Gender: Female	0.02	0.07
	Race: Black	-0.14	0.11
	Race: Nonwhite, Nonblack	-0.01	0.10
*	Age	0.01	0.003
	Age Squared - Mean Age	-0.00029	0.00018
**	Household Family Income x 10,000	-0.037	0.016
	Income Data Missing	-0.07	0.17
	Employment: Full Time	-0.01	0.08
	Member of an Environmental Organization	0.15	0.13
	Visited Lake or River in Last 12 Months	0.12	0.10
	Number of Family Members in Household	0.01	0.03
	Survey Location: Denver	-0.08	0.09

Survey Location: Charlotte	-0.06	0.11
Survey Location: Cary	-0.08	0.11
Time in Minutes to Complete Survey	0.0002	0.004

N	242	F Value	0.860	R-square	0.0540

Exhibit 37: Sample Water Quality Uses Task

==========

Water Quality Uses

It is possible for a lake or river to have good quality for one use, but not for other uses. This means that a single region can have different levels of water quality for different uses or dimensions of water quality.
Some of the questions in this survey will ask you about three dimensions of the quality of lakes and rivers:

* Whether the lake or river has fish that are safe to eat,
* Whether the lake or river is a safe place to swim, and
* Whether the lake or river has a healthy aquatic environment.

Press any key to learn more about these categories

==========

Fishing

A lake or river is good for fishing if fish caught in the lake or river are safe for you to eat.
A lake or river is not good for fishing if fish caught in the lake or river are not safe for you to eat.
How important is it to you that lakes and rivers in your region be good for fishing?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

==========

Swimming

A lake or river is good for swimming if prolonged contact with the water in the lake or river will not make you sick.
A lake or river is not good for swimming if prolonged contact with the water can make you sick.
How important is it to you that lakes and rivers in your region be good for swimming?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

==========

Aquatic Environment

The aquatic environment is good if the lake or river supports many plants, fish, and other aquatic life.

The aquatic environment is not good if the lake or river supports only a small number plants, fish, and other aquatic life, or cannot support some kinds of aquatic life at all.

How important is it to you that lakes and rivers in your region have a good aquatic environment?

1. Not at all important
2. Somewhat important
3. Quite important
4. Very important

==========

If you need to review the definitions for the water quality dimensions just described, you can open the folder next to the computer and find the page labeled

Water Quality Definitions.

If you do not find this page, or if there is no folder next to the computer, please ask the interviewer for help.

==========

Because a region has more than one lake and river, these three dimensions of water quality will be described in terms of percent good.

For example, if all the acres of lakes and miles of rivers in a region are good for swimming and if half have a good aquatic environment, then that region could be described like this:

Percent of Water
With Good Quality:

Swimming: 100%

Aquatic Environment: 50%

==========

Try answering this sample question to make sure we explained water quality for the three water quality dimensions clearly. How would you choose between regions that differ in two dimensions of water quality, but are otherwise alike? Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality:			
Swimming:	50%	75%	
Aquatic Environment:		50%	60%

==========

The question was not clear.

You chose to move to the region with worse water quality for each of the listed dimensions.

You could have chosen a region with better water quality for those dimensions that is alike in all other ways.

To change your answer, press any key and we will ask the question again.

Otherwise, please tell the interviewer you do not want to change your answer.

==========

The Region you chose, Region 2, has better water quality than Region 1 for both swimming and the quality of the aquatic environment.

Now we would like to ask some more questions like these, but whose answers depend more on how you value water quality for different dimensions.

==========

You indicated that you have no preference between two regions whose only difference is that one has a better water quality for the listed dimensions.

Are you sure that you don't care whether you would move to a region with better water quality for the listed dimensions when you could move to a region with better water quality for the listed dimensions that is alike in all other ways?

1. Yes, I'm sure that I have no preference
2. No, I'm not sure, ask the question again

==========

The next questions will have one region with better water quality for swimming, and the other will have a better aquatic environment. Keep in mind that the regions are the same in all other ways, including the number of acres of lakes and miles of rivers in the region and both regions are 50% good for fishing. Which region would you prefer?

