Final Report

ECONOMIC VALUE OF RECREATION AND PRESERVATION BENEFITS OF INSTREAM FLOW

John Duffield and Susan Butkay, University of Montana
Stewart Allen, University of Idaho

August, 1990

Submitted to: U.S. Department of Agriculture, Forest Service,
Rocky Mountain Forest and Range Experiment Station,
240 West Prospect Road, Fort Collins, Colorado 80526.

ACKNOWLEDGEMENTS

This document constitutes Final Report A of a study funded by the USDA Forest Service Rocky Mountain Forest and Range Experiment Station in Fort Collins through contract 28-K7-428 with the University of Montana. The broad outline of the study was originally conceived by Tom Brown at the Rocky Mountain Station. Both Tom Brown and John Loomis, UC Davis, contributed substantially to study and survey instrument design. This report has additionally benefited from their review, although they are in no way responsible for remaining errors. We have appreciated the help of Mel White of the U.S. Geological Survey who was both cordial and efficient in providing us with daily and aggregated flow data for our study rivers. Liter Spence, Bob McFarland and Fred Nelson of the Montana Department of Fish, Wildlife and Parks provided basic information on the biology, hydrology and recreational use of the study rivers. This information was very helpful during survey and study design.

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I. INTRODUCTION

The allocation of water among competing uses is an increasingly important public policy issue in the Western U.S. As both consumptive uses and water-based recreation have increased, policies of instream flow reservation have emerged in many states. Montana's 1975 Water Use Act, for example, formally recognized that instream flow for recreational and other purposes was a beneficial use of water, ending the previous "use it or lose it" philosophy.

The benefits of instream flows extend beyond the provision of habitat for fish, wildlife, and increasing numbers of recreation visitors. Keeping adequate amounts of water in the river also has intrinsic or indirect values to many people. For example, individuals may value simply knowing that there is a large and dramatic river flowing through the Grand Canyon, even if they haven't seen it themselves. They also may benefit from knowing they can see the river in the future, or from preserving this opportunity for future generations.

One basis for identifying appropriate levels of instream flows is to compare the economic value of instream flow to the values of competing consumptive uses. Consumptive uses are typically marketed commodities, so their values are relatively well-understood. However, the estimation of instream flow recreation and preservation values is a relatively new area of research. The basic purpose of this study is to develop and demonstrate methods for estimating the recreation and preservation benefits of alternative levels of instream flows.

The specific study objectives are as follows:

1. Valuation of alternative flow levels by site
2. Additivity of values across sites
3. Share of direct versus indirect (intrinsic) values
4. Valuation across activity and user type

The motivation for the first objective is fairly obvious; determination of an appropriate or socially optimal level of instream flow requires estimates of the economic value of water in different uses. The second objective is motivated by two general issues in the area of nonmarket valuation. These issues are the validity of nonmarket measures and the aggregation of values across sites or other environmental goods. The specific problem focused on is whether estimates developed for the value of flow in a given river are additive to separately estimated values for other rivers. Addressing the first two problems provides an opportunity to also investigate the relationship between use and preservation-related benefits, our third objective. Previous studies of instream flow have focused almost entirely on values associated with direct recreational use; this study attempts to explicitly identify the share of total value associated with preservation benefits. The final major issue addressed is the extent to which values vary across user group or activity. One would expect that the effect and importance of alternative flow levels may vary considerably across user groups.

The basic approach used to determine instream flow values is the contingent

valuation method (CVM). In the CVM approach, individuals are surveyed directly and asked about their willingness to pay for the services of a given resource contingent on the existence of a hypothetical market situation. This approach has been applied by economists to a wide variety of environmental goods (Cummings, Brookshire and Schulze, 1986).

The specific method used in this study is the dichotomous choice or close-ended type question. This is a relatively new question format (Bishop and Heberlein, 1979) that appears to overcome some of the bias and participation problems of the bidding game and open-ended format. In dichotomous choice CVM, the probability of a positive response to a given bid level can be identified through a logit specification, from which both mean and median net willingness to pay for given flows can be derived. Additionally, limited application of the open-ended CVM question format was also undertaken.

The analysis and interpretation of dichotomous choice CVM responses is relatively complex. The application of this valuation technique to our study objectives resulted in a number of methodological innovations. With regard to valuation of alternative flow levels, previous studies have focused on either the effect of flows on the quality of the experience (Daubert and Young, 1981; Boyle, Welsh, Bishop and Baumgartner, 1988), or on the number of users (Narayanan, 1986; Walsh, Ericson, Arosteguy, and Hansen, 1980). The latter study additionally examined the effect of congestion on trip valuation. We present a general framework for estimating the recreation value of instream flows that includes the direct effect of flows on trip valuation (quality change) and on daily use levels. Additionally, the model incorporates the indirect effects of flows on trip values due to changes in daily use levels (congestion) and quantity demanded (seasonal trip total).

Following Boyle et al (1988), on-site users can be asked the value of their current recreational experience. The correlation of these responses to actual daily flows can then be estimated. Our extension of this basic method involves using a reparameterization of the basic logistic regression model (first shown in the economics literature by Hanemann (1984) and extended to include covariates by Cameron, 1988). Given the reparameterization, it is possible to identify an inverse Hicksian demand function for recreational trips that incorporates flow as a covariate. Inverse demand is conditional on the probability of response; the choice of welfare measure can then be explicitly related to a percentile of the underlying willingness to pay (WTP) response distribution (eg. the median, etc.). By identifying an inverse demand relationship, the effect of covariates on WTP (elasticities and partial derivatives) can be easily derived analytically.

Our model of the effect of flow on quantity demanded is similar to Narayanan (1986). This author used a logistic specification that relates the probability of daily visits reaching the observed maximum to flow. The disadvantage of this specification is that visits asymptotically approach a maximum as discharge rises to infinity. In fact, very high flows (flood) will have a negative impact on many activities beyond some point. We use a third-order polynomial (in the flow variable) which permits identification of optimal flow levels. Because quality changes are measured in an inverse Hicksian demand specification, the two models can be integrated. This provides a consistent

framework for separating the effect of flows on quality and quantity of use across sites. The general method can additionally be modified to incorporate a day-level recreation use simulation model of alternative (historical or hypothetical) flow regimes.

We address the issue of additivity across sites through a household survey of WTP for preservation of instream flows. The payment vehicle utilized is a trust fund used to augment instream flows through the purchase water from irrigators or upstream storage. Some respondents are asked their contribution to protect a single river and others are asked to value protection of a group of rivers. The naive assumption would be that consistent responses (perfect additivity) require the single river responses to add up to the response for the equivalent river group. We show analytically that in fact perfect additivity is not consistent with consumption theory. Specific testable hypothesis for the trust fund responses are developed.

The trust fund survey of households also provides an opportunity to distinguish the share of total willingness to pay that is associated with direct use as opposed to future use (option value) and preservation (existence and bequest motives (Krutilla, 1967)). Previously applied methods for identifying the relative shares of direct and indirect values include a follow-up question where the respondent is asked to apportion his total WTP among alternative uses or motives (for example, Walsh, Sanders and Loomis, 1985) and the use of separate CVM questions - with and without use (Boyle and Bishop, 1987). The problem of the apportionment method is that there is no way to test its validity; respondents may or may not be able to quantitatively estimate the significance of a given motive (such as future use) distinct from other motives. The separate question approach requires additional effort on the part of respondents and may be affected by respondent fatigue, ability to imagine sequential hypotheticals, or bias from previous relative bid amounts. Our approach is to utilize the methods of social-psychology to develop psychometric measures of existence and option preferences. These are included in a multivariate regression model along with traditional measures of direct use (number of trips or recreation days). It can be shown that when all independent variables are transformed to their natural log value, the relative share due to each factor is a simple function of the estimated parameters. The latter is a result from Euhler's Theorem for homogeneous functions, and is closely related to a standard result in production theory. The apportionment method is compared to this multivariate regression approach in our application.

Our approach for examining the variation in instream flows across user group and site is relatively straightforward: separate estimates are made for subsamples defined by respondent characteristics. Additionally, in multivariate analysis, different groups may be represented by dummy variables. A limitation of previous dichotomous choice CVM applications is that mean WTP has been estimated by numerical integration; accordingly the standard error for this welfare measure can not be derived analytically (for the case of a logged bid variable). Following the methods described in Duffield and Patterson (1989), we demonstrate the application of nonparametric methods to measure dispersion for the most widely used welfare measure in dichotomous choice CVM - the truncated mean. These methods allow us to rigorously test

differences across user groups and sites.

It should be noted that the values to be estimated are net economic values. For example, many federal agencies are required by U.S. Water Resources Council Principles and Guidelines (1983) to use net willingness to pay (eg. net economic value) as a measure of value in benefit-cost analysis or evaluation of federal actions. The work reported here is consistent with these guidelines.

We demonstrate these methods for two Montana rivers, the Big Hole and Bitterroot. Both rivers are "blue-ribbon" trout fisheries with the major limiting factor being severe dewatering that can occur during the summer irrigation season. This study focused on river sections that receive considerable recreational use yet are subject to dewatering: Wise River to Glenn on the Big Hole and Woodside to Stevensville on the Bitterroot.

While both rivers are important fisheries, there are differences between the two that provide the opportunity for potentially interesting comparisons. The Big Hole is nationally acclaimed for its wild trout fishery; use in the study section is dominated by anglers (approximately 90 percent of all users). By contrast, the Bitterroot is less well known and only approximately 50 percent of all users are anglers. The Bitterroot flows through a much more populated area than the Big Hole; this also contributes to a higher share of general shoreline activities such as picnicking, swimming and camping. The Big Hole is an unregulated river, while the Bitterroot has a major reservoir upstream on the West Fork (Painted Rocks Reservoir).

Both rivers have been extensively studied by the Montana Department of Fish, Wildlife and Parks (DFWP) to determine relationships between flow levels and fishery quality. DFWP recently completed a major study of the effect of management of Painted Rocks Reservoir releases on the trout fishery in our study section (Spoon, 1987). DFWP is currently in process of developing specific minimum instream flow recommendations for the entire Upper Missouri River Basin, which includes the Big Hole.

Additional considerations in site choice are that current daily and historical flow levels for study sections were available from U.S. Geological Survey gauges at Darby (on the Bitterroot) and Melrose (Big Hole). Temporary gauges have also been installed in the dewatered sections of both rivers (Bell Crossing and Wise River, for Bitterroot and Big Hole respectively).

Data were collected with both onsite and mail surveys (Appendix A). The on-site survey was conducted in the summer of 1988 (May through August) to identify direct use values and river activities. There were 319 on-site respondents on the Bitterroot and 590 on the Big Hole. Since the sample frame was similar on both rivers, the larger Big Hole sample reflects the higher use density on this river, particularly in the early season. As it happened, 1988 was a year of severe drought in Montana so that respondents experienced a wide range of actual instream flow levels.

A regional mail survey was undertaken in the winter of 1988-89 (December-January) to identify intrinsic or nonuser values. The latter was stratified

by distance and for reasons of efficiency focused on six regional population centers: Hamilton, Missoula, Butte, Helena, Billings and Spokane. Of the total of 1850 questionnaires mailed out, 140 were not deliverable and 582 were completed and returned. This indicates a 34 percent response rate. Two additional surveys were conducted related to the mail survey: a phone survey pretest (sample of 100) was conducted in Missoula in early October, 1988 and a nonrespondent phone survey was conducted in April, 1989 (sample of 251).

The remainder of this report is organized into nine major sections: theory and methods, data and survey design, site description and respondent characteristics, estimated equations, measuring preservation motives, additivity and separability in value components, three sections providing analysis of benefit estimates, and conclusions.

II. THEORY AND METHODS

This section begins with a description of the specific valuation techniques employed in this study: dichotomous choice and open-ended contingent valuation. A more general literature review of contingent valuation methods is provided in Appendix B. The remainder of this section describes the extension of the basic valuation methods to address the major study objectives: valuation of flows, additivity across sites, share of direct and indirect uses, and valuation across user or activity group.

A. DICHOTOMOUS CHOICE CVM

In dichotomous choice, individuals respond "yes" or "no" as to their willingness to pay a specific cash amount for a specified commodity or service. Hanemann (1984) provides both a utility difference approach and an alternative derivation of the statistical binary response model based on the relationship of the individuals unobserved true valuation compared to the offered threshold sum. In the latter, it is assumed that if each individual has a true willingness-to-pay (WTP), then the individual will respond positively to a given bid only if his WTP is greater than the bid. For example, suppose that an individual is confronted with an offered price (A) for access to a given resource or recreational site. The probability of accepting this offer (P), given the individual's true (unobserved) valuation (C) is then:

$$(1)\quad P = \Pr(C \geq A) = F(A)$$

where A is a cumulative distribution function. In the logit model $F(\cdot)$ is the c.d.f. of a standard logistic variate and in the probit model $F(\cdot)$ is the standard normal c.d.f.

This motivation for the logit (and similarly for the probit) has long been utilized in bioassay problems (e.g., Finney (1982) or Cox (1970)) where, for example, a researcher observes a dichotomous response, such as live or die in animals administered various doses of a drug. Hanemann (1984) of course recognized this motivation in referendum type contingent valuation surveys and also recognized that the curve fitted to the probabilities of a positive response as a function of bid represented the estimated cumulative distribution function (c.d.f.) of the WTP distribution (from which the mean and median can be easily derived). Seller, Chavas and Stoll (1985, 1986) also recognized that the fitted logistic curve represents the c.d.f. of the WTP distribution and additionally discussed the influence of a covariate (quantity demanded) on a measure of location of the distribution.

The specification of this model can be briefly illustrated for the case where the WTP values are assumed to have a logistic distribution in the population of interest conditional on the value of covariates. In other words, the proportion of respondents answering "yes" to a given bid level is utilized in a statistical model relating the probability of a "yes" to explanatory variables such as the bid amount, tastes, income, and other standard demand shifter type variables. The specific model is:

2) $P = (1 + \exp(-a-bx))^{-1}$

where P is the probability of buying, x is a vector representing explanatory variables (including the offer price), a is the constant term or intercept; b is the vector of regression coefficients. The equation to be estimated can be derived as:

3) $L=\ln(P/1-P)=a+bx$

where L is the "logit" or log of the odds of a "yes". Hanemann (1984) has shown that the specific linear logit formulation in equation 3 is consistent with the hypothesis of utility maximization. A log formulation has also been widely used in the literature:

4) $L=\ln(P/1-P)=a+b\ln(x)$

where the vector of explanatory variables may include the bid amount and typical demand shifter variables such as quantity demanded, income and measures of taste and preference. In a recent paper (1986), Sellar, Chavas and Stoll have shown that an inverse demand curve can be derived from equation 4 and have explored the implications of functional form for consistency with economic theory. Their basic finding is that a linear logit specification was found to be inappropriate by implying an upward sloping demand curve. Although other specifications may also be possible, a log-linear specification was found to be superior in terms of meeting the theoretical restrictions. Given these findings, we have generally chosen in this application to estimate a logit model of the log-linear form as in equation 4.

For the demand function to be downward sloping with respect to quantity consumed, Sellar, Chavas and Stoll also show that the estimated coefficient on log of trips must be negative and have an absolute value less than one. The usual approach to estimating equation 4 is a maximum likelihood procedure.

Once the estimated model parameters are available, a number of alternative measures, including the mathematical expectation (mean) of maximum willingness to pay or the median of the distribution (where the probability of acceptance equals .5) can be used as a measure of welfare surplus. Hanemann (1984) suggests that the median is more robust; however, both the mean and a truncated mean are widely used. The truncated mean (Bishop and Heberlein, 1979) is calculated (for nonnegative WTP values) by integrating one minus the cumulative distribution function over the offer bid range from zero to the maximum offer bid. We favor the truncated mean over the overall mean (where the upper limit of integration is infinity) because the latter requires extrapolating the model far beyond the range of the data and the overall mean (for the logit) is in some cases undefined (infinity). This extrapolation, not surprisingly, results in relatively imprecise estimates for the overall mean, as has been demonstrated for the Bishop and Heberlein (1979) data set by Patterson and Duffield (1989). Additionally, the overall mean is not consistent with consumption theory (unless one admits the possibility of infinite incomes), since theoretically any given individual willingness to pay is necessarily less than the budget constraint. We also favor a mean over the median for purposes of this study since (for skewed distributions where the

median and mean may differ considerably) the median does not correctly reflect total value for a population in aggregation. As Johansson, Kristrom, and Maler (1989) point out, the median if used in benefit-cost analysis does not lead to Pareto efficient outcomes.

While we tend to favor the truncated mean for aggregation purposes, in our applications we will generally report both the median and the truncated mean. Using both statistics provides information on the shape of the willingness to pay distribution. It may be noted that the median is a welfare measure defined by a specific quantile (50 percent) of the WTP distribution. We will also utilize in some applications reported below a welfare measure defined at other quantiles of the distribution, specifically at around 25 percent (that is, the WTP value which at least 25 percent of the population is willing to pay). As will be shown below, this quantile generally corresponds to a WTP value quite close to our empirical truncated mean. Hanemann (1989) has discussed this particular measure, which he favors partly on distributive grounds.

It should be noted that judgement is required in the choice of the upper limit of integration in the estimation of the truncated mean. We have generally chosen to truncate the estimate at the maximum bid utilized in the sample. The argument for this is that extrapolating beyond the range of the sample data is inappropriate on statistical grounds. Of course truncation is not an issue if benefits are not sensitive to the upper limit. If benefits are sensitive, it may be an indication that the range of offer bids in the sample was not sufficiently high. In other words, one will generally want to have sufficient high bids to clearly establish the point at which probability of a "yes" goes to near zero. A more complete discussion of dichotomous choice survey design issues is provided in Duffield and Patterson (1989). This reference also describes a nonparametric method for estimating the truncated mean and an associated standard error. These methods are utilized in the several hypothesis tests discussed below.

Three specific dichotomous choice valuation questions were utilized in this study: on-site current trip valuation, on-site trust fund contribution for protection of instream flows, and a mail survey trust fund contribution for protection of instream flows. (See Appendix A for specific wording of each question.) All of these valuation questions were estimated in the form of equation 4, but it should be noted that the interpretations differ. The on-site current trip elicits valuation of the current trip; accordingly this is a marginal valuation with quantity of trips to this river thus far in the season as an explanatory variable.

By contrast, the trust fund questions are for total willingness to pay to protect instream flows over a year or recreation season. The on-site version essentially provides a point estimate on this total valuation function for the given river. However, the mail survey trust fund was utilized in three versions (to separate subsamples): Bitterroot River only, Big Hole only and protection of a group of five rivers including the Bitterroot, Big Hole, Smith, Gallatin and Upper Clark Fork. Accordingly, when mail survey trust fund responses are pooled, responses relate to the distribution of total willingness to pay (annual basis) conditional on the number of rivers protected (one or five).

C. OPEN-ENDED CVM

One open-ended CVM question was utilized in this study. Respondents to the mail survey dichotomous choice trust fund question were asked a follow-up open ended question about their maximum willingness to pay (Appendix A). The conventional analysis of these responses includes specifying a "bid equation":

5) $WTP = f(X)$

where X is a vector of explanatory variables, WTP is the open-ended response, and both WTP and X are typically transformed to natural log values (double log specification). This question format can be used to directly identify either marginal valuation of a given resource (i.e., value of the current trip) or total valuation (i.e., value of all trips taken this year, perhaps through an annual permit payment vehicle). For the case at hand, the application has a total willingness to pay interpretation. Respondents are asked for an annual trust fund donation to protect a number of rivers varying from one to five. In this context, number of rivers protected is a quantity demanded index.