	1. Region 1	2. Region 2	3. No Preference Between Regions
Percent of Water With Good Quality:			
Swimming:	50%	30%	
Aquatic Environment:	50%	70%	

==========

Exhibit 38: Summary Water Quality Use Valuation Results

A. Portion of Water Quality Improvement That Should Improve Swimmable Water Quality.

All	348	35.3%	0.20	33.3%
Cary	44	38.3%	0.20	39.9%
Charlotte	44	35.2%	0.22	32.6%
Colorado Spr.	74	34.4%	0.19	33.3%
Denver	80	36.2%	0.20	24.1%
RTP	106	33.8%	0.21	31.2%
RTP Excluded	242	35.9%	0.20	33.5%

B. Portion of Water Quality Improvement That Should Improve Water Quality for Aquatic Environment.

	N	Mean	StDev	Median
All	348	31.8%	0.20	26.7%
Cary	44	30.6%	0.21	26.4%
Charlotte	44	29.5%	0.20	24.2%
Colorado Spr.	74	29.7%	0.20	25.0%
Denver	80	30.1%	0.18	26.6%
RTP	106	35.9%	0.21	33.3%
RTP Excluded	242	29.9%	0.20	25.0%

C. Portion of Water Quality Improvement That Should Improve Fishable Water Quality.

	N	Mean	StDev	Median
All	348	28.4%	0.18	23.8%
Cary	44	27.9%	0.19	23.2%
Charlotte	44	29.7%	0.19	24.2%
Colorado Spr.	74	30.7%	0.20	26.7%
Denver	80	28.8%	0.19	24.7%
RTP	106	26.3%	0.16	23.1%
RTP Excluded	242	29.4%	0.19	24.7%

Exhibit 39: Swimmable Water Use Valuation Regression Results

Dependent Variable:
Source of Water Pollution.
Higher value means greater preference for industrial toxic waste rather than agricultural waste

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	0.42	0.06
	Gender: Female	0.01	0.02
	Race: Black	-0.03	0.03
	Race: Nonwhite, Nonblack	-0.01	0.03
	Age	0.0004	0.001
	Age Squared - Mean Age	0.000042	0.000058
	Household Family Income x 10,000	0.0050	0.0048
	Income Data Missing	-0.06	0.05
	Employment: Full Time	0.0004	0.02
**	Member of an Environmental Organization	-0.07	0.04
**	Visited Lake or River in Last 12 Months	-0.09	0.04
**	Number of Family Members in Household	0.02	0.01
	Survey Location: Denver	0.01	0.03
	Survey Location: Charlotte	0.00003	0.04
	Survey Location: Cary	0.04	0.04
	Survey Location: Research Triangle Park	0.01	0.03
*	Time in Minutes to Complete Survey	-0.002	0.001

N 348 F Value 1.737 R-square 0.0775

Dependent Variable:
Source of Water Pollution.
Higher value means greater preference for industrial toxic waste rather than agricultural waste

	Variable	Parameter Estimate	Standard Error
***	INTERCEP	0.44	0.07
	Gender: Female	0.01	0.03
	Race: Black	-0.02	0.04
	Race: Nonwhite, Nonblack	0.001	0.04
	Age	0.0003	0.001
	Age Squared - Mean Age	0.000019	0.000068
	Household Family Income x 10,000	0.0037	0.0058
	Income Data Missing	-0.04	0.06
	Employment: Full Time	-0.04	0.03
**	Member of an Environmental Organization	-0.10	0.05
**	Visited Lake or River in Last 12 Months	-0.08	0.04
**	Number of Family Members in Household	0.02	0.01
	Survey Location: Denver	0.005	0.03
	Survey Location: Charlotte	0.01	0.04
	Survey Location: Cary	0.04	0.04
**	Time in Minutes to Complete Survey	-0.003	0.001

N	242	F Value	1.800	R-square	0.1067

Tri-TAC **Jointly Sponsored by: League of California Cities California Association of Sanitation Agencies California Water Environment Association**
CASA **California Association of Sanitation Agencies**

Reply to: Sharon N. Green
Sanitation Districts of Los Angeles County
P.O. Box 4998
Whittier, CA 90607
(562) 699-7411, x-2503
January 11, 2000

Dr. Alan Carlin
Office of Policy and Reinvention, Mail Code 2172
U.S. Environmental Protection Agency
Washington, D.C. 20460

Delivered via electronic mail:

Dear Dr. Carlin:

SUBJECT: COMMENTS ON PROPOSED INFORMATION COLLECTION FOR VALUING INLAND WATER QUALITY IMPROVEMENTS (ICR NO. 1914.01) (64 *FED. REG.* 61632)

I am writing on behalf of Tri-TAC and the California Association of Sanitation Agencies (CASA), California-based organizations comprised of local public agencies responsible for wastewater collection, treatment, disposal and reclamation. Tri-TAC is an advisory group including representatives of CASA, the California Water Environment Association, and the League of California Cities. CASA's membership includes 87 agencies responsible for the operation of publicly owned treatment works. Collectively, the constituent agencies of Tri-TAC and CASA serve most of the sewered population of California.

Enclosed are Tri-TAC's comments on the proposed information collection for valuing inland water quality improvements. Tri-TAC supports EPA's efforts to obtain better estimates related to the economic benefits of improved water quality, since currently the lack of adequate information on the benefits of improved water quality poses a major barrier to analyzing whether the costs of stricter water quality regulations are justified by the benefits. In addition to the stated intention for the survey to provide information to EPA for the purposes of compliance with Executive Order 12866 and for academic use, EPA should be aware that such estimates are also likely to be used by States in analyzing the benefits of proposed changes in water quality standards, as well as by interested parties such as environmental groups to justify the tightening of water quality regulations. As such, it is extremely important that the survey be as rigorous as possible to provide valid estimates for such use.

The enclosed comments were prepared for Tri-TAC by M.Cubed, a consulting firm specializing in resource economics and public policy analysis. Based on this analysis, we have major concerns about the rigor and usefulness of the theoretical benefit estimates that will be generated by the proposed survey. The Federal Register notice requests comments on the quality, utility, and clarity of the information to be collected. We believe that the survey as presently structured will not yield high-quality information that can be used with confidence for the stated purposes, and therefore recommend that EPA not proceed with this survey unless it is revised substantially. Our specific concerns are contained in Attachment 1.

Thank you for the opportunity to comment on the proposed information collection valuing inland water quality benefits. If you have any questions about our comments, please contact Sharon Green at the address indicated above.

Sincerely,

Phil Bobel, Chair
Tri-TAC

Roberta Larson, Director of Legal and Regulatory Affairs
California Association of Sanitation Agencies

ATTACHMENT
Tri-TAC Comments on U.S. Environmental Protection Agency's (USEPA)
Proposed Survey to Value Inland Water Quality Improvements
January 10, 2000

developed by M.Cubed

Developing better information and insight into the value of water quality improvements to the public, particularly from a marginal benefit and cost perspective, would assist policy-makers and analysts in creating useful information with which to develop cost-effective water quality policies. That is, if regulators knew with certainty that for a particular increment of cost a specific increment of improved quality would be obtained, knowledge of whether or not the public believes this cost-quality trade-off to be worthwhile would helpfully inform policy decisions. In this respect USEPA's attempt to increase and enhance this type of information should be commended.

Many methods are available to place a value on water quality improvements, all of which have their strengths and weaknesses, and all of which require different resource levels to implement. Surveys are perhaps the least-expensive strategy to obtain this information. However, because of the difficulty of devising and implementing effective instruments, the use of surveys are also a technique which can frequently result in useless or misleading data.

It is extremely difficult to obtain thoughtful responses from surveys, particularly those attempting to investigate complex and unfamiliar issues. Although USEPA's survey instrument has some notable strengths, it is questionable whether the survey in its current form will result in robust insights into the value the public places on water quality improvements. This is chiefly because participants may find a large number of the survey questions to be confusing, and as a result their responses may not truly reflect their attitudes. Further, many of the questions could act to bias participants towards placing a higher value on water quality than their actual willingness to pay for improvements.

M. Cubed offers the following comments and recommendations to revise the survey so that it will yield useful information.

(1) *The survey introduction should be clear and comprehensive*. The survey is introduced as being about "water quality," rather than about how individuals "value water quality," or what the respondent is "willing to pay" for improvements in water quality. The existing set-up fails to establish the cost-quality trade-off which the survey ultimately hopes to probe.

(2) *The survey should either examine specific or conceptual attitudes towards bodies of waters*. The survey starts by telling respondents that it will ask how they "value" the "lakes and rivers near where you live." As a result of this prompting, it is likely that participants will visualize the attachment they have to the water bodies near them, and may even use these places as reference points throughout the survey. This attachment to particular water bodies may be true even if the respondent infrequently "stopped what they were dong to look at a view of a lake or river" (i.e., participants may have a historical relationship with their local body of water even if they rarely pay any conscious attention to it). The existence of a specific personal attachment is likely to induce a different sense of value than one for a lake or river that has never seen, and is not even

identified.