D. VALUATION OF FLOWS

The basic study objective of valuing instream flows was undertaken with all four valuation questions. We begin with a discussion of the method based on valuing current trips in the on-site survey.

CURRENT TRIP VALUATION APPROACH

River related recreation such as fishing, floating, picnicking and camping has the general characteristics of a private good. Outdoor recreation opportunities happen in this country to be typically available at a zero entrance fee, but this should not obscure the fact that there is an underlying demand relationship between the quantity demanded (trips or days) and the total price of using the resource. Our a priori assumption is that instream flow levels enter this demand relationship as a standard shifter variable that will potentially affect both quantity demanded (at any given price) as well as the reservation price at any given quantity of use. Less abstractly, for any given site one would expect flows to influence both the number of visitors (quantity demanded at current price) as well as the quality of the experience. These two effects of varying instream flow levels on demand will be referred to here as the quantity effect and the quality effect, respectively.

Previous studies of instream flow valuation have generally focused on one or the other of these effects. The seminal study of instream flow valuation by Daubert and Young (1981) and a recent study of instream flows in the Grand Canyon (Boyle, Welsh, Bishop and Baumgartner, 1988) provide useful analysis of the quality effect. Daubert and Young used a CVM bidding game format (with both sales tax and entrance fee payment vehicles) to value alternative flow levels on the Poudre River in Colorado. On site respondents were asked to value seven specific flow increments for instream flows varying from 50 to 1150 cfs. The effects of varying flows on angler catch, river depth and velocity were described to respondents; additionally (following Randall, Ives

and Eastman (1974)) actual photographs of the river at varying flows were shown to respondents. The resulting total and marginal valuations were aggregated under the assumption of no quantity effect (for example, average daily visits were assumed to be constant across flow scenarios at 228 visits per day for anglers). One would expect this approach to understate the total value associated with changing flows, other things equal.

Boyle et.al. (1988) provide an analysis of the quality effect for varying flows (due to Glen Canyon Dam releases) on whitewater boaters in the Grand Canyon. They use a dichotomous choice question format in a mail survey with a trip expense payment vehicle. Within this general method, the authors demonstrate two specific approaches. The first, which they term "unexperienced scenarios" is very similar to Daubert and Young's approach: respondents are asked to value a specific flow level based on a description of the recreation experience corresponding to that flow. It may be noted that Boyle et.al. put considerable effort into developing the scenarios, including a preliminary "attribute survey" to identify the important aspects of the recreational experience and how these vary with flow. The second basic approach is to simply include actual flow levels as an explanatory variable in the logistic regression estimate (in the general form of equation 4 above). The plots of marginal valuation (consumer surplus per trip) against average flow level in cfs are very similar for white-water boaters for both methods. Again, the separate possible influence of flow on the quantity of trips was not investigated. (For white-water boating in the Grand Canyon, this may be entirely appropriate given that this is a permit river that is generally being used at its carrying capacity.)

An example of an instream flow valuation study that focuses on the quantity effect is provided by Narayanan (1986). This study of the Blacksmith Fork River in Utah used a conventional double-log single site zonal travel cost model to estimate total recreational benefits in 1982. Since this was a single site model based on one season of use, flow was not directly included as an explanatory variable in the travel cost model. The quantity effect was instead estimated by an on site survey where respondents were asked to indicate "at what percentage of current instream flow they would cease to visit the site for the entire season. The percentages given as options were 0, 10, 25, 33, 67, 75, and 100." This amounts to another "unexperienced scenario" type question, but here the response is in terms of quantity of use rather than valuation. Survey responses were used to estimate a simple bivariate logistic model with the ratio of expected use to actual 1982 use as a function of flow levels. The predicted ratio is then simply multiplied times the 1982 aggregate benefits to generate total benefits as a function of flows. As the author notes, this model assumes that instream flow levels affect only the number of trips and not the consumer surplus per trip. In other words this is a pure quantity effect model.

Walsh, Ericson, Arosteguy and Hanson (1980) also develop a quantity effects model in an application to nine sites in Northwest Colorado. Their model additionally identifies the effects of congestion on trip valuation, but not the direct quality effect of flows on trip valuation. Both congestion and quantity effects were estimated for every respondent for a range of use and flow scenarios. This approach would seem to place a considerable burden on

the respondent.

As Narayanan notes, the results of any study based on different unexperienced flow scenarios will depend on how accurately the respondents perceive the given options in flow levels and are able to evaluate the impact on their recreation experience. (In fact, some users will have experienced a given hypothetical scenario at a previous time.) Boyle et.al. 1988 appear to demonstrate that the scenario estimates are plausible, but the authors caution that they should not be interpreted as perfect substitutes for values based on actual experience. In any case, it appears that the scenario approach requires considerable effort and careful consideration with regard to the types of information and level of detail presented. Additionally, as Boyle et.al. 1988 note, it is nearly impossible to identify an optimum flow condition (given a finite number of workable scenarios). A specific limitation of Narayanan's study in this regard is that (for the logistic specification that he employs) use is a positive function of flows at all levels; this of course rules out any optimum even on pure quantity grounds. Additionally, this specification does not correctly model a decline in use (for most activities) as flows approach flood levels.

The approach taken in this study was to measure both a quality and quantity effect based on actual conditions. At the most general level, a model that can represent the main effects of flow on total recreational benefits is:

$$6) \quad T = Q(F,Z)\ W(F,q,Q(F,Z),X)$$

where T is total recreational value per day as a function of flow levels (F), Q(F,Z) is total recreational use at the site per day, and W(.) is an inverse Hicksian demand function where W or willingness to pay has the interpretation of compensating variation per individual-day. Z and X are vectors of explanatory variables and q is quantity demand (seasonal use to date at the site for the average respondent). This model has the general structure of a Bradford (1970) aggregate bid relationship. Several previous applications to instream flows have used a similar structure, that is deriving a total benefit function by multiplying total use for some time period (day, season, year, etc.) times individual values. As noted previously, a limitation of previous applications is that either only use is modeled as a function of flow (Narayanan, 1986) or only user values are modeled as a function of flows (Daubert and Young, 1981; Boyle et.al. 1988).

It can be noted that the model in (6) gives the total benefits associated with recreational use of the site. However, an inverse Hicksian demand function for flows can be derived from (6) by differentiation. The partial total derivative of T with respect to F is:

$$7) \quad dT/dF = \partial Q/\partial F \cdot W + Q(\partial W/\partial F + \partial W/\partial Q \cdot \partial Q/\partial F)$$

where the first term is the quantity effect and the second term is the quality effect in marginal terms (for example, dollars/day-cfs). This function can be used to derive a marginal valuation schedule at alternative flow levels. It may be noted that flow influences consumer surplus directly and also indirectly via the effect of flow on Q (daily use). Total daily use levels in

turn directly affect trip valuation (congestion effect).

The model in equation 6 is an integration of separate models of each of the three major flow effects on recreation value: the quantity effect and the direct and indirect quality effects.
The direct quality effect is measured by incorporating actual average daily flow into the current trip logistic regression model. For example, the variables in equation 4 for a current trip valuation model could be made explicit as:

$$8)\ \ln(p/1-p) = bo + b1\ln(Bid) + b2\ln(q) + b3\ln(F) + \sum_i bi\ln(xi)$$

where bi = estimated parameter
Bid = bid offer value
q = quantity demanded (trips so far this year in this context)
F = flow variable
xi = other explanatory variables such as total number of users per day (Q).

This aspect of our model parallels the Boyle et.al. 1988 second approach described above. However, Boyle et. al. 1988 evaluate a model like equation 4 or equation 8 by numerical integration to identify the truncated mean (estimated compensating variation per trip) conditional on a given flow level. In order to generate a W(F) type relationship for a truncated mean welfare measure, we generalize a reparameterization of the usual logistic model (eg. equation 8) to:

$$9)\qquad WTP = \exp(b0/b1)\,(p/1-p)^{-1/b1}\,q^{-b2/b1}\,F^{-b3/b1}\,\sum_i xi^{-bi/b1}$$

This reparameterization, which results in an inverse Hicksian demand function, was first introduced by Hanemann (1984) and extended to include covariates by Cameron and James (1987) for the probit model and by Cameron (1988) for the logit. Implicit in Cameron's (1988) reparameterization is the use of the median or the overall mean of the underlying WTP distribution as the welfare measure. However, the reparameterization can be generalized to hold for any quantile of the distribution. Of particular interest here is the reparameterization of WTP conditional on p* where p* is given by the truncated mean (holding all independent variables at their mean values):

$$10)\qquad p^* = 1/(1 + \exp[-(b0 + b1\ln(WTP^*) + \sum_i bi\ln(xi)])$$

$$\text{and } WTP^* = E(WTP) = \int_0^T b0 + bi\ln(WTP) + \sum_i bi\ln(xi)\ dWTP$$

where T is the upper limit of integration for the truncated mean.

In other words, equation 9 evaluated at p* provides an inverse Hicksian demand function with the reservation price (or compensating variation welfare measure) in the vicinity of the truncated mean of the underlying WTP distribution (depending on levels of covariates). The particular quantile in our applications is around 25 percent. This quantile-based measure is an alternative to the conventional welfare measures discussed above; however, its

similarity to the truncated mean is apparent. As noted, this measure was first proposed by Hanemann (1989).

Since the concern here is with the distribution of WTP conditional on flow (not p), equation 9 can be rewritten with the constant term simplified to k(p) or:

$$11) \quad WTP(F) = k(p) \cdot F^{-b3/b1} \sum_i xi^{bi/b1}$$

Another element in our total value model (equation 6) is Q(F,Z). Q(·) is use per day for a given recreation site. This is modeled as a second (or higher) order polynomial in the flow variable (F) plus an assumed linear relationship to a vector of other explanatory variables (Z) such as a weekend/weekday dummy variable or:

$$12) \quad Q(F) = c0 + c1F + c2F^2 + \sum_i cizi$$

This model provides a quantity effect measure and parallels the use of a logistic regression specification by Narayanan (1986) as discussed above. As noted, the limitation of the logistic specification is that use is not necessarily a continuous positive function of flows but will likely turn negative as flows reach very high levels. A second order or higher polynomial specification (depending on signs of estimated parameters) may permit identification of an optimal flow level (in quantity terms). The congestion effect relationship is estimated by including total daily use (as a proxy for respondent encounters with other recreationists) in equation 8.

The basic problem in modeling instream flow valuation for direct use is in combining valuation of quality changes on an individual level with the aggregated response of total daily use. The quality effect can be measured on an individual level and for daily (current) flow given seasonal quantity demanded. Unless one has a large time-series data base, the quantity effect is necessarily on a daily (flow) basis. The model described above can be aggregated in two ways. The first is to simply evaluate all functions at the sample means and estimate a model for value of an average day over the season. The effect of changing flow then has the interpretation of a changed flow increment over the season. (Depending on the exact specification of equations 10 to 12, conversion constants may also be required. For example, if WTP is in terms of trips and use is days, a conversion constant of days/trip is required.) The average day value is then extrapolated to the season based on the season length. The second approach is to make total value (T) in equation 6 specific to some time period i (ie, Ti). Then equation 6 is evaluated at the variable values that held for that time period. The main variable of interest, flow, can also be set for each time period. Then T for the season is simply:

$$13) \quad T = \sum_i Ti \qquad i = 1...n$$

By setting Fi (flow in period i) at a specific level (actual historical, or any hypothetical pattern) the valuation associated with alternative flow regimes can be evaluated. For example, the incremental benefits associated with maintaining July and August flows at some minimum level over the 20 year

historical record can be estimated. For n=1, equation 13 becomes the simple seasonal aggregation at sample means. Depending on the availability of data, time periods could be specified at the day, week or month level. In short, this model can have an application to valuing the actual sampled recreation season or used as a simulation tool to evaluate alternative policy objectives.

TRUST FUND - ON-SITE

The second instream flow valuation approach in this study is also derived from a sample of on-site users. The specific valuation question is for a trust fund contribution to protect instream flows on the sample river. While it would have been possible to use this question format to value unexperienced scenarios (following Daubert and Young (1981) and Boyle et.al. (1988)), it was beyond the scope of this study to develop sufficiently informed and meaningful scenario descriptions for both our study rivers. Our application of the trust fund is instead primarily motivated by the larger policy context of the instream flow issue. We view the institution of trust funds as having played (and continuing to play) an important role in the protection of natural environments. Accordingly, our use of the trust fund vehicle is motivated by dual purposes: the usual valuation purpose and also to get some sense of the actual effective demand for instream flows. Another way to look at this is that our trust fund question gives some insight into the private non-profit sector budget for instream flows.

Getting at both purposes results in some compromise. The compromise arrived at in question wording (Appendix A) primarily leans toward the vagueness as to actual flow increments that one would necessarily be forced into in a large trust fund mailing. However, we do provide some application to the usual valuation purposes by specifying the increment to be the respondent's self-defined "preferred flow". A related series of questions earlier in the survey (Appendix A) identify this "preferred flow" at the respondent level by comparison to the actual experience flow at the time of the interview. This provides a possible efficient substitute for the costly and difficult task of defining "unexperienced scenarios".

The estimated equation based on valuation responses is of the same general form as equation 4 and has a similar reparameterization to equation 8. However, this is not an inverse Hicksian demand relationship, but a total valuation function (the question is contribution to maintain flows over the season) with the quantity variable (number of rivers protected) implicitly at one for all observations. This estimate has some special problems in aggregation. The sample is biased toward more frequent users (the on-site sample frame samples the average day, not the average user). Accordingly, to expand the sample valuation to all users requires some correction (for example, the methods of Edwards and Anderson (1987) or Loomis (1987) may be appropriate).

A value per cfs-day or acre foot of instream flow can be derived with this method by comparing sample preferred flow to average historical flows. The total annual value by all river users is divided by the required annual flow increment (to achieve mean respondent preferred instream flow levels). The

resulting value is a marginal value per acre foot (over a fairly large increment). The comparison of preferred to historical actual flows needs to be disaggregated to at least the month level.

The value per acre foot based on this model includes both direct and intrinsic (preservation) values.

TRUST FUND - MAIL

The trust fund valuation question administered to a regional household sample (by mail) was explicitly designed to address the primary study objectives of partitioning use into direct and indirect components and to evaluate additivity across sites. Given these objectives (particularly the need to ask at least some subsample to value protection of a group of rivers), the definition of precise site-specific flow scenarios becomes unmanageable. Accordingly, in the design of this question, the objective of precisely valuing a given flow increment was more or less abandoned. Instead, the question is designed to demonstrate a workable trust fund mailing and to primarily provide an estimate of effective demand (or an instream flow protection budget). This approach in fact complements the on-site work and provides a needed element for the larger policy analysis context.

The response to the trust fund mail survey question analysis parallels the on-site trust fund analysis described above. However, in this case the total valuation functions (equations 4 and 8) have an observed quantity (of rivers protected) at both one and five. In addition to the dichotomous choice question format, the trust fund mail survey also employed an open-ended format. In this case the total value function follows equation 5, since the latter can be directly estimated using the open-ended response as the dependent variable.

E. ADDITIVITY ACROSS SITES

A basic issue in the use of nonmarket valuation techniques is whether results for different sites or resources are consistent and valid estimates. For example, are valuation estimates derived with CVM consistent with welfare estimates derived from real markets? We focus here on the specific problem of whether values across sites are additive. The naive view of this problem would suggest that if a change at each of two rivers is valued at say $10,000 per annum then when the same methods are applied to value the change on the two rivers together, a value of $20,000 should result. In fact this sort of strict additivity is not implied by consumption theory. WTP for recreation or preservation benefits is subject to a budget constraint and shows diminishing marginal utility the same as any other purchase. Previous research on this issue includes a study of wild and scenic rivers in Colorado by Walsh, Sanders and Loomis (1985).

To specifically identify theoretically consistent behavior for trust fund donations, it is necessary to recognize that the quantity demanded in the underlying demand relationship is the number of rivers protected. The implications of basic consumption theory for this problem can be briefly illustrated.

Suppose that a total willingness to pay function can be estimated for the given change across a set of homogeneous rivers or

14) $T = f(Q,Z)$

where Q is quantity demanded (rivers protected or changed) and Z is a vector of explanatory variables. Then the marginal valuation (or inverse demand) function is given by $\partial T/\partial Q$. By the nonsatiation axiom of consumption theory we expect this to be always greater than zero. The second derivative is given by $\partial T^2/\partial Q^2$. By the law of demand (and the usual convexity assumptions) this derivative should be negative. Finally, assuming that the second derivative is negative, we also know that the average willingness to pay is also a declining function of quantity. If a total willingness to pay function of the general form of equations 8 and 9 is estimated (substituting T for WTP and Q for q), then the first two hypothesis can be made explicit in terms of the equation 9 parameters. (In other words, the following analytical results are specific to a double-log specification of the total WTP function.)

It can be shown that total willingness to pay is a positive function of quantity if $-b2/b1 > 0$. (Recall from equation 8 that b2 is the estimated coefficient on quantity of rivers protected and b1 is the coefficient on the logged bid offer for a the dichotomous choice logistic regression model.) Marginal WTP is an inverse function of quantity demanded if the second derivative of T is negative. It can be shown that the second derivative of T is negative when $-b2/b1 < 1$. In short, for the responses to valuation of one versus multiple rivers to be consistent, the parameters of the total willingness to pay response function (as equation 8) must satisfy: $0 < -b2/b1 < 1$. These requirements are in terms of the parameters of the dichotomous choice model. For the open-ended the negative of b2/b1 corresponds to the estimated parameter on quantity demanded (for the double-log specification of equation 5).

Alternative hypothesis tests can be conducted by comparing subsample mean welfare estimates for the single river and multiple river responses. For example, if $Q2 > Q1$, then $T(Q2) > T(Q1)$. Similarly, average WTP for one versus five rivers can be compared. It may be noted that a dummy variable for one of the single rivers can be included in the specification of equation 5) actually estimated. The t-test on the estimated parameter for this dummy variable provides a test of whether valuation of at least the two single rivers (Bitterroot and Big Hole) is the same. Another way to deal with the problem of heterogeneity is to ask respondents to allocate their river group valuation by percentage among the five rivers having instream flows augmented (Appendix A). This provides a comparison of average WTP at one and at five rivers that corrects for heterogeneity among rivers. As noted previously, consistency with consumption theory is indicated if the single river mean valuation is greater than the allocated multiple river mean valuation for the same river.

It is of interest to interpret the Walsh, Sanders and Loomis (1985) study in light of this model. The 1985 study was based on a mail survey of Colorado residents using an open-ended contingent valuation format of willingness to

donate to a trust fund to protect a set of 11 wild and scenic study rivers from development. Each respondent was asked to value different groups of the study rivers including the "three most valuable rivers", the "seven most valuable rivers" and all eleven rivers. A WTP total valuation function was estimated of the form: $WTP = 4.67 + 13.03(Q) - .44(Q)^2$ (Walsh, Sanders and Loomis, p.72). As the authors note, with the designation of additional rivers, benefits increase at a decreasing rate. Within the range of their sample, the Walsh, Sanders and Loomis WTP equation is consistent with the theoretical constraints derived above. Specifically, the first derivative of WTP with respect to quantity of rivers protected is positive up to a level of 15 rivers and the second derivative is negative.

F. DIRECT VERSUS INDIRECT SHARE

In an influential paper, Krutilla (1967) identified a number of possible motives for economic valuation of natural environments, these include not only direct recreational use but also what he called existence, bequest and option values. The view that total economic value includes both direct and indirect values was made explicit by Randall and Stoll (1983). The concept of total economic value has given rise to a number of studies that attempt to identify the share of total value that is attributable to each motive: direct use, option of future use, existence and bequest (see Loomis (1987b) for a recent review). One approach to identifying the share to each motive is to first determine total valuation (for example, through a CVM question) and then ask respondents to apportion total value (by percent) among the various categories (Sutherland and Walsh (1982), Duffield (1982), and Walsh, Loomis and Gillman (1984)). The problem with this approach is that there is no evidence that respondents can give meaningful responses or even that the various use categories are well understood. An alternative is to ask a series of CVM questions that attempt to identify valuation with and without direct use (Boyle and Bishop, 1987). This may be a good approach, but valuation in sequential questions may be affected by respondent fatigue and bias introduced by previous bids (depending on the question format). A related strategy (Brookshire, Eubanks and Randall (1983) and Stoll and Johnson (1984) is to ask respondents if they expect to utilize the site. The WTP response of the subsample who would utilize the site is assumed to be option price (direct use value plus option value) while the WTP response of nonusers is assumed to be purely existence value. The problem with this approach is that even users may be motivated by existence or bequest uses. Additionally, only a two-way split of total use is possible.

The approach introduced in this study is to include measures of both recreation and preservation motives as explanatory factors in the valuation model. Social psychology techniques for defining and measuring motives are used in the context of our theoretical model of consumption behavior. For the case where the specification of the CVM response function is homogeneous of degree r, an interpretation of relative direct and indirect shares can be derived from model parameters. The household survey trust fund for instream flows is an appropriate application given that user and nonuser response can be interpreted as a Randall and Stoll (1983) measure of "total economic value". We first describe the basic model and then in the following section discuss the methods for measuring recreation and preservation motives.

A function f(·) that is homogeneous degree r satisfies the condition:

$$15)\quad f(kx1, kx2, \ldots, kxn) = k^r y$$

by Euhler's theorem, then

$$16)\quad \Sigma\, fi \cdot xi/ry = 1$$

where fi is the partial of the function f with respect to the ith variable, xi. Accordingly, the term fi·xi/ry has the interpretation of being the relative share of y due to the ith factor. This interpretation is analogous to a standard result in production theory for homogeneous degree one production functions: if factors are paid their marginal product then total product is just exhausted. For the case at hand, if f(·) is a functional measure of total willingness to pay (an in equation 9), then equation 16 provides an analytical method for identifying the share of total valuation associated with a given subset of explanatory variables.

The application of this result to our basic dichotomous choice model can be illustrated by rewriting equation 4, with an explicit set of explanatory variables:

$$17)\quad \ln(p/1-p) = a + b1\ln(W) + b2\ln(q) + \sum_i bi\ln(Ei) + \sum_i bi\ln(Fi) + \sum_i bi\ln(Xi)$$

where a, bi are parameters to be estimated
W = bid value
q = quantity demanded (direct use measure)
Ei = measures of preservation/existence/bequest motives
Fi = measures of option (future use) motive
Xi = other explanatory variables (income, etc.)

It can be shown that if equation 17 is reparameterized in the general form of equation 9 (with WTP as dependent variable), it is homogeneous degree r = $\Sigma bi/b1$ and that factor shares are given by $bi/\Sigma bi$. This result is easily seen since in its reparameterized form, the model (equation 9) is similar to a Cobb-Douglas production function. To provide an interpretation that allocates total value uniquely among direct use, option use and existence motives, the set of i parameters bi used to define r can be restricted to those on the direct, option and existence factors. All other variables are evaluated at their means (such as income, etc.) and collapsed into the constant term. The specification allows for the possibility that more than one specific existence or option variable may be used to define a given motive. Additionally, this formulation provides a general model for exploratory research on motive categories that may or may not include the conventional option, existence and bequest taxonomy.

Factor shares can also be calculated for motives represented by unlogged independent variables (including for example, dummy variables) in the framework of equation 17. It can be shown that for these variables, the numerator in the factor share equation is the estimated parameter times the variable (evaluated at its mean or some other level). In other words, for a

semi-log specification, the elasticity of a given independent variable is conditional on the value of that variable. For example, in a specification that includes both logged (x_i) and unlogged (z_j) terms in the estimated equation, then the reparameterized equation is $y = a \prod_i x_i^{bi} \prod_j \exp(b_j z_j)$. Then the factor share for an x_i variable is $b_i/(\Sigma b_i + \Sigma b_j x_j)$ and the factor share for a z_j variable is $b_j z_j/(\Sigma b_i + \Sigma b_j x_j)$.

Our measurement of preferences or motives follows general social psychological methods demonstrated in Duffield and Allen (1988) for market segmentation of Montana anglers. There is in fact an emerging literature that demonstrates the importance of integrating psychological measures into recreation analysis (for example, Hautaluoma and Brown (1978), Baumgartner and Heberlein (1981) and Driver (1985)). For the case at hand, our household mail survey participants were asked to respond to a series of 23 questions on how they felt about rivers and various environmental issues (Appendix A). Response was

in terms of a five-point Likert scale from "strongly agree" to "strongly disagree". It was anticipated that these questions could be analyzed through factor analysis to identify a set of variables measuring the existence motive. The basic theoretical considerations underlying the design of the 23 questions are discussed in the following section. Respondents were additionally asked a series of questions about plans for future use that could be used to define the option motive. Direct use is measured by the conventional quantity demanded variable (trips taken so far this year) or by a measure that aggregates several seasons of use (trips taken in the last two years).

An application of the apportionment method was also undertaken for purposes of comparison. Respondents were directly asked to apportion their trust fund contribution among two categories: current plus future use and reasons other than personal use (see Appendix A for question wording).

G. TAXONOMY OF VALUES

This section provides a discussion of the theoretical considerations underlying the design of the 23 preservation motive questions.

BACKGROUND

There's been a good deal of discussion in the economic literature on the nature of indirect (preservation) values. Various taxonomies of value have been proposed in the attempt to explain why people hold preservation values, their relationship to direct use values, and why indirect values are typically so much higher. However, the taxonomies proposed have not been tested empirically and there's been little evidence that the vast social psychological and sociological literature on values has been tapped.

Economists have taken it for granted that a stated willingness to pay for natural resources (or specific characteristics of resources, such as clean air or instream flow levels) means that the payers must value that resource somehow. With this assumption, the problem is then one of developing a taxonomy of values, and relating willingness to pay back to this taxonomy.

The papers in the volume "Toward the Measurement of Total Economic Value" (Peterson and Sorg, 1987) reflect this approach, breaking total value into any number of components (depending on the taxonomy used), including past use values, future use values, vicarious use values, option values, preservation values, existence values, bequest values, quasi-option values, indirect values, intrinsic values, nonuse values, option price values, interpersonal values, intergenerational values, onsite values, offsite values, aesthetic values, and stewardship values.

This has led to such finely-tuned philosophical debates as whether altruism must by definition exclude any type of personal benefit--including the personal well-being gained from knowing that you're altruistic which, after all, is a concept valued by our society in general.

The interesting thing about these taxonomies is that none of them have been tested directly. Instead, the traditional approach has been to state one's

taxonomy and the resulting types of values, word a contingent valuation question in a way that reflects these values, and obtain a willingness to pay for the stated benefits. The dollar values estimated have been assumed to measure that particular set or type of values, because that was the question to which people were responding.

The problem with this assumption is that people may have many reasons for responding the way they did, regardless of whether the taxonomy of values is valid and reflects peoples' decision-making processes. Willingness to pay in response to a question does not mean that people are buying off on all of the assumptions inherent in question wording.

Do people have a single value they attach to a resource, and then partition out chunks of that amount to use, nonuse, or other characteristics of that resource? Do people value a resource in many ways that are additive to obtain total value? Are people able to distinguish option values from existence values from use values, and, if so, how conscious a process is this--are people aware that they are making these distinctions? We don't know.

The concept of altruism in particular is worth a closer look. Psychologists seem to agree that altruistic behavior has three characteristics: it is done voluntarily; the goal is to benefit another (person or thing); and it must be done without expectation of a reward (Bar-Tal, 1976). The third criterion is put in terms that avoid the "pure altruism" argument that suggests that any possible benefit--such as knowing that you've done (what you think is) the right thing automatically means a behavior is not altruistic.

Some economists have suggested that feelings of general concern or global responsibility are best expressed as a form of altruism. For example, Randall has suggested that "pure existence value excludes any values that arise from current (personal) use or anticipated future (personal) use. Because vicarious consumption is a kind of use, all pure existence demands must be altruistically motivated" (p. 6, Peterson and Sorg 1987).

Interestingly, though, implicit in Randall's discussion is the notion that people place some positive value on an asset because they derive some kind of utility from it, though not from the benefits of direct, personal use. Their motives for valuing an asset may reflect benefits derived either from the asset itself (i.e., knowledge as a form of vicarious use) or from others' use of it.

Arguments about whether something is "pure altruism" largely miss the point--which should be to learn more why people hold existence values. Study after study has found that existence values are far higher than use-related values. However, we don't know if this reflects a social desirability to appear altruistic or whether it really reflects a greater concern for preservation values than use-related values.

Basic research is needed to understand peoples' own value taxonomies rather than relying on CVM question wording. Smith (1987) realized this, saying that we need a "better understanding of the actual considerations individuals use in valuing resources and how they are communicated ..." (p. 34).

This paper reports the results of some exploratory research addressing peoples' beliefs, attitudes, and self-reported behaviors regarding what we'll refer to loosely as preservation values--values apart from those related to personal onsite resource use.

The 23 statements were developed by reviewing the literature on motives for existence or preservation values and writing questions based on statements made by a wide variety of authors. The purpose of these questions was to test for any underlying patterns of relationships that might help define a set of useful concepts.

QUESTIONNAIRE ITEMS

Brookshire et al. (1980) concluded, "Certainly we can directly inquire as to individuals' motives and ethical structures underlying statements of willingness to pay." The present questions were not linked directly to dollar amounts, but were designed to explore peoples' underlying value systems in a way that could be correlated with dollar amounts in the analyses. Following is a list of ideas advanced in the literature, along with the questions designed to tap each domain.

Krutilla (1967, p.781) said, "There are many persons who obtain satisfaction from the mere knowledge that part of the wilderness of North America remains even though they would be appalled by the prospect of being exposed to it." The same sentiment has been expressed by many authors, perhaps most eloquently by Edward Abbey.

I'm glad there is wilderness in Alaska even if I never get there to see it.

Allen (1979) believed that another possible motive was that wilderness (or other protected wild things) could act as an escape button, allowing people to cope with the stressors of urban existence. Glass and Singer (1972) found that people could adapt quite easily to loud noise while working on various tasks. Exposure to the noise, however, extracted a psychic cost from the individuals, whose performance was impaired on tasks following termination of the noise. Then an escape button was provided for some subjects, who could use it to end the noise if it became unbearable. The results were striking; with the escape potential, postadaptive adverse effects were greatly reduced even though none of the subjects actually used the button. To people who value an environmental asset, the knowledge of its existence may be enough to have beneficial effects on the stress of daily life--another possible underlying motive for holding non-use values.

Some days when I'm feeling pressured it calms me down to think that some lands out there are wild and undeveloped, even if I never get to go there.

Krutilla (1967) suggested that one source of satisfaction from this knowledge might be that it exists for future generations (heirs); this also reflects feelings of long-term stewardship of natural resources.

Our society should consider the needs of future generations as much as we consider our needs today.

Altruism has been hypothesized to be one motive for holding existence values. Randall distinguished among three types of altruism: "interpersonal altruism," from knowing an asset is available for others to use; "intergenerational altruism," from knowing that an asset will be available for future generations to use; and "Q-altruism," from knowing that the asset "Q" itself benefits from being undisturbed. Several statements tapping different dimensions of altruism were included.

Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.

I enjoy knowing that my friends and family can visit rivers for recreation if they want to.

I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.

It's also valuable to know if people believe in the general concept of existence or preservation values.

People can value a river even if they don't actually go there themselves.

Many authors have said that one motive for valuing environmental goods is vicarious consumption--enjoying learning or hearing about rivers through experiences of other people or by viewing picture books or movies about rivers.

I enjoy looking at picture books or going to movies that have rivers in them.

I enjoy hearing about rivers from my friends or family.

One potentially confounding variable is belief about the viability of the resource in its existing state. For example, people could value rivers highly, but believe that additional flows are not needed, leading them not to pay. People may value the resource but not demonstrate existence values because they think the resource is fine.

I think that most rivers already have enough water in them to be healthy resources.

I have been concerned about how the recent drought may affect fish and wildlife that depend on rivers.

Randall said that the uniqueness and the threat of irreversible loss of the resource or object are circumstances in which incremental loss of existence values are the greatest (but people must value the resource in the first

place!).

The flow levels in Montana's rivers and streams are a unique and irreplaceable resource.

The theories of humanistic psychologist Abraham Maslow provide one possible explanation. Maslow (1968) believed that self-actualizing people "are more able to perceive the world as if it were independent not only of them(selves) but also of human beings in general...(and can) look upon nature as if it were there in itself and for itself, and not simply as if it were a human playground..." (p. 76). Such people might be expected to hold non-use values--and be willing to pay to maintain an environmental asset regardless of their own expected benefits. In addition, people who have been helped toward self-actualization by river-related experiences (such as peak experiences) would be expected to value that environment highly.

I have had inspirational experiences on rivers

Rivers do not have many spiritual or sacred values to me

Endangered species should not be protected if they don't have any benefits to humans.

General concern for the natural environment and its various components also could be reflected by a willingness to pay for instream flows and other environmental conditions.

I have a great deal of concern for endangered species.

It's important to protect rare plants and animals to maintain genetic diversity.

Philanthropy could be another motive; some people like to know that they're helping a cause even if they don't highly value that particular cause themselves.

Donating time or money to worthy causes is important to me.

Another motive, sympathy, has been defined as a condition when one's own welfare will improve because of concern for others. A related motive, commitment, has been defined as doing something for others even though you know you will be worse off than if you had acted in alternative fashion.

I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run. One motive, called quasi-option value, is held in the belief that preserving a resource today delays development until some future date, when more information may be available to make the decision. This idea was given to respondents, but with the eventual outcome skewed toward development rather than left open-ended.

The main reason for maintaining resources today is so we can develop

them in the future if we need to.

Another motive that's responsible for a fair amount of behavior is guilt. This could stem from peoples' belief that they have contributed to a problem, or that they aren't doing all they could to prevent it. A question on this idea was worded to avoid placing blame directly.

I feel that I should be doing more for Montana's rivers and streams.

People may not be willing to pay for instream flows because they place more value on flow uses which can conflict with instream uses of water.

I would like to see more hydroelectric dams on Montana rivers.

Finally, people may believe that attitude statements such as these are a flimsy foundation for water policy. The question testing this was interesting because we were not sure how people would respond; after all, the goal of the survey was to find out whether and how much people were willing to pay for instream flows--would people associate this effort with economic valuation of instream flows?

The decision to develop resources should be based mostly on economic grounds.

H. VALUATION ACROSS ACTIVITY OR USER GROUP

The final study objective was to investigate valuation across activity or user group. This analysis is straightforward, based on identifying mean welfare measures by activity or user subsamples. Questions were included in both the on-site and mail surveys (Appendix A) to identify activities actually engaged in by a given respondent.

III. DATA AND QUESTIONNAIRE DESIGN

As summarized in Table III-1, four different surveys were undertaken for purposes of this project: an on-site survey in the summer of 1988 on two Montana rivers with a total sample of 909; a 100 sample phone pretest of a mail survey in September of 1988; a regional mail survey in November 1988 to January 1989 with a total initial mailing of 1850; and a phone survey of nonrespondents in April 1989 (total sample of 251). The response rate for phone and on-site surveys was nearly 100 percent. For the mail survey, 140 of the initial mailing were undeliverable and 582 were returned completed for an overall response rate of 34 percent. Copies of all surveys are provided in Appendix A.

The study rivers selected for the onsite survey were the Big Hole and Bitterroot Rivers. Both rivers are important recreational resources and are subject to severe dewatering due to summer irrigation withdrawals. It was anticipated that there would be significant flow variation over the course of the May through August survey period to permit identification of valuation and use response to flow variation. Like most Montana rivers, the Big Hole and

Bitterroot have pronounced seasonal variation, with runoff due to snowmelt typically peaking in June and low flows for the year in August or September. Both rivers have good historical flow records; the mean flow at Melrose on the Big Hole is 1152.8 cubic feet per second (cfs) on a 65 year record. June flows average 4055 cfs and August 479. The historic mean flow on the Bitterroot at Darby is 909.4 cfs (51 years of record), with June and August flows of 3197 and 376 cfs respectively.

The Big Hole is one of the premier trout fisheries in North America. It starts near Jackson, Montana in a broad valley bounded by the Bitterroot, Pioneer and Pintler Mountains. It circles west then north and east around the Pioneers to where it joins the Beaverhead (to form the Jefferson) at Twin Bridges. In the middle section of the river, between Wise River and Melrose, the valley narrows in a canyon. This canyon section is world-renowned for its dry fly fishing for browns and rainbows. Particularly during the salmon fly hatch in mid-June, the river attracts anglers from across the nation.

The Bitterroot is also an excellent fishery, but reflecting the considerably higher population density of the Bitterroot Valley (compared to the Big Hole) receives the bulk of its use from floaters and general shoreline recreationists. This river flows north from the junction of the East and West Forks south of Darby, Montana to where it joins the Clark Fork in Missoula. While the Big Hole has a well-defined and generally stable stream bed, the Bitterroot is a river on the move, constantly redefining its course through braided and cotton-wood lined channels. The Bitterroot has a major reservoir (Painted Rocks) on its West Fork tributary. In recent years, the Montana Department of Fish, Wildlife and Parks has purchased water from this reservoir to supplement summertime flows.

The purpose of the onsite surveys was to gather information on respondents on a daily level that could be correlated to daily river flows from U.S. Geological Survey river gauges. In addition to the long-term gauges at Melrose and Darby, there are temporary gauges at Bell Crossing (Bitterroot) and Wise River (Big Hole). Interviews were used to identify respondent characteristics, river activity share, trip valuation, and total visitation.

The onsite surveys were conducted from May 1, 1988 to August 26, 1989. There were a total of 34 interview days spent on the Bitterroot River with 8 days in May, 10 days in June, 12 days in July, and 4 days in August. The Big Hole sample was collected on 37 days, consisting of 6 days in May, 14 in June, 8 in July, and 9 in August. The details of the interview schedule, including sample dates and sizes, are provided in Table B-1 of Butkay (1989, p. 160).

The survey procedure used in gathering interviews of recreationists on the two rivers consisted of an eight hour day. Big Hole surveys were collected between 9 or 10 in the morning and 6 or 7 in the evening. The Big Hole sample day was split between the upper and lower river, alternating morning and afternoon hours between the two sections. Approximately 45 minutes were spent at each access in the course of a day. During a typical eight-hour interview day on the Bitterroot, two hours were spent at each of four Bitterroot access point, with time of day randomly varied across sites. Sampling on the Bitterroot began as early as 8 in the morning and lasted as late as 5 or 6 in the evening.

The random selection procedure used on the rivers seemed to provide an accurate representation of the characteristics of the population. When a site was crowded, the person to be interviewed was randomly chosen. Of the recreationists remaining at the site, the next person to be interviewed was also chosen at random. This procedure continued throughout the time period at the site. Typically, while an interview was being conducted, recreators remained at the site.