As the instrument continues the respondent is moved from the particular to the general. Survey respondents are ultimately asked how they value unnamed, conceptual bodies of water, with which they may have no relationship. Although the questions revolve around rivers and lakes near where the participant will theoretically live, this approach does not fully ameliorate the different values individuals may place on water bodies they currently know and imaginary places they could ultimately live near. The instrument's mixing of the known with the unknown may not result in accurate valuations. Likewise, respondents may picture different quantities and types of bodies of water, which may make it difficult to calculate average willingness to pay for some mythical "typical" body of water.

(3) *The survey should provide clearer examples of value/cost trade-offs*. The survey attempts to probe two complex variables -- value, which is composed of the worth an individual places on the characteristics of an experience or thing; and cost, which though more absolute than value, tends to be relative to other factors (e.g., income, other costs). In this vein the comparisons between a "sit down" and "fast food" restaurant may not serve to elicit the responses or reasoning that USEPA is attempting to engender.

An implicit assumption is made that a sit down dinner is inherently more valuable than a fast food meal, even though many Americans may prefer fast food in general, and may make a judgement about the value (e.g., characteristics) of differently priced sit down meals that would serve to bias their decisions, or at least make it difficult to interpret the results uniformly. That is, participants may view a $10 sit down meal as equivalent in characteristics to $5 worth of fast food, but just more slowly eaten. Likewise, the survey defines the restaurants as "more" or "less" "expensive," rather than "cost more or less" or even "offer a more or less enjoyable dining experience." The latter definition could tend to encourage respondents to focus on expense as opposed to any other characteristics of the meal.

(4) *The link between water quality improvements and associated costs should be clearer.* It is unclear whether respondents would view questions about the general "cost of living" in an area as similar to questions which probe participants' attitudes towards paying taxes to improve water quality. That is, cost of living may be seen as something over which respondents have little control - financing improved water quality is lumped together with higher food or housing prices. If the questions were framed as willingness to pay higher taxes or fees, they may engender different responses. USEPA seems to understand this distinction, as taxes are mentioned at the end of the instrument.

Likewise, differences in cost of living may be inherently linked with peoples' understanding of value. That is, it may be generally understood that cost of living is higher in desirable or densely populated places (e.g., San Francisco Bay Area; New York City) than in less attractive or populated places. As a result, despite the instrument's admonishment that the places under question are the same, respondents may not believe this to be the case.

(5) *Survey questions should be sensitive to the role of time*. For example, responses to "sudden" increases in costs of living may reflect attitudes towards suddenness, rather than to cost increases. That is, people's willingness to pay for anything may be higher if the cost increases

are predictable and gradual.

(6) *USEPA should be careful about what information is presented by the instrument*. For example, the instrument states that "in the United States, the overall level of water quality for lakes and rivers is 65% Good." The purpose of providing this information is unclear, and by stating a percentage the instrument will almost certainly bias responses. That is, respondents will likely be influenced by the statement that on average bodies of water are 65 percent "good," and may, as a result, want their responses to reflect above average, or at least average, water quality. This may result in different answers than if, for example, the statement was that most lakes and rivers have "good" water quality, with some having extremely poor quality.

(7) *The instrument's attempts to ascertain marginal willingness to pay may not be effective*. In general the survey questions are abstract, which may encourage participants to likewise treat their valuations abstractly (e.g., imaginary improvements in imaginary rivers can be paid with imaginary money). In this vein little information is provided about the differences between lakes and rivers, and no questions are posed which may provide insight into why a respondent might value improved water quality in one type of water body more than another. In addition, a large quantity of percentages and dollar amounts are introduced, and in many cases the difference between the numbers are small and may be difficult to understand (e.g., will the survey respondents be able to accurately quantify the difference between 60 and 62 percent? What does such a small increase in the quality of a purely hypothetical body of water mean?). Taken together this approach is confusing, and may act to degrade the seriousness with which respondents treat the survey.

(8) *The instrument inquiries about sophisticated trade-offs may be ineffective and unnecessary*. Respondents are asked to make complicated quality trade-offs between different water uses (i.e., fishing, swimming, and aquatic). Because of the complexity of the choices, it seems likely that participants will choose a leading indicator to dominant their selections. As a result, it is unclear what useful information will be derived from this series of questions which could not be teased out of the survey through alternative analyses (e.g., examining respondents choice of water-based activities as compared with their valuations).