On both rivers, when fishermen or shoreline recreators were encountered in a group, one member of the group was chosen at random to be interviewed. If a group of shoreline fishermen was spread out along the river's edge, with distance separating them, all were interviewed assuming that the other group members could not influence the responses given. In the case of groups composed of family members, an adult member of the family was chosen to be interviewed. Fishermen in midstream were interviewed by either calling them over to the bank or wading to them. Floaters were interviewed upon taking out of the river.

On site interviews on the Bitterroot were taken at four river access sites: Woodside Bridge, Tucker West, Bell Crossing and Stevensville Bridge. These sites encompass 19.5 river miles and account for an estimated 11 percent of recreational use on the Bitterroot. This section of the Bitterroot is dewatered by irrigation withdrawals during low-water years (while the section below Stevensville Bridge is typically replenished by return flows).

On the Big Hole River, the study section was between Wise River and Glen - a stretch that is heavily used by anglers. This 52 mile section of river gets an estimated 43 percent of total Big Hole recreational use. Interviews were collected at nine sites in the upper and middle sections of the Big Hole River, including: Dickey Bridge, Jerry Bridge, Dewey, Divide Bridge, Divide Camping and Fishing Access, Maiden Rock Bridge, Salmonfly Access at Melrose, Brown's Bridge Access and Glen Fishing Access.

Throughout the four month sampling period, one interviewer was able to collect

surveys of all Bitterroot recreators encountered at each site. During May, July, and August, one interviewer was also able to interview all Big Hole recreators seen. During the salmon fly hatch, which occurs in mid-June, hundreds of fishermen, both floating and shoreline, are attracted to the Big Hole River. With only one person collecting surveys during this time, some recreationists were missed.

In early June, the salmon fly hatch begins the Glen area and moves upstream 3 to 5 miles per day. Between June 10 and June 12, the hatch was occurring in the Melrose to Divide area. With only one interviewer, on these three days, some floaters taking out at Melrose were missed.

During this onslaught of fishing enthusiasts, more effort was made to gather as many interviews as possible throughout the length of the Big Hole River. During the sampling day, one interviewer remained in the section between Maiden Rock and Glen, while the other interviewed recreators in the upper reaches between Dickey Bridge and Divide. Each spent eight hours interviewing, for a total of 16 sample hours per day, and found that it was possible to interview all recreators at each site, with one exception: during afternoon and evening hours at Melrose, due to the large number of recreators between June 10 and June 12 and the time constraints involved, it was not possible to approach each group before their departure from the site.

By the end of June and July, the hatch was in the upper river from Divide to Dickey Bridge. Most recreators were found between Maiden Rock and Wise River during the morning and afternoon hours. Some evening interviews took place in the lower river near Melrose. Low flow levels on the Big Hole River contributed to the paucity of the August sample size. The interview day was split between the upper and lower river. The majority of interviews took place in the upper river. Very few river recreators were encountered below Melrose in August due to the relatively low water flows.

Our judgment is that the onsite survey procedure successfully provided an accurate representation of the characteristics of the population.

While the onsite survey provides considerable information on river users, nonusers may also place significant values on protecting instream flows. Both users and nonusers were contacted through a regional household mail survey designed to measure the level and extent of indirect or preservation values associated with instream flows. The sampling strategy was designed to obtain responses from a wide range of people in the region where the target rivers were located, rather than obtain a probability sample representing the views of a specifically-defined regional population. Six populations were sampled: people listed in the current telephone directories for five Montana areas (Billings, the Bitterroot Valley, Butte, Helena and Missoula) and Spokane, Washington. These were selected to cover several population centers at varying distances from the study rivers.

Three different mail survey instruments were used, differing primarily in which river(s) were to be protected in the trust fund question (Appendix A). In addition to a Bitterroot only and a Big Hole only hypothetical instream flow trust fund, a five river (Bitterroot, Big Hole, Clark Fork, Gallatin and

Smith) version was developed. This group of five rivers was selected for the combination of high recreational use and values plus severe summer dewatering.

The mailing procedure was based on Dillman's Total Design Method, and included the standard initial mailout with cover letter, questionnaire, and stamped return envelope. A postcard reminder was sent 10 days after the initial mailout, and a second mailing was made to nonrespondents about one month later. A problem with the mail survey (that may have contributed to the low response rate) was that the second mailing was delayed several weeks so as to not arrive just before Christmas.

The first section of the mail questionnaire asked about peoples' recreational use of rivers, including how frequently they and members of their household participated in river-related recreation, what activities they did on or along rivers, the types of experiences people desired, and the importance they placed on recreation compared to other uses of river water such as irrigation or hydropower.

The second section asked about their past use of the target river(s)--Big Hole, Bitterroot, or set of five rivers--including number of visits in the past three years, activity participation, encounters with low flow conditions, and intended future use levels.

The following section contained the contingent valuation questions. They were prefaced by a series of four questions designed to measure peoples' familiarity and experience with the general objective of increasing instream flows, as well as the trust fund payment vehicle. These questions were asked both to collect data and to introduce the payment concept and trust fund payment vehicle to respondents.

The lead-in to the CVM question described the problems associated with low flows, and the possible benefits if flows were increased. The benefits included those related to recreational use ("people would be able to float the river later in the summer") and those not necessarily related to recreational use ("many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters"). The question also included a direct appeal to non-users ("Even if you don't use the ------ River for recreation, you would know you are helping to keep an important Montana river clean and healthy").

Asking the question this way presumed to measure a "total value" that could then be partitioned into direct (recreational use) and indirect benefits.

The contingent value question was posed in a closed-ended format; respondents were asked if they would purchase an annual membership in a trust fund to buy water when needed at a specific dollar amount (which varied from $5.00 to $300.00). If the respondents said no, they were asked if they'd pay a smaller amount, such as $1.00 per year, and, if the answer was still no, they were asked to describe their reasons for declining. If they said yes, they were asked to specify the maximum amount they'd pay for such a membership.

People who were willing to contribute any amount were then asked what percent

of that amount they would allocate to direct use values (their own current and future use of the river) and the percent allocated to indirect or preservation values (reasons apart from their own use of the resource, including benefits to plants and wildlife, and availability for future generations). A final followup question asked people who, if anyone, should be responsible for maintaining adequate flow levels: no one; the state; the federal government; recreational users; or private trust funds. This was designed to assess people's attributions of responsibility, a potentially important mediating variable.

The questionnaire then asked in a five-point Likert-scaled format how much people agreed or disagreed with each of 23 statements related to peoples' reasons for holding preservation values. The statements were derived from largely-untested "hypotheses" posed in the literature. This part of the survey was purely exploratory research, designed to see if any underlying patterns could be found in peoples' attitude and belief systems that might help explain why people are (or are not) willing to pay for instream flows. The development of this section is discussed in greater detail in Section VIII.

The final section asked about respondents' gender, employment status, education, income, membership in organizations, and level of donation to causes and charities. A blank page was provided for additional comments.

A phone pretest of the mail survey was administered to 100 Missoula area residents in September 1988 using the Big Hole survey version. The pretest was to establish the feasibility of the survey, and to obtain preliminary estimates of the trust fund response. The latter was used to establish the range and distribution of the dichotomous choice dollar bid levels.

The nonrespondent phone survey, conducted in April 1989, was a very abbreviated version of the mail survey (Appendix A). The main purpose of the nonresponse survey was to identify any significant differences between respondents and nonrespondents. This information could then be used to extrapolate the mail survey valuation responses to the regional population.

IV. SITE AND RESPONDENT CHARACTERISTICS

This section provides a summary of site and respondent characteristics from the onsite and mail surveys. Additionally, responses related to flow preferences are summarized.

A. ONSITE SURVEY

Table IV-1 provides a summary of activity shares for survey respondents on the Bitterroot and Big Hole river study sections as observed in the summer of 1988. Fishing is the dominant activity on the Big Hole, comprising 86.8 percent of all use. By comparison, only 40.5 percent of all recreationists on the Bitterroot are anglers.

Fishing from shore is the chosen activity of about 25 percent of all users on both rivers, but on the Big Hole there is much more float fishing (49.6 percent of all Big Hole users are float fishing or float fishing and camping,

compared to only 14.8 percent on the Bitterroot). The dominant use on the Bitterroot is general shoreline activity (picnicking, swimming, etc.). These activities occupy 53 percent of Bitterroot users compared to only 7 percent of Big Hole users.

The importance of angling on the Big Hole and this river's fame is reflected in the type of visitor it attracts. Twenty-nine percent of Big Hole users are from out of state (compared to 16 percent of Bitterroot users)(Table IV-2). The mean household income of Big Hole visitors is $41,500 compared to $31,000 on the Bitterroot. Eight percent of Big Hole visitors are on guided trips, compared to only 0.3 percent on the Bitterroot. The typical trip to the Big Hole entails more time at the site (25.5 hours compared to 6.8 on the Bitterroot), greater expense per person per trip ($329 versus $133), and is less frequently taken. The average Big Hole respondent had taken 2.8 trips so far that year to this river compared to 8.6 trips for the average Bitterroot respondent. Additionally, the Big Hole was considered to be crowded by 20 percent of respondents; only 7 percent of Bitterroot visitors thought that river was crowded.

The summer of 1988 happened to be one of the driest on record, and the Big Hole was particularly hard hit (Table IV-3). June flow on the Big Hole averaged only 705 cfs (based on Melrose and Wise River gauge average), or 17 percent of the historical Melrose mean flow. By August flows averaged only 52 cfs, or 10 percent of the historical mean. The Bitterroot also was below normal, with August average discharge at 216 cfs (Bell Crossing and Darby average) compared to the historical average of 376 at Darby.

Table IV-3 shows the monthly change in respondent characteristics and average number of individuals sampled per day. Individuals sampled per day is a proxy for use, since a formal use survey was beyond the scope of this project. Individuals sampled per day is probably a very good index to use on the Bitterroot since it was always possible to sample all individuals observed at the access sites. On the Big Hole, which was more crowded that the Bitterroot during good flow levels, it was not always possible to sample all individuals observed. For purposes below, where use (individuals sampled) is regressed on flows to estimate the model in equation 12, this has the effect of underestimating the influence of flows on use for the Big Hole. Accordingly, the quantity effect as defined previously is conservative. For the several days in June (during the salmon fly hatch) when two interviewers were present on a given day on the Big Hole, the use index of individuals sampled per day used in estimating equation 12 is based on an average of the two interviewers' samples.

Based on individuals sampled per day, use on the Bitterroot peaked in July and on the Big Hole in June. On both rivers there was increased nonresident use over time. On the Bitterroot, only 2 percent of May users were nonresidents, compared to 29 percent by August. The absolute change was even more pronounced on the Big Hole, going from 16 percent nonresident use in May to 63 percent in August. While visits on the Bitterroot averaged around 5 hours onsite through the summer, on the Big Hole trip length changed from 17 hours onsite to 50 hours.

Variables describing the quality of fishing on each river during the sampling period are recorded in Table IV-3b. Monthly averages were estimated for the number of trout caught (TROUTSF) and the hours fished (HOURSF) at the time of the interview. The average number of hours fished were significantly greater on the Big Hole than the Bitterroot for May, June and July. A weighted average indicated that Big Hole fishermen fished 6.54 hours per trip while Bitterroot respondents fished only 1.39 hours per trip during the three months. In August the hours fished at each river were not significantly different. The number of trout caught was significantly higher on the Big Hole than the Bitterroot throughout the summer of 1988. The weighted average for TROUTSF on the Big Hole was 5.77 trout versus 0.56 trout on the Bitterroot. The monthly means for the number of trout caught per hours, SUCCESS, was computed as TROUTSF/HOURSF. For May-July, SUCCESS was significantly greater on the Big Hole than the Bitterroot with a weighted average of .318 fish per hour on the Bitterroot versus .818 fish per our on the Big Hole.

The average trout catch statistics in Table IV-3b indicate that the Big Hole is a generally higher quality fishery than the Bitterroot, at least as far as angler success rates.

These catch statistics in Table IV-3b also show how catch rates changed over the course of the summer on each stream. On the Bitterroot, the August success rate of .55 trout/hour was approximately double the May-June success of .28 trout/hour and also higher than the July .35 trout/hour. On the Big Hole, the August success (.85 trout/hour) was almost as high as in June (.90 trout/hour) and higher than May (.77) or July (.55). The high June success on the Big Hole is probably due to the excellent fishing that results from the salmon fly hatch. The pattern of generally high success in August may have several explanations. One cause may be that August anglers are likely to be the more dedicated, highly skilled anglers; this is reflected in the fact that a greater share of August anglers on both rivers are nonresidents. Another factor is that with the extremely low flows of 1988, fish were concentrated in limited areas and were more easily caught. Discussions with fishery biologists disclosed reports of very high catch rates on the Big Hole in late summer. Some guides reportedly quit fishing as they felt it was unethical to take advantage of the trout vulnerability.

It was beyond the scope of this study to attempt to build a formal model to explain why success varied over the summer for the on-site samples. However, it is likely that flows, the timing of insect hatches, and angler skill levels would be important factors. With regard to flows, it is important to note that while the short-term effect of low flows may be to actually increase angler success, the long term effect is likely to be negative. For example, biologists are finding that on some streams that were heavily impacted by low flows in 1988, an entire age class of trout is missing. This effect of flows on reproductive success and survival would require a multi-year model to incorporate these lagged relationships.

Table IV-4 summarizes flow-related responses by river. The majority of users on both rivers felt that the flow was adequate for their purposes at the time of interview. Only 19 percent of all Bitterroot respondents and 31 percent of

Big Hole respondents would have preferred higher flows. However, for July-August respondents 30 percent of Bitterroot visitors and 59 percent of Big Hole visitors would have preferred higher flows. It appears that low flows were perceived to be more of a problem on the Big Hole than the Bitterroot in 1988. (This is not surprising given the relative absolute flow levels described in Table IV-3.) This is also reflected in the comments recorded regarding flow. Of those commenting (only about 20 percent on each river), 65 percent of Big Hole respondents said the flow was "too low" compared to 21 percent of Bitterroot respondents.

Given a greater share of local users, it is not surprising that Bitterroot visitors were more informed in advance of their trip as to flow conditions. Fifty-nine percent of Bitterroot visitors knew the flow conditions in advance of their trip compared to 50 percent of Big Hole users. The main source of information on flows on both rivers was past experience.

B. MAIL SURVEY

This section provides a brief overview of respondent characteristics for the mail survey. A summary tabulation of survey responses is provided in Appendix C. Additional discussion of respondent characteristics for the mail survey is deferred to Section IX, where it is convenient to describe the mail responses in comparison with the nonrespondent survey.

As noted previously, the population sampled was not a random population sample of Montana residents, but it is still useful to know how similar the respondents are to population average demographic characteristics. This comparison suggests that extrapolation from our sample to a population of Montana residents would not be appropriate.

Sixty-nine percent of the respondents were men, compared to about 50% of the Montana population, according to the 1980 census. The higher proportion of men in our sample likely resulted partly from the sampling method (more telephones listed in names of males) and the nature of the study (higher non-response among women, who are less likely to participate in river recreation. McCool (1986), for example, found in his statewide survey that 70 percent of the men sampled had fished in the last 12 months, compared to 42 percent of the women.

The respondents also had completed more years of education than the average for Montana residents; the 1980 census reported that 15 percent of Montanans had completed college or taken graduate courses, compared to 26 percent of McCool's statewide sample and 43 percent of our respondents.

A high proportion of our respondents (26 percent) said they were retired; 20 percent of our sample was aged 65 years or more, compared to 15 percent based on the 1980 census. However, the difference also may be due to an increase in the average age of Montana residents, and the proportion of respondents in other age categories closely matches the 1980 findings.

The statewide survey conducted in 1986 by McCool found that 56 percent of the population had fished at least once (and a median of 12 days) in the past 12-month period. In addition, 25 percent of Montanans had floated a river or

stream in the last 12 months; residents of DFWP Regions 2 and 3 in west-central and southwestern Montana floated the most (32 percent reported floating in the last 12 months), while residents of Regions 6 and 7 in eastern Montana floated the least (about 18 percent reported floating in the last 12 months). Forty-two percent said they had gone swimming in a lake or river in Montana.

The present survey did not ask these identical questions, but some comparisons can be made. Twenty-seven percent said they visit rivers never or rarely, and another 31 percent said they visit rivers sometimes (several days a year). The remaining 41 percent said they visit rivers frequently or very frequently--at least 11 days a year. This seems to be a higher rate of participation than that obtained by the 1986 survey. However, that question anchored participation to the previous 12-month period, so the two figures are not directly comparable.

Visitation was strongly linked to distance from the rivers; one or more visits to the target river(s) were made in the last three years by 85 percent of the respondents from the Bitterroot valley, 74 percent of the Butte residents, 65 percent of the Missoula residents, 37 percent of the Helena residents, 34 percent of the Billings residents, and 20 percent of the Spokane residents. The same patterns held for number of visits; 35 percent of the Bitterroot valley residents and 29 percent of the Butte residents had visited the river(s) 21 times or more, compared to 0 percent of the Spokane and Billings residents.

V. ESTIMATED EQUATIONS

The general procedure for producing the dichotomous choice model estimates reported in this section was to estimate separate logit models for a large subset of the theoretically plausible independent variable combinations. The maximum likelihood-based logit model in SPSSX was used on a main frame VAX. Only the end result of this estimation procedure is reported here. The models reported are generally those estimates with the largest number of statistically significant (at the 90 percent level based on a t-test for the regression coefficient) variables. This procedure was utilized in part because of the absence of a step-wise procedure in SPSSX and because of the limitations of the goodness of fit statistic reported in SPSSX (the chi square). For several of the logit problems, where there was significant multicollinearity among the independent variables, several specifications are reported.

Ordinary least squares regression results reported (for example, for the relationship of use to flows) were computed with the SPSSX stepwise regression procedure. Models reported are based on the step with the last variable included having an estimated coefficient significant at the 90 percent level, based on a t-test.

A. ON-SITE SURVEY

The major relationships to be estimated from the on-site survey are the effect of flow on valuation and flow on use. These are of course the fundamental

elements in the instream flow valuation model summarized in Equation 6 (Section II.D.).

CURRENT TRIP VALUATION

The logistic response equations for current trip valuation are provided in Table V-2 (Bitterroot) and V-3 (Big Hole). Variable definition is provided in Table V-1. The major explanatory variables are the offer bid level, income, trips taken so far this year, hours on site (trip length), age of respondent, a dummy variable for residence (Montana equals 1), and discharge. The latter equals actual average daily cubic feet per second (cfs) discharge at U.S. Geological gauging stations at Darby and Bell Crossing (Bitterroot) and Melrose and Wise River (Big Hole) for given sample days.

For the Bitterroot, three basic equations are provided: complete sample, shoreline activity group only and fish/float activity group only. In all equations, the bid variable is negatively correlated (as expected) and highly significant. Additionally, income, trips so far and trip length have the theoretically expected sign and in most equations are highly significant. The trip so far variable has the interpretation of quantity demanded, and as expected has a negative sign. Discharge is positively and significantly correlated to the log of the odds of a positive response; this indicates that trips taken at higher flow levels are more valuable, other things equal.

On the Big Hole, expected signs and highly significant correlations also hold for most variables and subsamples. Four specific equations are reported: two versions for the complete sample and two equations for the specific activities. Unlike the Bitterroot, the activity split on the Big Hole is for two types of anglers (float anglers and bank anglers). The split on both rivers was designed to divide the sample approximately in half.