Likewise, it is unclear why questions about individuals' preferences related to pollution sources are included in the instrument. It seems more likely that the resulting responses will have more to do with participants attitudes towards the word "toxic" than provide any thoughtful information. In this same vein, the question, which is similarly asked of agricultural wastes would seem to inherently encourage a positive response:

Do you believe that in regions polluted by toxic chemical wastes, even water rated by the government as having good quality may be dangerous because of the possibility of toxic chemical pollution?

(9) *Extraneous questions should be eliminated*. For the purpose of valuing water quality improvements, why does it matter whether the respondent is male or female? Married? Why are some environmental organizations named and not others, and why are no non-environmentally focused organizations identified (e.g., business groups). What is the point of these questions?

The following are our responses to comments on the water quality survey provided by Tri-TAC and the California Association of Sanitation Agencies (CASA). The original comments can be found in Attachment 5. Although Tri-TAC interprets the M.Cubed comments as cause to not proceed with the survey without substantial revision, we have directly addressed some of the comments, and clarified why the rest of the comments are not relevant to this study. EPA concurs.

1. The survey introduction should be clear and comprehensive.

The survey is introduced as being about "views on water quality," rather than "water quality" itself. Great care is later taken to introduce the tradeoffs respondents are being asked to make. In addition, the tradeoffs respondents are asked to make are not between cost and quality, but between cost of living and water quality. We will examine the survey text to try to better connect water quality improvements to cost of living increases, but it is difficult to do this without mentioning specific payment mechanisms inappropriately in this section of the survey. The early section of the survey which asks respondents about water use generally is intended to engage respondents and get them thinking about how they do or could use lakes and rivers, so as to better equip them to assign their informed value to lake and river water quality improvement.

2. The survey should either examine specific or conceptual attitudes towards bodies of water.

Attitudes towards lakes and rivers come, in part, from respondents' actual experiences with them. As such, initial questions in the survey deal with actual uses of lakes and rivers. To avoid any undue influence of what respondents know or feel about familiar lakes and rivers, their quality, or usability, the hypothetical move to another region format is used. Moreover, respondents' zip codes are collected and provide a means to test the hypothesis that respondents use the quality of nearby waters as a reference point (e.g., for the question that asks about an improvement to 90% from a hypothetical 75%, the test is whether or not willingness to pay is better predicted by substituting the actual rating of waters within two hours of respondent's zip code).

3. The survey should provide clearer examples of value/cost tradeoffs.

The survey does not ask respondents to make value/cost tradeoff. Respondents are asked to make cost of living/water quality tradeoff. This information is then used to determine value. Furthermore, the "sit down" and "fast food" restaurant example (where cost is noted) is merely used as an example to introduce the format in which questions will be asked and was chosen because the idea of visiting restaurants is familiar to most respondents. This is a practice question not used to value water quality. This question set was pretested and respondents did not seem to have difficulty with either the concept or the question.

4. The link between water quality improvements and associated costs should be clearer.

We agree that the word "tax" could elicit a negative response independent of the question asked, which is why we chose a more neutral cost of living metric. We included tax later to test this difference. The tradeoffs that respondents are asked to make are clearly stated as being between two

places that are the same in every way except for cost of living and water quality, and not between Des Moines/lower cost of living and San Francisco/higher cost of living. We do not believe that the cost of living differences of less than $300 annually reflect the magnitude of location effects mentioned in these comments.

5. Survey questions should be sensitive to the role of time.

We will remove the term "suddenly" from the survey.

6. US EPA should be careful about what information is presented by the instrument.

One half of respondents are given the information that "in the United States, the overall level of water quality for lakes and rivers is 65% good." This same set of respondents is then asked "What would you believe about the quality of lakes and rivers in your region?" This information will be used to test whether reference points (i.e., beliefs about how local water quality compares to the national average) affects the values being explored in the survey. Moreover, the information presented in the survey correctly reflects the nationwide level for water quality as presented by the EPA Water Quality Inventory.

7. The instrument's attempts to ascertain marginal willingness to pay may not be effective.

The very small changes in water quality mentioned here are in question iterations where respondents are very close to indifference, so no large effects are likely. In the example mentioned, the maximum effect is a $4 per year swing in water quality valuation. The survey uses hypothetical moves and unfamiliar water bodies to avoid unanticipated focus on specific water bodies which could unduly affect respondents' valuations. The attributes of water quality that we wish to test are too complex and unfamiliar to respondents to use CV effectively, and this method breaks the task into understandable chunks. Attachments 3 and 4 demonstrate application of the methodology for estimating marginal willingness to pay for water quality improvements based on responses to pilot study questions.