A surprising result on the Big Hole is that discharge was not significantly correlated to the probability of a yes response. When discharge is included in Equation 1, the t-statistic on this variable is only 0.02. This finding may be due to the dramatic change in sample composition over the course of the summer on the Big Hole. As noted previously from Table IV-3, nonresident use increased from 16 percent to 63 percent between May and August. By August, the only recreationists continuing to use the Big Hole had to be those least sensitive to instream flows. Because most potential Big Hole users were not experiencing the low flows, Equation 1 provides a probably misleading result concerning the effect of flows on trip quality (at least in so far as extrapolating to the entire population of users).

Some evidence of sample (self) selection bias for the Big Hole is provided by the onsite logit trust fund results discussed below. It was found that the probability of a trust fund donation was highly and positively correlated to discharge levels, indicating that individuals present at higher flow levels placed a higher total value (both direct and indirect motives) on improved flows over the recreation season.

These findings indicate that an "unexperienced scenario" approach may have been preferable for the Big Hole, since it would permit obtaining flow

valuation responses at a variety of flow levels from all respondents. (The comparative consistency of both approaches for Boyle and Bishop's Grand Canyon study may have been in part due to the fact that users can not so easily self-select the flow level they will experience.)

An interactive variable was defined for the Big Hole to test if higher flows resulted in higher trip values for at least the subsample that preferred higher flows. The variable HISTAGE takes the value of average gauge height if the respondent reported preferring higher flows and zero if the respondent preferred current or lower flows. HISTAGE and SQHISTAG have the expected signs and are significantly correlated to probability of a yes response (Equation 2, Table V-3). While this is informative, this equation can not be used for total flow valuation purposes since it includes a preference variable that would be difficult to model.

The complete sample equations are reparameterized as shown in Table V-4. As noted previously, reparameterization amounts to solving the estimated logistic equations for log(BID) and taking the antilog. In this functional form, parameters have the interpretation of elasticities of the welfare measure (either the mean or median compensating variation per trip) with respect to the given variable. Accordingly, the elasticity of willingness to pay (WTP) with respect to income is positive (.76 on the Bitterroot and .28 on the Big Hole) and elasticity with respect to trips so far is -.29 and -.38 for the respective rivers. For the Bitterroot, elasticity of WTP with respect to discharge is .37; in other words, WTP increases by 3.7 percent for every 10 percent increase in discharge, other things equal.

Variables designed to measure crowding and congestion were also included in preliminary versions of the equations reported in Tables V-2 and V-3. The estimated parameters on these variables were of the right sign, but not significantly different from zero. It may be noted that Walsh, Ericson, Arosteguy and Hansen (1980) found that congestion had a large effect on trip valuation on a set of Colorado rivers. However, it appears that on average the Colorado rivers were much more crowded than the Montana study sites. The Colorado rivers averaged approximately 12 users/mile-day over the sample season compared to about 2 users/mile-day on the Big Hole and Bitterroot.

DAILY USE PREDICTION

Estimated equations relating daily use levels to flow (and other explanatory variables) are provided in Table V-6. Variables are defined in Table V-5. The dependent variable is observed daily use. The explanatory variables are discharge (as defined previously) and squared and cubed discharge terms, and dummy variables for weekend days, strong winds, cold temperature and periods when the salmon fly hatch was on (Big Hole only).

The estimated use equation for the Bitterroot has expected signs for discharge, weekend and strong winds (and all are highly significant). In addition, discharge squared and cubed are significant with negative and positive coefficients respectively. This polynomial fit to the discharge terms indicates that use is initially positively related to discharge, peaks at some level and declines. This is consistent with the general expectation

that use is low at very low flows and at flood levels and is maximized at moderate flows. The equation for the Big Hole shows significant correlation with expected signs for discharge, discharge squared, weekend dummy variable, cold temperatures and dates when the salmon fly hatch is on. The estimated parameters on the latter dummy variables are quite large.

The R squared statistic is fairly high for both equations, at .43 for the Bitterroot and .58 for the Big Hole, indicating that approximately half the variation in the daily use is explained by the models.

ONSITE LOGIT TRUST FUND

Onsite logit trust fund equations are summarized in Table V-8, with variables defined in Table V-7. The key explanatory variables are bid, income, trips in the last two years, years visiting the river, a dummy variable for fishing activity and discharge. The model for the Bitterroot has highly significant estimated parameters with correct signs for bid, income, years, and trips. It may be noted that in this case the yes response is for total annual valuation; accordingly the expected sign on the trips variable is positive. The model for the Big Hole includes bid, income, trips and discharge, as previously noted.

B. HOUSEHOLD MAIL SURVEY ESTIMATED EQUATIONS

The valuation models for the mail survey are based on both dichotomous choice and open-ended format questions on willingness to donate to a trust fund for instream flows. In the equations reported below, the single river (Bitterroot or Big Hole only) responses are combined with the multiple river responses. A "quantity of rivers protected" (QUANT) variable was included that took a value of one or five for this aggregation. When a dummy variable for Bitterroot river surveys was included in the logit trust fund equations described below (Table V-10), the estimated coefficient on this variable was not statistically significant. This implies that the rivers are sufficiently homogeneous to permit estimation of a meaningful total willingness to pay (as a function of number of rivers protected) relationship.

Other explanatory variables for both question formats are listed in Table V-9 and include bid (logit only), income, distance of respondent residence from river, gender, days of recreational activity on rivers per year (ACTDAY), a dummy variable for planned future use on the river(s) in next three years (FUTURE), and three existence motive variables: NONUSE, HELP, AND PROTECT. The interpretation and development of the latter variables is described below in Section VIII. Additionally, Section IX provides the analysis of separability of value components (use, option and existence) is summarized. Additionally, several dummy variables are included for direct use: USER takes a value of 1 if the respondent visited the river(s) in the last three years; DUMFREQ has a value of 1 if the respondent reported visiting rivers at least sometimes (as opposed to never or rarely).

Four different specifications of the complete sample mail logit equations are provided in Table V-10. Several specifications are presented for two reasons. The first is that a number of the independent variables had fairly high simple correlations, indicating a potential for multicollinearity in the model. For

example, Table V-11 provides Pearson correlation coefficients for a number of motive variables. Many of these correlations are .5 to .6. Because of this high correlation (especially relative to correlation to the dependent variable), estimated standard errors (and accordingly, significance) may be unreliable. Relatedly, these conditions may also lead to problems with omitted variable bias. The approach taken was to examine a variety of specifications and note the stability of estimated parameters and standard errors.

The second reason for looking at several specifications was to provide an opportunity for sensitivity analysis of the effect of model specification on estimated direct/indirect value shares. (As noted, these results are presented below in Section IX.)

A common feature of all specifications is that generally signs are as expected. For example, QUANT and BID have the correct sign and are highly significant in all specifications. Income also has the correct sign, but tends to decline in significance as additional variables are included (Table V-10). ACTDAY and FUTURE, measuring current and future use respectively are highly correlated. When ACTDAY or FUTURE is included alone, the sign is as expected and the estimated parameter is highly significant. When both are included, neither is significant at the 90 percent level. The three existence motive variables, NONUSE, HELP and PROTECT are also highly correlated. The estimated parameter on NONUSE declines to near zero when HELP and PROTECT are both included.

The mail survey logit trust fund equations are reparameterized as shown in Table V-12. Again, the reparameterized coefficients can be interpreted as the elasticity of WTP with respect to a given variable. Because of omitted variable effects, some parameters vary considerably across specifications.

Corresponding estimates for the mail trust fund response are provided in Table V-13. A major difference between the logit and open-ended models is that participation on the latter question format was considerably lower. The sample size for the logit specifications ranged from 386 to 319 (the greater the number of variables, the more likely some data will be missing); however, only about 40 percent of all respondents completed the open-ended question resulting in sample sizes of 159 to 165. This sample is smaller in part because only individuals that answered "yes" to either the initial logit bid or the followup $1 bid were asked the open-ended question (316 respondents, or about 57 percent of the total respondents (555) who participated in the initial logit question). Additionally, of the 316 who could have answered the open-ended question, only 227 (72 percent) actually provided a response.

For purposes of aggregation, individuals who responded "no" to the $1 logit question and did not answer the open-ended question can be considered to have an open-ended format value of zero. A weighted average open-ended value that accounts for both nonresponse and nonparticipation in a the open-ended question is obtained by multiplying the mean for the subsample that did respond by the factor .409 (227/555). This method of aggregation implies a value of zero to nonrespondents.

Several different specifications of the open-ended trust fund response equation were estimated (Table V-13). A general finding is that estimated coefficients on key variables are highly significant and of the correct sign. The overall adjusted R square is, however, only around .20 for all specifications. Because the dependent variable in Table V-13 is the log of the open-ended response, the estimated parameters are elasticities comparable to those in the reparameterized logit equations of Table V-12.

For both logit and open-ended question formats, the key variables from the standpoint of providing an aggregate estimate of total instream flow valuation are distance and QUANT. Because of multicollinearity and omitted variable effects, these parameters vary considerably across specifications.

An additional estimate of the logit and open-ended question formats for the trust fund is provided in Table V-14. The motivation for this set of estimates is that the main difference found between the mail survey and nonresponse survey (Section X below) had to do with use (whether the respondent visited rivers or not). To provide an aggregate value estimate that takes account of nonrespondent differences therefore required a model estimate that included use variables and other variables common to both the nonresponse and mail surveys. This is done explicitly in Table V-14 because when motive variables are included (as in Tables V-10 and V-13), none of the user dummy variables are significant. Accordingly, equations were estimated for aggregation purposes that contain only the key variables: QUANT, distance, USER, DUMFREQ and gender (Table V-14).

Interactive variables were defined by multiplying the direct and future use variables times the various existence motive variables. The estimated parameters on these interactive variables were not significantly different from zero.

VI. RECREATION VALUES OF INSTREAM FLOWS

This section describes an application of the model of instream flow recreation values developed in Section II (equations 6 and 7). The basic elements are the reparameterized current trip valuation equations (Table V-4) and the use equations (Table V-6). In the notation of Section II these correspond to the $W(F,q,Q,Y)$ and $Q(F,Z)$ relationships respectively where W is willingness to pay (compensating variation per trip), F is discharge or flow, q is quantity demanded (seasonal trips), Q is total daily use, and Y and Z are vectors of explanatory variables. As noted previously, no useable estimates were identified for the relationship of trip valuation to daily use levels (congestion) or of the relationship of daily use and seasonal use at a given point in time. Accordingly, in the application described below the current trip valuation model is simplified to only include the effect of flow on willingness to pay ($W(F,Y)$) with all other variables held constant.

Before examining the model estimates, it is useful to summarize average welfare measures for the current trip valuation models. These results are presented in Table VI-1 for the multivariate equations of Tables V-2 and V-3 evaluated at sample means. Mean welfare measures are presented for various truncation levels. The mean value for the Bitterroot based on truncation at

the sample maximum offer of $2000 is $244 for the complete sample, $419 for the fish/float activity group and $104 for the shoreline activity group. The truncated means decline to $168, $240 and $89 respectively at $500 bid truncation level. The fish/float WTP distribution is evidently the most skewed, as evidenced by the considerable sensitivity of the mean to the truncation level. In other words, the mean of $419 for anglers is heavily influenced by the very high values on the part of a few individuals. The corresponding median values are $102, $184 and $49. A basic finding is that all measures indicate anglers place a value on current trips that is three to four times that of shoreline users.

The means for the Big Hole at $2000 truncation level are $303 for the complete sample, $315 for float anglers, and $239 for bank anglers. The corresponding medians are $136, $171, and $76.

Turning to the instream flow valuation model, it is useful to recall that the final output is either total value (per day for the study section) or marginal value (dollars per acre foot). Computation of the latter requires taking the partial derivatives of the basic equations (as in Section II's Equation 7). Table VI-2 provides a variable list of the basic components of Equation 7 and Appendix D provides the computational algorithm used to generate the values.

Results for the Bitterroot are provided in Tables VI-3 to VI-5. Table VI-3 shows the valuation and use components at various flow levels ranging from 100 to 3000 cfs (which was approximately the range of flows during the study season). Daily use levels (USE1) vary from 94 users per day at 100 cfs to a maximum of 126 at 1100 cfs down to 62 at very high flows (3000 cfs)(Figure VI-1). Valuation per day (current trip values divided by sample days/trip) for logit means (DAYWlMN) increases from $62 at 100 cfs to $220 at 3000 cfs. The corresponding logit median based value begins at $27 per user per day. The "quantity effect" (dQ/dF*W(F,..) or QUTlMN) is $2.16 per acre foot at 100 cfs and declines to zero near 1100 cfs and is negative thereafter. This is the value of instream flows through the effect on daily use levels; the marginal zero value at 1100 cfs of course reflects the fact that the derivative of the total use equation goes to zero where total use is maximized.

The "quality effect" (dW/dF*Q(F..) or QUALlMN) is $11.06 per acre foot at 100 cfs and declines to $.86 at 3000 cfs. This is the effect of changing flows on the quality of the recreational experience as reflected in changed current trip valuation.

Total values per day as a function of flow levels and marginal values (dollars/acre foot) for the Bitterroot are shown in Table VI-4 and Figure VI-2. Total value per day is $5860 at 100 cfs, is maximized at around $20,800 at 1700 cfs and declines to $13,600 at 3000 cfs. The corresponding marginal value ranges from $13 per acre foot at 100 cfs to zero at around 1700 cfs and is negative thereafter (Figure VI-3). In other words, increased flows over 1700 cfs actually reduce recreational values given the mix of recreation activity on the Bitterroot. Corresponding values for the median are also provided.

Table VI-5 provides a comparison of the model presented above with a

simplified model where only the partial derivative term in either the quantity or quality effect measure varies, while the valuation or use term is held constant at average levels. For example, the quality effect is dW/dF(F..)Q(F,..). When Q(F,..) is held constant at average seasonal use levels, the quality effect is overstated at low flows (because use levels are at constant average levels not at the low level of use actually likely to occur at low flows) and at flows. For example, at 100 cfs the correct quality effect is $11.06 (QUAL1MN), while the constant use quality effect (QUDYMN1) is $13.69. The two are of course similar at flows that correspond to average use levels, and again diverge at high flows. This constant use quality effect corresponds to the model used by Daubert and Young (1981). The latter model does not include a quantity effect. The net differences of the current model and Daubert and Young's model can by seen by comparing QUADYMN1 in Table VI-5 with DTOT1MN in Table VI-4.

A symmetric interpretation can be made of a constant valuation quantity effect model (column QUTNMN1) and the quantity effect of the current model (QUT1MN) in Table VI-5. The QUTNMN1 estimate corresponds to an application of the methodology introduced by Narayanan (1986). A further limitation of the latter model is that it of course ignores quality effects. For example, the Narayanan model overstates the quantity effect at low flows ($5.87 at 100 cfs vs $2.16) but understates total recreational valuation ($5.87 for QUTNMN1 vs $13.22 for DTOT1MN).

This critique is limited to a discussion of the underlying theoretical valuation model. In some particulars of methodology, the applications of Daubert and Young and Narayanan may well be superior. For example, an application that utilized Daubert and Young's careful use of unexperienced scenarios may have resulted in a good estimate of the flow-trip valuation relationship on the Big Hole. As it was, use of actual flows did not succeed for the possible reasons outlined above - primarily a dramatic change in sample composition over the summer. Because only daily use levels were found to be a function of flows on the Big Hole, the application to this river is essentially a Narayanan constant valuation quantity effect model. In other words, the marginal value of flows is simply dQ/dF(F)*W where W or willingness to pay is constant at the sample mean.

Results for the Big Hole are provided in Tables VI-6 and VI-7. The mean value per acre foot for the Big Hole, even without measuring the quality effect, is around $14 at 100 cfs and declines to zero at around 950 cfs. The range of flows modeled for the Big Hole is 50 to 1500, again corresponding to the sample season observed flows.

Because of the unusual drought conditions encountered in 1988 and because of the particular limitations of the Big Hole model, one should be cautious in making any comparisons of water values between the two river basins. Nonetheless, the allocative implications of these models can be noted. Looking at actual flows in August of 1988, the discharge on the Big Hole was around 52 cfs and on the Bitterroot was 215 cfs. The relative marginal value of increased flows at these levels (based on the analysis in this section) are $14.33 on the Big Hole versus $10.11 on the Bitterroot based on logit means. In other words, an extra acre foot of flow in the Big Hole in August of 1988

would have yielded approximately 50 percent greater net benefits compared to a corresponding marginal acre foot in the Bitterroot.

VII. RECREATION AND PRESERVATION VALUES OF INSTREAM FLOWS: ONSITE TRUST FUND

The second contingent valuation exercise in the onsite sample consisted of a trust fund donation to keep flows at the respondents "preferred level". A series of questions prior to trust fund question established the respondent's preferred level. Specifically, each individual was asked if they would have preferred to visit the river at a different flow level. Those who preferred a different level were asked how many inches higher or lower than current level would be preferred.

The analysis in this section examines the trust fund and preferred flow responses of users surveyed onsite to estimate a value per acre foot of water. This value might be viewed as an annual water purchase budget estimate (the payment vehicle was an annual membership in the trust fund). It is also of interest to compare the results to the current trip valuation approach. Other things equal, the latter should only reflect direct recreational use values, while the trust fund should include option and existence values on the part of the user. One would therefore expect the trust fund valuation of a given flow increment to be higher than the current trip valuation based on estimates of a corresponding flow increment.

The mean and median user trust fund donations (based on the logit equations reported in Table V-8) are shown in Table VII-1. The mean based on a truncation level of $1000 (the maximum bid offer in the sample) is $80.16 for the Bitterroot and $119.70 for the Big Hole. The medians are much lower, $12.47 and $16.36 respectively, indicating that the WTP distributions are quite skewed and that the means are strongly influenced by the upper tail of the response distribution.

The estimates reported here are based on onsite sample means for years visiting the site and for discharge, but for mail survey means for income and trips in the last two years. The latter are used because the onsite sample frame identifies characteristics of the average trip, but oversamples more frequent users. Accordingly the onsite means are appropriate for the current trip valuation estimates (Section VI) where valuation is for the typical trip. However, for the trust fund an estimate is required for valuation for the typical user. Accordingly sample means for visitation frequency and income are taken from the mail survey sample frame (for users only) which provides a better estimate of typical user characteristics. The sample means for trips in the last two years are provided in Table V-8; for example onsite users reported an average of 13.0 trips in the last two years, while mail survey Big Hole users had an average of only 3.9 trips in the last two years.

The next series of Tables VII-2 to VII-4 establish a sample average preferred flow level for each river and the amount of water that would be required in an average year to achieve the preferred flows. Table VII-2 shows the preferred river gauge height by month and by subsample preferring current flows, higher flows or lower flows. As discussed in Section IV, there is an increasing share of respondents that would prefer higher flows over the course of the

summer in response to the decline in current actual flows (see also Table IV-4). The average preferred stage height (based on a weighted average of the data in Table VII-2) is shown in Table VII-3. This declines dramatically on the Bitterroot from 4.8 feet in May to 2.76 feet in August. The very high gauge height in May and June reflects the large share of respondents satisfied with current flows at a time when the river is quite high. The Big Hole responses are more stable at 2.6 to 3.0 feet for all four months. Table VII-3 also shows a conversion of river stage height to discharge (cfs). For the critical months of July and August, the preferred flows on the Bitterroot are 836 and 747 cfs respectively and on the Big Hole are 592 and 879 cfs.