8. The instrument inquiries about sophisticated tradeoff may be ineffective and unnecessary.

EPA requested and gathers data on individual uses (fish consumption, supporting aquatic environments, and swimming). The purpose of the survey is to develop economic benefit values for water quality improvements for lakes, rivers and streams by individual use. An alternative analysis *may* provide more detailed information, but only at the expense of project cost and respondent burden.

9. Extraneous questions should be eliminated.

We collect demographic information at the end of the survey in order to run regressions and projections of water quality valuations to populations not necessarily represented in the survey sample and to see if the survey is representative once done. We tried to include as many environmental organizations as were reasonable, and tried to include the major ones. Business and industry groups were not explored because we did not consider them to be predictive of water quality valuation in the same sense that environmental membership might be.

To All Whom It Concerns:

The Tennessee Valley Authority (TVA), a U.S. Government-owned public power producer with water resource management responsibilities, appreciates the opportunity to review this Notice, and supports the development of a survey instrument to develop economic benefit values for water quality improvements. We asked one of our water quality program managers and the environmental coordinator for our economic development programs to review the proposed survey, and offer the following comments based on their review of that survey.

1. The proposed survey is more comprehensive than many we've seen, provoking thought about a number of aspects of water quality / water resources. It also prompted one's thinking about how much water quality is worth.

2. We are uncertain about the availability of empirical research reports or data comparing actions of survey respondents to their survey answers. We would encourage EPA to address this in the reports releasing survey results.

3. EPA might consider asking respondents a question about their relative valuation of water quality versus other environmental attributes (e.g., air quality).

4. We believe that it will take most people closer to an hour to complete the survey (versus the 30 minute estimate provided), particularly if they attempt to go back and review or modify an answer -- the process for which is slow if one has to go back several questions. The survey does seem to be cleverly designed to help respondents reconsider answers which appear contradictory.

5. We recommend that small towns be added as a locality choice (In addition to city, suburb, country).

6. We recommend that the Great Lakes be identified separately from other lakes and reservoirs (due to significant differences in size, water quality history, uses, and stakeholder expectations).

7. We recommend consideration of the addition of a middle category between 'stopping to view a river or lake' and the no notice category (for those who notice / view / value, but don't necessarily stop what they are doing).

Again, TVA appreciates the opportunity to comment of this Notice. If you or your staff have questions regarding these comments, please contact Jim Wright (Sr. Water Regulatory Specialist) at (865) 632-8104, or jrwhright@tva.gov, or my at (423) 751-3742, or jwshipp@tva.gov.

Sincerely,
John W. Shipp, Jr.
General Manager
Environmental Policy and Planning

Attachment 8: Responses to TVA Comments

The following are our responses to comments on the water quality survey provided by the Tennessee Valley Authority (TVA). Those comments are included as the previous attachment.

1. We appreciate the comment. We worked very hard and considered many methods to evaluate water quality to arrive at this survey instrument.

2. We found quite a few studies attempting to value water quality, mostly for specific regions. The estimates varied widely, depending on the facet of water quality studied and the method used to estimate the value. As part of this survey we will also obtain information on water uses by respondents which potentially can be matched to other data EPA might have.

3. In past surveys we have valued air quality relative to accident safety, which is a metric for which there is a well known dollar value. To do the air quality comparison effectively we would have to provide detailed information to respondents so that they could think sensibly about air quality dimensions. This would have been interesting, but the survey already has many dimensions of interest to value with respect to water quality and is already long. The sensitivity test we do perform is using the referendum approach rather than the regional choice approach.

4. Data from our pretests show that some respondents do take longer to complete the survey. The slowest 25% of respondents completed the survey in an average of 42 minutes. The overall average completion time was under 28 minutes and the median respondent completed the survey in under 26 minutes. We will compensate respondents for their participation, which is voluntary.

5. Though we try to use census designations for most of our demographic questions, we did find that subjects have difficulty classifying whether they were in urban, suburban, or rural settings. We will add this designation to the survey.

6. We do not identify any particular water bodies in the survey. However, we do know the zip code of the respondents as well as their current water uses so that we can explore differences in valuation for people living in the Great Lakes regions.

7. We will include this distinction in the survey question.