It is of interest to compare these respondent preferred flows to the minimum instream flows established by biologists who have studied these rivers. The basic method employed in Montana by biologists to establish minimum flows is the wetted perimeter method (Nelson, 1984). This approach is based on the relationship of flow (cfs) to the amount of wetted stream bottom established at typical riffle locations. For the Big Hole River, Montana Department of Fish, Wildlife and Parks (DFWP) is recommending a minimum instream flow reservation of 800 cfs in DFWP Reach #2 (Pintler Creek to Divide Dam) and 650 cfs in Reach #3 from the old Divide Dam site to the mouth (Nelson, 1989). Our study section is essentially centered on the old Divide Dam site and overlaps both DFWP reaches. Interestingly, the DFWP recommended minimum flows are very similar to the respondent preferred flows. An additional perspective on Big Hole flows is provided by Nelson (1989) who estimates that most people quit floating at flows of 500 to 600 cfs.

Spoon (1987) has written an extensive and interesting evaluation of the biological impacts of instream flows in the Bitterroot. Spoon's study focuses on the effects of water releases from Painted Rocks Reservoir on the West Fork. He reports a wetted perimeter based estimate of minimum instream flows for the "dewatered section" (our study section) of 402 cfs. Spoon also reports a minimum flow for drift boats and rafts of 150 cfs. In the case of the Bitterroot, angler preferred flows are almost double the minimum flows based on biological productivity.

Preferred flows are compared to historical flows in Table VII-4. Because a long term record is only available at one gauge on each river, the two-gauge average (which is more representative of the study sections) must be interpolated. The estimated historical flows for June are adequate when compared to preferred flows on both rivers. The historical average flows for July are also similar to preferred. For example on the Bitterroot, average historical flows in July are 852 cfs, while preferred is 836. However, comparisons of these averages understate the actual average amount of water that would be needed to maintain a minimum flow of 836 cfs in July. It is instead necessary to look at the year by year historical deviation from the preferred level. The sum of these negative deviations from preferred levels averages 176 cfs over the last 20 years for July on the Bitterroot. This method indicates that on average 413 additional cfs would be needed in August on the Bitterroot and 103 and 598 cfs for July and August respectively on the Big Hole (Table VII-4).

There is a possibility that historical records overstate current expected

flows because of increased irrigation. Discussions with U.S. Geological Survey personnel indicated that this is unlikely and in any case difficult to establish given existing data.

In order to estimate an aggregated trust fund, it is necessary to estimate total use in the study sections. The onsite sample frame, given budget constraints, was designed to provide a sufficient sample of river users for the valuation estimates. Estimating use was a second order consideration. Given these limitations, our use estimate (derived in Table VII-5), relies heavily on previous use estimates by DFWP. DFWP has conducted annual "fishing pressure" surveys for a number of years, based on a large mail sample of fishing license holders. Estimated fishing pressure (user days) is available by stream and stream reach. These estimates for 1985 were interpolated (based on the river miles in the study sections) to estimate total angler use in the study section. Based on a study by Hagmann (1973) of the Clark Fork River, it is assumed that 65 percent of this use is in the months of May-August. The ratio of anglers to total use from the onsite survey was used to inflate this summer angler use estimate for the study sections to an estimate of total May-August days of use of around 10500 for the Bitterroot and 15300 for the Big Hole. Comparing average daily use for this 123 day season to our observed user sample indicates a sample fraction of .08 to .09 on the two rivers. In other words, on any given day our interviewer observed/contacted approximately 10 percent of the actual users present in the study sections. (It may be noted that this sample fraction was used in Section VI to estimate total value per day based on the current trip responses.

Total summer season river users was derived from the total use estimate by dividing by days of use per user from the mail survey. Total summer season users of the study sections is estimated to be 1850 on the Bitterroot and 3700 on the Big Hole (Table VII-5).

Based on the estimate of total users and mean trust fund donation per user, an instream flow trust fund vehicle limited to current river users yields a value of $149,000 on the Bitterroot and $446,000 on the Big Hole. This estimate is not construed to be the actual money that might be raised through such a fund, which will depend on question format and payment vehicle. Additionally, transaction costs have not been estimated or deducted. However, this treatment is symmetric with the current trip valuation approach, and follows the convention in the economics literature.

The preferred flow requirement in cfs can be converted to acre feet needed to maintain preferred flows through July and August in a typical year. The totals are 30,000 acre feet on the Bitterroot and 43,000 on the Big Hole. Comparing required additional flows to the trust fund, a marginal value of $5.10 per acre foot is derived for the Bitterroot and $10.34 for the Big Hole. Again this is for a single respondent-defined scenario - preferred flows. This increment is quite large and possibly unavailable. Nonetheless, this marginal value can be compared to the results from the current trip valuation approach. Referring to Tables VI-4 and VI-7, an approximate marginal value for these increments on the Bitterroot is around $6 and on the Big Hole is $7. The expectation that the current trip values would be lower than the trust fund approach only holds for the Big Hole. However, given the uncertainty

regarding our estimate of total recreational use in the study section, the similarity of estimates from the two approaches is, if anything, encouraging.

It may be noted that the trust fund estimate presented thus far may be overly conservative. As a practical matter, delivering water to the dewatered section of the Bitterroot will likely augment flows and benefit recreationists on the entire river. If this is the case, assuming that only study section users (11 percent of total users on the Bitterroot) would support the trust vastly understates the value per acre foot of water. The opposite extreme is to assume that all users would participate in a trust fund to the same extent as the study section sample. In this case the acre foot values are $44 on the Bitterroot and $24 on the Big Hole. (The increase on the Big Hole is relatively less because a larger share of users are in the study section - 43 percent.)

VIII. ANALYSIS OF PRESERVATION MOTIVES

The objective of this section is to utilize the mail survey responses to describe peoples' possible reasons for being willing to pay for instream flows, and, in particular, the variables predicting willingness to pay for current users and non-users of the rivers studied. The perspective in this section is primarily that of social-psychology.

The basic data for this analysis was collected, as previously described, through the mail survey. Necessary information included respondents' demographic characteristics, recreational use of rivers, and other beliefs, attitudes, behavior, behavioral intentions that were likely to influence--or at least be related to--willingness to pay for instream flows. The findings reported in the other sections of this report incorporate many of these variables, but are done in the aggregate, predicting, for example, the mean amount different categories of people are willing to pay. The results reported in this section, in contrast, are designed to explore simple and basic relationships between willingness to pay (defined somewhat differently here) and the other study variables. Additionally, the analysis is presented that identifies the specific existence or preservation motives used in the economic models.

This section is organized into four parts: definition of the dependent variable, possible reasons for preservation values, analysis of effects on willingness to pay through crosstabulations, and multivariate prediction of willingness to pay.

A. DEFINITION OF THE DEPENDENT VARIABLE

The basic economic findings for the mail survey are discussed below in sections IX and X of this report; they are summarized here only in enough detail to provide a foundation for defining the primary dependent variable used in this section.

There's been a fair amount of discussion in the literature on what type of measure stated willingness to pay constitutes. Economists have treated statements about willingness-to-pay as behavior, while social psychologists

have pointed out that, depending on question wording and context, these statements should be considered at best as behavioral intent and more likely as a general attitude toward the topic at hand, whether it be instream flows, air quality, fishing, or big game hunting.

Regardless, the goal for the analysis in this section was to identify an economic response that could be used as a dependent variable, to see what behaviors, attitudes, and beliefs would correlate with peoples' willingness to pay for instream flows.

One variable considered was willingness to pay the amount filled in on the survey form for an annual membership in the trust fund. Eight percent of the sample (41 people) said they would pay the amount listed; of these, one-third had been presented with the lowest amount listed ($5.00 annual membership), and an additional one-fifth had been presented with the second-lowest amount ($10.00). Out of the 239 people who had been asked if they would pay either $100, $200 or $300, just one person agreed to purchase an annual membership. While appropriate for a logistic regression model, this variable does not make a good dependent variable for purposes of this section because unacceptably small cell sizes would have resulted when analyzed in conjunction with other variables.

Willingness to pay at least $1.00 a year to augment instream flows was another possible dependent variable. Of the people who responded to this, 52 percent said they would pay $1.00 a year, and 48 percent said they would not. This breakdown provided a much better sample size for other analyses.

However, only people who responded "no" to the dichotomous choice question answered the $1.00 question--so use of this as a dependent variable would omit people who agreed to pay the stated amount, obviously another population of interest despite the small sample size. In addition, a followup question asked in an open-ended format the maximum amount people would be willing to pay (if they were willing to pay 1.00), also valuable information; nearly 200 respondents said they would pay more than 1.00, with a mean of about 13.00 and a median of 10.00.

Therefore, people were divided into three groups: those who were not willing to pay any amount (n=241); those who were willing to pay 1.00 (n=99), and those who were willing to pay more than 1.00 (n=202). This variable was then analyzed with the other variables to shed light on variables related to membership of these three groups.

Most analyses demonstrated that there were significant differences between people who were unwilling to pay and those who were willing to pay more than 1.00. The people who were willing to pay just 1.00 were a difficult group to predict, resembling the nonpaying group on some variables and the over-1.00 group on other variables. For this reason, most discussions that follow focus on the other two groups. This finding also suggested that it would be misleading or at least confusing to lump the 1.00-only group in with either of the other groups for analyses.

One explanation for the inconsistent responses is that this variable is

measuring susceptibility to the high-ball technique, not willingness to pay for instream flows.

The highball technique, along with the lowball technique, have long been favorite ways to persuade people to undertake a certain behavior. The highball technique refers to first asking someone to perform an unreasonable or difficult task; the large proportion of 100, 200, and 300 dollar starting bids used in the current study would certainly qualify for this. Then, people are asked to comply with an easier or more reasonable request, in this case, paying a token amount such as 1.00. Social psychologists generally have found that compliance with the easier request is higher when the initial, rejected request is made than when the reasonable request is made alone.

The lowball technique is similar, only the token request--to which almost everyone agrees because compliance is very easy, is followed by a request to perform a more difficult or involved behavior. The finding is similar; people generally comply more with the second (target) request if it's accompanied by the first one than when the target request is made alone. Interestingly, the sequence of questions on the survey form consisted of both the highball technique (the initial bid amount) and then the lowball technique (asking the maximum amount if people agreed to just 1.00).

If the pay-1.00 only category of the dependent variable is dominated by people vulnerable to the highball technique, for whatever reason, then it would follow that their responses regarding other dependent and independent study variables would tend to be somewhat random and unpredictable. While some of their responses did tend to fall somewhere between those of the other groups, as would be expected, this did not occur in any particularly consistent, reliable fashion.

This also points out another characteristic of the economic findings--that the order and context of questions has an effect on the responses. For example, the results could vary if the lowball technique, instead of the highball technique, was employed first. The actual effects of question context and wording would have to be studied by using side-by-side alternatives to see whether any systematic differences emerged.

Another key economic finding was that, as has been found in previous studies, people allocated greater amounts of their membership fee to indirect than to direct use values. Users and nonusers alike allocated a greater proportion of their payment to indirect values; 62 percent allocated more toward indirect than direct, while 31 percent allocated equal amounts toward each and just seven percent allocated a larger proportion toward direct use. These proportions differed between users and nonusers; 72 percent of the nonusers allocated more to indirect values, compared to 56 percent of the users. Similarly, 24 percent of the nonusers allocated their payments equally, compared to 34 percent of the users.

At first it's surprising that 28 percent of the nonusers allocated equal or greater portions of their payments to direct use values. However, of the current nonusers of the target rivers, 21 percent said that other family

members sometimes or frequently participated in river recreation, and 26 percent planned to start visiting the target river(s) themselves. The allocation question had been worded to include values expected from future recreational use, so the finding is reasonable.

Intended use was related to donation among current non-visitors. Thirty four percent of the respondents who said they planned to visit the target river(s), in the next three years were unwilling to donate (and 49 percent said they'd pay more than a dollar), compared to 65 percent of those who were not planning to visit the target river(s) in the next three years (and only 20 percent were willing to pay more than a dollar). Roughly equal proportions of each group, about 15 percent, said they would pay 1.00, but no more.

Thus of the people who did not currently visit and had no intentions of visiting (who comprised about 34 percent of the respondents), 35 percent were willing to pay something; these, perhaps, were the true altruists in the sample (although they may visit other rivers for recreation). In fact, 84 percent of the people who didn't plan to visit in the next three years allocated the majority of their memberships to indirect values, compared to 55 percent of those who planned to visit in the next three years.

B. POSSIBLE REASONS FOR PRESERVATION VALUES

The responses to the 23 questions exploring beliefs, attitudes, and behaviors potentially related to peoples' willingness to pay for instream flows (aside from onsite use) are listed below in order of agreement. The responses provide a strong foundation for values other than those stemming from personal use of the rivers; 97 percent of the respondents said that people can value a river even if they don't visit it, suggesting that nearly everyone understands--and accepts--the concept of non-use values.

Furthermore, the majority of respondents demonstrated concerns hypothetically related to non-use values. This is what one would expect given that these are people who made the effort to complete and return the survey, but the strong level of agreement with all the questions was not expected.

However, the strong agreement posed a problem for further analysis because little variation was available to explain using other variables. For example, for many questions the only variation available for analysis was the distinction between "strongly agree" and "agree," not as critical a distinction to explain as the difference between agreement and disagreement.

The main reason for including these 23 diverse questions, however, was to see if they would group together in any meaningful way. Any resulting groupings--items that correlated with each other but not with the other variables--could indicate general concepts underlying peoples' responses.

This was accomplished using a factor analysis with varimax rotation (SPSS, Inc. 1985). Five factors emerged, each representing a somewhat distinct dimension of possible reasons for valuing instream flows, apart from one's past or intended use of the rivers. The five factors accounted for 56 percent of the variance. Nearly all of the 23 items had been intercorrelated, so some

of the factor loadings were in the .50 range, suggesting that the factors were not orthogonal. However, the factors that emerged had face validity, and the emergence of this set of factors allowed some comment on previously advanced taxonomies of value. These comments should be viewed as tentative--more as concerns worthy of further study than conclusions about the nature of indirect values. Of course, the solution depended on the questions asked, so the results did not exhaustively describe all motives or reasons for non-use values.

The five factors that emerged were subjected to an item analysis to assess their reliability. The Cronbach's alpha for the five factors ranged from .75 to .89, with the alpha for three of the factors above .80, suggesting that acceptably reliable scales could be constructed. These scales (with somewhat different labels), were employed in the mail trust fund regression analyses presented in Section V and contributed to prediction of willingness to pay.

Following is a description of each of the five factors, along with their relationships to willingness to pay and the specific items loading on the factor (scaling was reversed on the items that are starred).

The first factor, labelled Vicarious Use, was loaded primarily by items describing indirect personal benefits, such as enjoying hearing about others' experiences on rivers, or enjoying books and movies about rivers.

The Vicarious Use factor also was loaded by the only item related to past use: "I have had inspirational experiences on rivers," suggesting that people who enjoy vicarious uses of rivers also have visited rivers themselves, and that this experience enhances the vicarious enjoyment. In fact, 61 percent of the people who had visited the target river(s) strongly agreed with this statement, compared to 39 percent of the people who had not visited.

This factor also contained the item on spiritual and sacred values, suggesting that vicarious users (and onsite users) may have value systems incorporating spiritual aspects of natural resources. Finally, a statement affirming peoples' belief in the concept of non-use values was included on this factor. It's somewhat surprising that this item loaded strongly here, and not at all on the factor labelled Altruism (described below). Perhaps this concept is more closely aligned with indirect enjoyment of the resource than with the slightly more detached knowledge that a resource exists in a healthy form.

Responses to the item having the highest item-total correlation for this scale, the question dealing with "enjoying knowing friends and family can visit rivers," were related to willingness to pay. Fifty three percent of those who strongly agreed with this statement were willing to pay over 1.00, compared to 30 percent of those who just agreed with the statement (these compare to the overall total of 37 percent who were willing to pay over 1.00). Among visitors, the respective percentages increased to 66 percent and 45 percent, while among current nonvisitors, the percentages dropped to 44 percent and 30 percent (these compare to overall totals of 65 percent of the visitors and 35 percent of the nonvisitors who were willing to pay over 1.00). * indicates that coding was reversed.

Vicarious Use:

I have had inspirational experiences on rivers

Rivers do not have many spiritual or sacred values to me *

I enjoy knowing that my friends and family can visit rivers for recreation if they want to.

People can think a river is valuable even if they don't actually go there themselves.

I enjoy hearing about experiences my friends or family have had on rivers.

I enjoy looking at picture books or going to movies that have rivers in them.

The second factor, called Environmental Concern, was loaded primarily by items pertaining to endangered species, concern for drought effects on fish and wildlife, and other indicators of a broad concern for the state of the natural environment. Inclusion of the items related to the environmental worth and condition of rivers suggests that this could be a subset of a broader environmental concern.

Environmental concern has been linked to outdoor recreation participation. In fact, participation in outdoor recreation appears to be one means of developing environmental awareness and concern (Allen, 1978) that, in turn, could precipitate a number of environmentally-responsible behaviors, such as contributing money toward instream flows.

This was supported by the present data, which showed that, for nearly all of the items composing this factor, people who had visited one of the target rivers had stronger environmental concerns. As mentioned above, most respondents demonstrated concern--the visitors were just more emphatic. For example, 45 percent of the visitors, compared to 31 percent of the nonvisitors, strongly agreed that endangered species were important. Responses to the variable having the highest item-total correlation on this scale, the question on "importance of endangered species," was related to willingness to pay. Fifty-five percent of those who strongly agreed were willing to pay over 1.00, compared to 31 percent of those who said they agreed. The respective percentages increased to 62 percent and 40 percent for those who had visited the target river(s), and dropped to 45 percent and 23 percent for those who had not.

Environmental Concern:

I have a great deal of concern
for endangered species.

Endangered species should not be
protected if they don't have any
benefits to humans. *

I have been concerned about how the recent
drought may affect fish and wildlife
that depend on rivers.

I think that most rivers already have enough
water in them to be healthy resources. *

Montana's free-flowing rivers and streams
are a unique and irreplaceable resource.

It's important to protect rare plants and
animals to maintain genetic diversity.

The third factor to emerge, labelled Personal Contribution, was loaded by items related to behaviors that people could undertake to help rivers or worthy causes in general. This three-item factor suggested that one reason people might be willing to pay for instream flows is that they consider themselves to be helpers in general. Perhaps this comes from a feeling of personal responsibility or involvement, or from altruism.

One of the three items stated that people would be willing to contribute time or money even if they could never visit the rivers they were helping. This item loaded strongly on this factor, and not at all on the Altruism factor described below. This suggests that the personal contribution aspect of this item was linked more strongly with the donation items than to altruism, emphasizing the importance of the personal contribution concept.

This variable also could be a mediating influence between willingness to pay and other attitudes. Past research has found that people who have very favorable attitudes toward natural resources and who are already undertaking a number of behaviors consistent with those attitudes may refuse to do more because they perceive they're already helping enough, making enough sacrifices. This could explain why someone who really should be willing to pay in fact refuses to contribute.

Responses to the question having the highest item-total correlation, the question on "I should be doing more...", were related to willingness to pay, but the relationship was not linear. Of those who strongly agreed, 65 percent were willing to pay over 1.00; the proportion was the same for people who agreed with the statement (these compare to the overall total of 37 percent

who were willing to pay over 1.00).

However, 27 percent of those who strongly agreed were not willing to pay and 8 percent were willing to pay 1.00; the corresponding percentages for people who agreed were 17 percent and 19 percent. Apparently, some people who thought they should do more still believe so! In fact, after refusing to pay even 1.00, they felt this even more strongly. This latter finding held true for both current visitors and nonvisitors.

Personal Contribution:

I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.

I feel that I should be doing more for Montana's rivers and streams.

Donating time or money to worthy causes is important to me.

The fourth factor, Altruism, was loaded by items which expressed values specifically apart from those related to onsite recreational use. Every item contained references to the respondent visiting rivers less or not at all, yet were still positive expressions of value. The underlying concept is therefore very close to altruism--which, as defined earlier, is voluntary behavior designed to benefit something or someone else and without expectation of personal reward.

The items that loaded (and did not load) on this factor suggest possible comments on the altruism motive as defined by economists. First, items that contained altruistic elements but also focused on personal benefits loaded on the Vicarious Use factor, not here; this supports the validity of the concept of altruism as applied to natural resources. However, the "escape button" question's loading on this factor suggests that we need not be too picky about weeding out any possible personal benefit, no matter how nebulous or indirect, in order to label something altruism. In other words, the presence of some small or indirect personal benefit shouldn't mean that a behavior cannot be motivated primarily by altruism.

It's possible that this question is related to use of the resource--after all, people who don't use rivers have nothing to lose by agreeing to any of these statements; they can "afford" to be altruistic. People who currently visit rivers, however, have much to lose in direct personal benefits if they really did behave consistently with their statements.

For the items that didn't involve rivers directly, there were no differences between the responses of users and nonusers of the target river(s). For the item specific to less river use, more river users had an opinion--but not necessarily the same one! Twenty-five percent of the non-visitors had no opinion on this question, compared to just 12 percent of the current visitors.

Among the users, the additional people who had an opinion were divided evenly between "agree" and "disagree." Visitors did tend to have stronger positive opinions; although they comprised 53 percent of the respondents, they comprised 62 percent of the people who strongly agreed with the statement.

It's possible that reasons other than altruism motivate agreement with these statements. One possibility is that because altruism is a social value, people are prone to expressing it even if they don't really feel that way. The statements could therefore be a measure of the importance of social desirability, not altruism. Another possibility is that people really derive personal benefits from knowing there are wild lands out there, so the motive is not altruism, but selfishness. To avoid getting involved in a long-winded philosophical debate, perhaps it's best to say that this factor deserves to be studied further, but will be called Altruism for now.

Responses to the question having the highest item-total correlation, "wilderness in Alaska," were related to willingness to pay. Fifty two percent of those who strongly agreed were willing to pay over 1.00, compared to 32 percent of those who just agreed (these compare to the overall total of 37 percent who were willing to pay over 1.00). For current visitors, the percentages increased to 61 percent and 41 percent, while for nonvisitors the respective percentages dropped to 40 percent and 25 percent (these compare to overall totals of 65 percent of the visitors who were willing to pay over 1.00 and 35 percent of the nonvisitors).

Altruism:

Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.

I'm glad there is wilderness in Alaska even if I never get there to see it.

Our society should consider the needs of future generations as much as we consider our needs today.

Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.

I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.

The last factor to emerge, labelled Conflicting Use Values, contained

statements that might be supported by people who favor using river flows for purposes other than recreation or preservation. This was highlighted by the fact that several other items loading more strongly on other factors also loaded weakly on this factor--but with the loadings reversed.

Ironically, the item on the need to base resource development on economic grounds loaded on this factor. This demonstrates the traditional notion that economic decisions inevitably lead to development, not preservation. Perhaps many people who responded to this question would be surprised at the notion of attaching dollar values to resource preservation, even though this was the purpose of the survey effort!

A greater proportion of current visitors (57 percent) than current nonvisitors (46 percent) disagreed with this statement, as would be expected, yet nearly one-quarter of the current visitors agreed that more dams are needed. Again, we don't know the underlying reasons for these responses; many possibilities appear. Slightly higher proportions of current visitors agreed that the main reason to maintain resources today is so we have the option of developing them in the future, not what one might expect.

Responses to the item having the highest item-total correlation on this scale, the "more dams" statement, were related to willingness to pay. Of the people who strongly agreed there should be more dams, 62 percent were not willing to pay 1.00 for instream flows; of those who strongly disagreed, just 24 percent were unwilling (these compare to the overall total of 44 percent who were not willing to pay even 1.00).

Attitudes toward hydroelectric power were related to willingness to pay above and beyond the effects of previous use. The same pattern was evident just considering current visitors to the target river(s), but stronger; of those who strongly disagreed, just 15 percent were not willing to pay. Among current non-visitors, the pattern was the same, but weaker; of those who strongly disagreed, 37 percent were not willing to pay (these compare to overall totals of 32 percent of the visitors who were willing to pay over 1.00 and 57 percent of the nonvisitors).

People who agreed more dams were desirable also were more likely to assign a higher percentage of their money to indirect than to direct use values than were people who disagreed--although both groups valued non-use benefits more highly than use benefits.

Conflicting use values:

The decision to develop resources should be based mostly on economic grounds.

I would like to see more hydroelectric dams on Montana rivers

The main reason for maintaining resources today is so we can develop

them in the future if we need to.

C. ANALYSIS OF EFFECTS ON WILLINGNESS TO PAY

The effects of previous recreational use

People who use the target river(s) for recreation were more likely to be willing to pay for instream flows than were non-users of the resource. Of the people who had made recent visits to the target river(s), 48 percent were willing to pay over 1.00 per year toward instream flows, 21 percent were willing to pay 1.00 per year, and 32 percent were not willing to pay. Of those who had not visited the target river(s), 28 percent were willing to pay over 1.00 per year, 15 percent were willing to pay 1.00, and 58 percent were not willing to pay.

Visits to rivers in general were strongly correlated with visits to the target river(s); of the people who said they visited rivers very frequently, 70 percent had visited the target river(s). Similarly, of the people who had not visited the target rivers, just eight percent said they visited rivers frequently. However, the correlation was not perfect; for example, of the people who had visited the target rivers, 17 percent said they visited rivers "rarely" and 32 percent said they visited rivers "sometimes."

Similarly, personal use of rivers for recreation was related to household use; 64 percent of the respondents who said they never visited rivers also said that no one in their household did either, while 76 percent of those who participated very frequently also said that others in their household participated either frequently or very frequently.

THE EFFECTS OF AMOUNT AND TYPE OF RECREATIONAL USE

Among users, the amount and type of use should predict peoples' willingness to pay for instream flows. The results showed that, for people completing Big Hole or Bitterroot questionnaire forms, willingness to pay steadily increased as number of recent trips increased. The proportions willing to pay over 1.00 ranged from 33 percent of those who had visited the rivers before but had made no trips in the last three years, to 62 percent of those who had made 21 or more trips in the last three years.

The same pattern was found for levels of visits to any river; of those who visited rivers rarely or never, 20 percent were willing to pay over 1.00 per year, compared to 34 percent of those who sometimes visited rivers and 51 percent of those who frequently or very frequently visited rivers. Number of years visiting rivers for recreation was not related to willingness to pay, most likely because of the confounding influences of age and income.

It's also reasonable to expect that people engaging in activities depending directly on flow levels, such as boating, would be more likely to pay than people engaging in activities such as hunting, which may be less-dependent on flow levels. However, people who participated in any activity along the target river(s) were equally willing to pay; between 50 and 56 percent of the people

were willing to pay more than 1.00, regardless of which activities they participated in. The main reason for this finding likely is that people could check more than one activity, and many respondents did so, making it difficult to separate out the effects of activity-specific participation. The onsite survey reported by Duffield and Butkay is a better source for data on the distinctions among activity participants.

Among anglers, type of equipment used was related to willingness to pay, consistent with what would be expected based on specialization theory (Allen, 1987). Specifically, 49 percent of the anglers using flies or lures were willing to pay over 1.00, compared to just 25 percent of the anglers using bait. In general, the less-specialized anglers were less willing to pay for instream flows, as reflected by their evaluations of the importance of testing fishing skills, catching wild fish, catching large fish, and catching lots of fish.

Recreationists' desired experiences also was related to their willingness to pay for instream flows; people who said that viewing scenery, experiencing solitude, fishing, boating, viewing wildlife, or relaxing was always important were more likely to be willing to pay over 1.00 than people who said one or more of these characteristics was frequently or sometimes important. The importance of being with friends or family members was not related to willingness to pay for instream flows.

For example, 53 percent of those who said solitude was always important were willing to pay over 1.00, compared to 42 percent who said solitude was frequently important, 36 percent who said it was sometimes important, and 26 percent who said solitude was never important. This relationship likely had more to do with peoples' underlying value systems than with their river recreation behavior. Increased flows and the resulting sounds of rushing water could decrease the likelihood of hearing other people or sounds that intrude on solitude, but this seems to be a less plausible explanation.

THE EFFECTS OF PAST EXPERIENCES WITH LOW FLOWS

People who had experienced problems with flow levels were more likely to be willing to pay than were people who had not experienced low flow problems. Of the people who had visited one of the target rivers, 48 percent said they had experienced difficulties because of low flows on those rivers. Sixty two percent of the people who had experienced low flow problems were willing to pay more than 1.00, compared to 36 percent of those who had not encountered low flow problems.

A subsequent question asked about low flow problems experienced on other rivers; this question was not directed toward people who had visited the target river(s) or any other river in particular. The finding was similar; of those who had experienced low flow problems on other rivers, 50 percent were willing to pay over 1.00, and 28 percent were not willing to pay. For people who hadn't experienced flow problems on other rivers, 30 percent were willing to pay over 1.00 and 54 percent were not willing to pay anything. Of course, the latter percentage included many people who didn't visit rivers, and

couldn't have experienced low flows, confounding interpretation somewhat.

Another confounding variable was past visitation levels. People who visited the target river(s) more frequently in the last three years were more likely to have experienced problems with low flow levels; about 75 percent of the people who visited 21 times or more said they had such low flow problems, compared to 30-50 percent of those who'd visited the river(s) just one to five times (the range depended on which river was visited).

THE EFFECTS OF FAMILIARITY WITH NATURAL RESOURCE TRUST FUNDS

Another potentially important variable was familiarity with the concept of natural resource trust funds. People who were knowledgeable with this mechanism may have been more willing to pay because it was less foreign, and, perhaps, more believable and credible. People who knew little about such trust funds may have been skeptical of their effectiveness. Lack of knowledge should not be viewed as the main basis for possible protest against the payment vehicle, but familiarity with the payment vehicle may decrease resistance.

In general, people were somewhat familiar with the trust fund concept; 57 percent said they had heard of such funds, and 21 percent said they knew a fair amount about them. Thirty percent had donated money or time to natural resource conservation efforts, and about half knew of other people who had done so. However, 60 percent said they had never known about the state's past efforts to purchase flows when needed.

The results showed that people who did not use the resource themselves but who were familiar with the trust fund concept, have donated to similar efforts in the past, or who know of other people who have made similar donations were more likely to be willing to pay for instream flows. The same pattern was found among current users of the resource, but the role of these variables in predicting willingness to pay was much less.

Familiarity with natural resource trust funds was positively related to willingness to pay; 18 percent of the people who had never heard of trust funds said they would pay more than 1.00, compared to about 40 percent of those who had heard of them or knew a fair amount about them, and to 55 percent who said they knew a great deal about such trust funds.

However, knowledge of natural resource trust funds also was positively related to river recreation frequency; for example, 36 percent of the visitors said they knew a fair amount or a great deal about such trust funds, compared to 17 percent of the non-users. To determine the effects of familiarity alone, therefore, required controlling for the effects of target river(s) visitation.

The results showed that familiarity with the idea of trust funds increased willingness to pay especially for people who didn't visit the target river(s). For example, among respondents who had not visited the target rivers, 13 percent who had never heard of natural resource trust finds were willing to pay more than 1.00; this proportion increased to 29 percent for people who had

heard of trust funds, and to 44 percent for people who knew a fair amount about such trust funds. This variable was likely a proxy for general levels of environmental concern and awareness.

Among people who had visited the target rivers, the results were in the same direction, but the differences were smaller, showing that use of the resource overshadowed the effects of familiarity with the trust fund concept.

A related variable could be donation to natural resource trust funds. Self-perception theory suggests that people who have donated to such funds in the past may view themselves as donators, and may therefore be more willing to pay even if they don't visit rivers for recreation. Among people who had not visited the target river(s) 42 percent who had donated to trusts in the past were willing to pay over 1.00, compared to 25 percent of those who had not donated to such funds. The same pattern was found for visitors; 57 percent who had donated before were willing to pay more than 1.00, compared to 40 percent who had not donated before.

A third, related variable was knowledge of other people who had donated to such trust funds. Even if people had not donated themselves, having other people available as role models may increase the likelihood of donation behavior. Among people who had not visited the target rivers, 40 percent who said they knew of other donors were willing to pay more than 1.00, compared to 21 percent who did not know other people who had made such donations. A similar pattern was found among visitors, but once again the effects were less pronounced. Among people who had visited the target rivers, 50 percent who knew other donors were willing to pay over 1.00, compared to 42 percent who did not know other donors.

The results showed that having other donor role models available increased the likelihood of one's donation, regardless of one's own past donation history. Thirty nine percent of the people who had not donated themselves but who knew other people who had donated were not willing to pay even 1.00, compared to 55 percent of those who had not donated themselves and knew of no other donors. Similarly, of the people who had donated themselves, 33 percent of those without an available role model said they wouldn't pay even 1.00, compared to 19 percent of those who reported knowing someone else who'd donated to such funds.

THE EFFECTS OF PERCEIVED RESPONSIBILITY

Willingness to pay was be related to beliefs about who, if anyone, should be responsible for maintaining adequate flows in Montana rivers. Respondents believed that some entity should be responsible for maintaining adequate flows in Montana rivers and streams; only three percent said that "no one" should be responsible. Two-thirds believed that the state should be responsible, compared to 27 percent who felt the federal government should be responsible. About one-third (36 percent) believed recreational users should be responsible, compared to about 22 percent who checked private trust funds. Clearly, respondents felt that it was important to maintain adequate flows in rivers, and most placed this responsibility with the state.

Of the people who believed the state should be responsible, 36 percent were not willing to pay and 44 percent were willing to pay over 1.00; comparable percentages were obtained for those who said the federal government should be responsible.

However, more people who believed recreational users should be responsible refused to pay (45 percent), and correspondingly fewer were willing to pay over 1.00 (39 percent). When controlling for visitation to the target river(s), key differences emerged. Among people who had recently visited the target river(s), 25 percent of those who felt users should be responsible were unwilling to pay, while 59 percent were willing to pay over 1.00. In contrast, among nonvisitors, 59 percent who believed users should pay were not willing to pay even 1.00, and just 24 percent were willing to pay more than 1.00.

As would be expected, of the people who said private trust funds should pay, more people were willing to pay over 1.00 (50 percent) than were unwilling to pay anything (31 percent). The number willing to pay over 1.00 jumped to 60 percent for people who had visited the target rivers, and dropped to 40 percent for those who had not.

In other words, substantial proportions of people were willing to contribute to the private trust funds regardless of who they felt should be responsible for maintaining instream flows. The proportions were highest, however, for people who believed that trust funds should be responsible, regardless of personal visitation to the target river(s).

THE EFFECTS OF INCOME, GENDER, AGE, AND EDUCATION

Income. Past studies have suggested that higher-income people do not necessarily donate a higher proportion of their income to causes considered worthy. The results suggested that willingness to pay over 1.00 was a bimodal distribution peaking at income ranges $20-25,000 and at $75-100,000 (although the latter category contained few respondents). Unwillingness to pay even 1.00 showed a similar distribution.

However, income was related to past visitation to the target rivers; the highest participation rate, 65 percent, was by people in the $20-25,000 category, and the lowest, 22 percent, was by people in the highest income category. This suggested that visits should be controlled for when testing this relationship.
People who had visited the rivers were more likely to pay over 1.00 regardless of their income level, with a similar bi-modal distribution evident. Among nonvisitors, willingness to pay over 1.00 was roughly the same, varying between 28 and 40 percent, for income categories between $15,000 and $50,000, dropping off above and below this range, but increasing at the highest income categories.

The findings suggested that the original hypothesis was not supported, but that the relationship between willingness to pay and income was not linear and that participation in river recreation may have more explanatory power than does household income. This finding, of course, applies to the dependent variable as defined in this report--which was not the actual amount people

were willing to pay, but rather willingness to pay over 1.00.

Gender. Men and women were equally likely to be willing to pay over 1.00, despite the fact that 56 percent of the men had visited the target river(s), compared to 44 percent of the women. Among people who had visited the rivers, 47 percent of the men and 51 percent of the women were willing to pay over 1.00, compared to 30 percent of the men and 26 percent of the women who had not visited the target rivers recently. Gender did not appear to be a key variable identifying people willing to pay for instream flows.

Age. Willingness to pay over 1.00 was fairly constant for age categories up to about 50, after which it declined, despite a lack of corresponding decline in visitation to the target river(s). Visitation was highest (about 60 percent) for people in their thirties, but remained steady (between 47 and 51 percent) for the other age categories. Among people who visited the river(s), willingness to pay over 1.00 dropped as age of respondent increased. Among those who had not visited the river(s), willingness to pay was more normally distributed, peaking at about 41 percent of the respondents in their forties, and tapering off to about half that for people in their twenties or sixties. An interaction between age and income is most likely responsible for these results.

Education. Education level and willingness to pay over 1.00 were linearly and positively correlated; for example, 30 percent of those with high school educations were willing to pay over 1.00, compared to 40 percent of the college graduates and 48 percent of those having postgraduate degrees. However, visitation to the target river(s) remained fairly constant across educational levels (although visitation was slightly higher among people at the highest level of education). Controlling for visitation showed that, for people who had visited the target rivers, education was not strongly related to willingness to pay. However, among people who had not visited the target rivers, education was positively and linearly related to level of education.

D. MULTIVARIATE PREDICTION OF WILLINGNESS TO PAY

The analyses in the preceding discussion were based mostly on two-way and three-way crosstabulations in an effort to understand basic patterns in the data. An additional analysis tested how some of the key independent variables interacted to predict willingness to pay as defined in this report.

This was done by using an SPSSx discriminant analysis with stepwise variable selection to predict membership in two groups (not willing to pay anything; and willing to pay over 1.00). Discriminant analysis uses linear combinations of variables to distinguish among two or more categories of cases; in the stepwise method, variables can be added or removed at each step.

The independent variables used to predict group membership were income, education, and membership in organized groups (entered at the first step); level of past recreational use of rivers (entered second); and the four trust fund familiarity questions along with the five questions having the highest item-total correlations on each of the preservation scales (entered last).

Six of the variables comprised the final equation: "I should do more..."; "more dams..."; past donation to trusts; "enjoy knowing friends and family can visit..."; frequency of visits to rivers; and education. Together, these variables resulted in correct prediction of 73 percent of the cases, showing that a good deal of diversity still existed. In other words, there were many correlates of willingness to pay for instream flows, and the same characteristics were not always associated with each other.

However, these results also suggested that level of past river use, education, past donation behavior, importance of vicarious uses, sense of responsibility, and attitude toward conflicting resource uses were key variables helping to distinguish between people who were willing to pay more than a token amount for instream flows, and those who were willing to pay nothing.

IX. ADDITIVITY ACROSS SITES AND SEPARABILITY OF VALUE COMPONENTS IN MAIL TRUST FUND RESPONSE

This section provides an interpretation of the economic valuation models developed from the mail survey trust fund responses. The estimated equations were previously described in Section V.

A. DIRECT/INDIRECT SHARE IN TOTAL ECONOMIC VALUE

The preservation motive variables described in the preceding section can be used to analyze the components of total economic value. Results of a regression approach utilizing existence and option variables is summarized in Tables IX-1 (open-ended CVM) and IX-2 (logit). For the logit model, four different specifications are reported, depending on the combination of existence factor motives (NONUSE, HELP and PROTECT) and option/direct use motives (ACTDAY, FUTURE) that are included. The abbreviated existence factor names correspond to the preservation motives described in Section VIII as follows: NONUSE equals altruism, HELP equals personal contribution, and PROTECT equals environmental concern. The general finding is that the estimated existence share of total valuation varies from .68 to .83, while the option/use share is from .17 to .32 (Table IX-2). A slightly lower range is estimated for the option/use share for the open-ended model: .09 to .14 (Table IX-3). It will be recalled that the open-ended model is only estimated on the subsample that responded to this question format (about 40 percent of the full sample).

Table IX-3 provides a comparison of the regression method results to the apportionment method. As previously discussed, the latter is based on a follow-up question that asks respondents to allocate their trust fund donation between existence and option/use motives. The apportionment method mean estimated shares are 0.25 for the option/use motive and 0.65 for the existence motive. These means are based on individual responses, which did not always sum to 100 percent. These means can be "normalized" to sum to 100 percent, yielding a mean option/use and existence shares of 0.27 and 0.73, respectively. The means are bracketed by the logit estimated shares (.17 to .32 for option/use and .68 to .83 for existence) and indicate a somewhat

higher share to option/use motives than the open ended (.27 versus .09 to .14).

The general finding here is that there is remarkable consistency between the two very different approaches to identifying the components of total valuation. These results appear to confirm the success of the admittedly exploratory methods used to define the psychometric existence factors. A cautionary note is that the regression approach is dependent on a complete and accurate model of all important factors or motives. To the extent that pertinent variables for either use/option motives or existence are not included, there is potential for biased estimates.

The finding here for direct/indirect share of total value can be compared to the results of the Walsh, Sanders and Loomis (1985) study of a trust fund for Colorado wild and scenic study rivers. These authors utilize the apportionment method and find 34.7 percent of total value is associated with the use/option motive and 65.3 percent for existence (including bequest) motives. This is comparable to this report's find of 27 percent and 73 percent respectively with the apportionment method (Table IX-3).

Walsh, Sanders and Loomis (1985) also provide explanatory models of willingness to pay responses. Unfortunately, they do not report a model for total valuation (both direct and intrinsic values combined); the most comprehensive model reported is for "preservation values" which combine existence, bequest and option values (their Table 18, p.80). Since they report elasticities at mean values for all explanatory variables, the regression interpretation can applied to their model. The combined elasticity of variables that appear to be related to direct or future use ("probability of future use of a study river", "option value is important", "consumer surplus from last river trip", "number of trips to rivers in other states" and "recreation use is important") is .49. The sum of elasticities for variables related to existence motives ("existence value is important") is .18. This implies a direct/option use share of .73 and an existence share of .27. The estimated share to existence from the regression approach is much lower than their apportionment share (at .65). Since their response model is only estimated on preservation values (not recreation), the share to existence would probably be even lower for a total valuation model.

The Welsh, Sanders and Loomis (1985) study may illustrate the importance of defining a variety of possible preservation motives and taking care to provide the respondent with meaningful and easily understood questions related to motives. It may be that preservation motives are underrepresented in their model because of a failure to fully measure these motives. Asking respondents if "existence value is important" or if "option value is important" presupposes a value taxonomy and presupposes that the respondent understands that taxonomy.

B. ADDITIVITY ACROSS SITES

Total economic valuation responses for protecting instream flow were tested for consistency with the predictions of basic consumption theory. Specifically, the nonsatiation axiom of consumption theory implies that the partial derivative of the total willingness to pay function with respect to quantity be positive. The law of demand implies that the second partial be negative. For the specific functional form utilized in both the reparameterized logit model and the open-ended CVM model (double log), these requirements are satisfied if the estimated parameter on quantity demanded is greater than zero and less than one. Estimates of this parameter for both models are summarized in Table IX-4. The basic finding is that responses are consistent with theory: the estimated parameter varies from .39 to .78 for the logit model and from .19 to .25 for the open-ended model.

The estimated parameter in Table IX-4 is the elasticity of total willingness to pay with respect to the number of rivers protected. Corresponding elasticities can be derived from Welsh, Sanders and Loomis (1985). For the latter study, the elasticity of total willingness to pay with respect to the number of rivers protected varies from .78 at 3 rivers to .38 at 11 rivers. These elasticities are also consistent with theory and in the same range as those presented in Table IX-4.

The results in Table IX-4 are based on combining the single river and five river trust fund responses into a single model. An alternative way to examine the data is to look at point estimates for total willingness to pay for single or multiple rivers by subsample. These results are provided in Tables IX-5 to IX-7. These tables also show results for user and nonuser subsamples, where users are those who reported visiting the given river(s) in the last three years.

Table IX-5 shows estimated means for the dichotomous choice contingent valuation mail trust fund responses. The welfare measure is a nonparametric mean (Duffield and Patterson, 1989); this approach is used here since it provides a measure of dispersion for the mean (the standard error is reported). One measure of consistency with consumption theory is if total willingness to pay is an increasing function of the number of rivers protected. For example, for the complete sample, the single river means are $4.49 for the Big Hole, $8.19 for the Bitterroot and $6.38 for the combined single river samples. These values are lower than the multiple river mean ($15.45). A t-test (Table IX-6) indicates that the multiple river mean is significantly higher than the Big Hole and combined single river means. The Bitterroot mean is not significantly different, but this may only reflect the power of the test (which is a function of sample size).

Comparing single and multiple river means for the user and nonuser subsamples, no estimates are significantly different for nonusers and only the combined sample is significantly different for users. These results are not surprising given the reduced samples.

Table IX-6 also shows that the mean trust fund donation by nonusers is significantly lower than the mean donation by users. This holds for the

complete sample, where the mean user donation is $14.04 compared to $4.07 for nonusers, and for the river-specific subsamples as well.

Table IX-7 provides comparable mean donation values for the open-ended CVM responses. These means are based on individuals who participated in the question, and have not been corrected to include zero values on the part of nonparticipants. The pattern of responses is similar to that for the dichotomous choice responses, but the with smaller differences across the various subsamples. For example, the mean user donation is $15.12 and the nonuser donation is $9.45. The complete sample single river donation for the Bitterroot is $11.14 and for the Big Hole is $10.62; these are somewhat lower than the multiple river value of $16.49.

Another way to examine the consistency with theory is to compare average willingness to pay point estimates for one and five rivers. The law of demand implies that marginal willingness to pay is a declining function of quantity demanded; for the range where marginal WTP is below average WTP, average WTP will also be declining.

Table IX-8 provides point estimates of single river mean trust fund donations based on a nonparametric estimate of the mean value for dichotomous choice responses. For the Bitterroot, the mean is $8.19, for the Big Hole, $4.49 and the average for the combined single river sample is $6.38. The average point estimate for five rivers is $15.45 or an average willingness to pay per river of $3.09, assuming all five rivers are identical. (One would expect the average WTP to be declining as quantity demanded increases from one to five rivers since marginal and average are equal at one river and the marginal between one and five rivers ($1.75 to $2.75) is below the average at one or five rivers.)

Table IX-8 also provides means for allocated multiple river responses. The latter is the multiple river trust fund mean response times the mean share of this donation respondents said was for a given specific river. This allocated response can be interpreted as an average WTP (per river) corrected for heterogeneity for comparison to a given single river response. For example, respondents asked to value the Bitterroot by itself made a mean donation of $8.19, this is significantly higher than the allocated multiple river response ($15.45 times .1457 or $2.27). As noted in the theory section, declining average willingness to pay (with increasing quantity of rivers protected) is consistent with consumption theory. (This result is no surprise given the total WTP parameter test described above.) The average WTP for the Big Hole by itself is not significantly higher than the allocated Big Hole share of the multiple river response ($4.49 versus $2.01), but the power of the test may be low given the sample size.

These results provide evidence that trust fund responses are consistent with consumption theory. Specifically, responses indicate that individuals will donate more if more rivers are protected, but that the amount for each additional river (the marginal willingness to pay) is declining. Since the basic elements of the consumption theory model are derived from the standard constrained maximization formulation, these results provide some insights into characterizing the trust fund phenomenon. It appears that trust fund

donations can be modeled like the purchase of any other commodity and that these purchases reflect the presence of a budget constraint.

X. REGIONAL TRUST FUND FOR INSTREAM FLOW: AGGREGATION AND NONRESPONSE

This section provides a comparison of mail survey responses with results of the phone survey of nonrespondents. Aggregated trust fund values are derived for Montana residents based on estimated population characteristics. This exercise is presented despite the fact that the mail survey was not designed to be a random sample of the population. As described below, corrections for certain key nonrandom aspects of the sample are made - such as a correction for distance of the respondent from the site. Additionally, the geographic scope of the analysis is limited to Montana even though state of residence was not found to be a significant explanatory factor in mail trust fund donations. Potentially much higher regional trust fund budgets would be estimated if neighboring states were included in the population definition. It is simply beyond the scope of this report to explore all possible permutations in the following analysis. A limit to the geographic scope of the population could be defined by comparing the expected marginal return from a trust fund mailing to the marginal cost. This consideration is discussed below.

A. NONRESPONDENT ANALYSIS

The phone survey of nonrespondents was based on an abbreviated script using 13 questions; these questions were largely a subset of the 39 questions asked on the mail survey (Appendix A). Definitions for specific variables which have identical or similar meaning for both surveys are listed in Table X-1. Estimated average values for these variables from both surveys are listed in Table X-2. A major difference between the two samples is in the percent of respondents that are river users. For example, the percent of respondents who reportedly "never" or "rarely" visit Montana rivers for recreation (RIVREC) was 28 percent for the mail survey, but 51 percent for nonrespondents to the mail survey. Similarly, the percent of individuals that reported using (in the last three years) the river(s) to be protected for instream flows (VISRIV) was 52 percent on the mail survey, but only 30 percent among nonrespondents. These results indicate that individuals that participate in river recreation and individuals that use the specific rivers to be protected were more likely to respond to the mail survey. Given the finding reported in Section IX that users are willing to donate considerably more than nonusers (Table IX-5 and Table IX-7), this is an important source of potential bias in applying the mail survey based valuation models to the Montana population.

On a number of other characteristics, however, mail survey respondents and nonrespondents were similar. For example, the percent of individuals that fish was about the same in both samples (around 60 percent). (Apparently, many of the nonrespondents must be lake anglers only.) Also, somewhat surprisingly, both groups reported approximately the same average probability of visiting a Montana river in the next three years (59 percent). However, this is not an exact comparison as the mail survey asked the likelihood of visiting one of the specific study rivers.

The total days of river recreation (DAYS) that the user subsample in both

surveys reported was quite similar at 23 days per year for nonrespondents and 25 days per year for respondents. Additionally, the share of trust fund donation that each group allocated to existence motives was similar at 68 percent for respondents and 66 percent for nonrespondents. Nonrespondents were slightly less likely to be members of conservation groups (14 percent versus 21 percent). Both groups were biased toward males with 69 percent of respondents being male and 66 percent of nonrespondents. As noted, this is biased with regard to the population as a whole, which is approximately 50 percent male.

One approach to developing estimated trust fund valuation appropriate to the population is to weight value estimates derived from the two samples. These estimates could be weighted by the response rate to the mail survey (34 percent). However, the valuation results for the two subsamples (respondents and nonrespondents) are not entirely consistent with previous findings. The major difference between the two samples appears to be the higher share of nonusers among nonrespondents. Given the mail survey results that nonusers have lower trust fund values, one would therefore expect nonrespondents to have lower values than respondents. This is not the case for the dichotomous choice question format (Table X-3). Based on the nonparametric method, nonrespondents have a mean trust fund donation of $18.09, compared to $9.40 for the mail survey. Based on estimated standard errors, the nonrespondent mean is significantly higher than the respondent mean. The two experiments seem to be otherwise comparable. For example, the mean bid offer (BIDF, Table X-2) is almost identical for the two surveys at around $90. However nonrespondents were more likely in aggregate to be willing to donate based on the dichotomous choice response with varying bid levels (7.9 percent yes among respondents and 12.8 percent among nonrespondents) and also for the $1 bid offer (56.4 percent of nonrespondents would donate $1 versus 52 percent of respondents).

The most likely explanation of these results is that it indicates the sensitivity of dichotomous choice responses to the media employed. Apparently, other things equal, a personal phone solicitation is on average more successful than a mail solicitation. This is an interesting finding, if true, and has relevance for the design of real world trust fund drives.

Results are also available for the open-ended question format. Based on means for participants only, in this case the respondent mean donation is slightly higher at $12.90 versus $11.75 for nonrespondents (variable MAX in Table X-2). However, these results are somewhat misleading because of the pattern of participation in this question format. One needs instead to look at overall means for the samples, including nonparticipants at zero value. While there was essentially 100 percent participation in the dichotomous choice format, not all of these participants responded to the open-ended format. This was in part because it was presumed that individuals who responded "no" to the $1 dichotomous choice offer had a zero open-ended value and were not asked the open-ended question. This approach was used on both the mail survey and phone script. Additionally, a share of people who responded "yes" to a logit offer did not answer the open-ended question, which is admittedly a more difficult type of question to answer. This was true of about 70 percent of the logit "yes" respondents on the mail survey.

Including nonparticipants at zero value yields an overall mean for the open-ended format of $7.03 for nonrespondents and $5.03 for mail survey respondents. These results again illustrate (as for the dichotomous choice format) that a phone solicitation (other things equal) appears to elicit higher donations. Additionally it may be noted that the phone survey resulted in greater overall participation in this question format (60 percent versus 39 percent, Table X-4). Means for participants only for nonrespondents are probably lower than for respondents because more individuals with low valuation are included in the participant subsample.

B. TRUST FUND AGGREGATION

An aggregated trust fund valuation for a subsample of Montana residents was developed based on the mail survey valuation models. Given the apparent sensitivity of valuation estimates to media choice, one could alternatively develop an estimate based on the nonrespondent phone survey valuation model. The latter was deemed to be beyond the scope of this project. Since the mail sample was not a true random sample of the population, a number of corrections and approximations need to be made explicit. The respondents did not include individuals under the age of 18. Accordingly, the aggregation is for that segment of the population that is 18 and over. The use of a phone directory-based sample introduces a gender bias and excludes the subset of the population without phones. A correction for gender was limited to a correction based on the nonrespondent sample as described below. It was assumed that individuals with phones and individuals without are identical for purposes of this study. A major departure from a random population sample relates to residence distance from the study rivers. This was explicitly corrected for in the model as described below.

The valuation model for the open-ended format is fairly straightforward, based on the mean of the sample and adjusting for nonparticipation. However, there are a variety of ways to evaluate dichotomous choice responses, and the literature provides little if any guidance on the appropriate method. Estimated means and medians for the mail survey trust fund logit response are provided in Table X-5. The nonparametric mean (truncated at $300) is $9.40. The truncated mean based on a simple bivariate (bid as the only independent variable) model is
$10.82, with a median of $3.22. Still another alternative is to estimate a multivariate model, and evaluate it at the sample means. Estimates for two specific models are provided in Table IX-5. One estimate is based on equation 1 in Table V-10, with mean of $10.98 and a median of $4.20. Another multivariate equation is the one explicitly developed to include use variables (Table V-14). The truncated mean for the latter is $8.99 with a median of $2.76.

The differences between these estimates is not great. Lacking a better criteria, the multivariate equation including use variables was used for the trust fund aggregation on the grounds that it is necessary to correct for the nonuser bias in the mail sample.

A variety of methods have been used for expanding contingent valuation sample

estimates to aggregate benefit estimates. Current practice and solutions have been recently reviewed by Loomis (1987c). Four of the specific alternatives identified by Loomis have been applied in this study:

1. Sample-based model with estimated population means for independent variables (method of Schulze et. al, 1983).
2. Weighted average of stratified sample WTP means (Carson and Mitchell, 1984).
3. No adjustment - extrapolate to population using sample-based model and sample means (Walsh, Loomis and Gillman, 1984; Stoll and Johnson, 1984).
4. Include nonrespondents and nonparticipants at zero value (Bishop and Boyle, 1985).

The basic information for applying methods 1 and 2 is provided in Table X-6. Sample means for user and gender related variables are listed along with population weighted averages. For example, the USER dummy variable has a value of .52 in the mail survey (52 percent of mail survey respondents are river users) and .303 in the nonrespondent survey. Since respondents and nonrespondents are a sample of the population, these values are weighted at .34 (response rate) and one minus .34 to yield an estimated population mean for this variable of .376. Similar calculations are displayed for the other user variable DUMFREQ and gender.

The logit mean based on method 3 (sample means for independent variables) is $8.99 (Table X-6 and Table X-5). When evaluated at estimated population means (method 1), the logit mean is $8.07. This essentially reflects a correction for the proportion of users in the population as opposed to the proportion of users in the mail respondent subsample. The open-ended (participants only) mean based on the predictive model of Table V-14 is $7.80 for the sample (method 3) and $7.26 for the population (method 1). These values are considerably lower than the simple average of the open-ended responses at $12.90 for the mail survey and $11.75 for nonrespondents. The simple averages would appear to be more reliable. Accordingly, a method 2 (weighted average of stratified samples) approach is reported for the open-ended mean of $12.14. (While all values reported below derived from the dichotomous choice (logit) format are based on the mail survey alone, the open-ended format (based on the apparent superiority of method 2 for that format) is based on both mail and nonrespondent phone results.)

The open-ended $12.14 estimate for participants can be adjusted for nonparticipation to $6.35 (Table X-6). All of these values are for sample average distance to river protected (157.42 miles) and for sample average quantity of rivers protected (2.36).

The influence of distance and quantity of rivers protected on estimated mean trust fund donations is provided in Tables X-7 and X-8. These are derived from the multivariate equations including use variables displayed in Table V-14. Based on the logit mean, total willingness to pay at one river protected is $5.04, for two rivers is $7.36 and rises to $12.14 for five rivers. Corresponding results for logit median and open-ended CVM (participants only) are also shown in Table X-7. The corresponding marginal individual donation for the logit mean (Table X-7, part B) is $2.75 at one river protected, $2.01 at two, and falls to $1.32 at five rivers protected.

There is a significant variation in mean donation depending on the proximity of the respondents residence to the river protected. For the logit mean (and for 2.36 rivers protected), respondents only 10 miles from the river will have a mean donation of $35.94; at 100 miles this drops to $15.88 and at 2000 to $5.49 (Table X-8). Table X-8 also shows the effect of distance on "overall means" - means that have been adjusted for both nonparticipation and nonresponse. These means are based on method 4 and count all nonrespondents and nonparticipant values at zero. This might be called the "reality method" in that it best reflects the actual probable return to a given trust fund mailing: nonrespondent and nonparticipant donations are necessarily zero. Further real world considerations are that dichotomous choice formats are not efficient ways to actually collect money. The sample mean reflects potential value; the actual return will depend on such factors as how many individuals are only asked for a $1 bid. In this sense, with the open-ended format you get what you see: the sample mean would be the take (aside from hypothetical bias). Interestingly, the open-ended overall mean is only $1.56 at 500 miles and $1.35 at 1000. Another real consideration is the marginal cost of the mailing. Depending on the purposes of a given study, an appropriate geographical scope to the aggregation exercise could be defined by comparing trust fund mailing marginal costs to marginal return. For purposes of our analysis here, the geographical scope of the aggregation is limited to Montana residents.

The basic location specific data for the trust fund aggregation is provided in Tables X-9 and X-10. The first of these tables list the 25 largest population centers (counties and county seats) in Montana. This group of counties (25 of the 50 in the state) accounts for 85.4 percent of the population. It is assumed for purposes of the aggregation that the location of the remainder of the state population is identical to the distribution of the 25 population centers. The distance variable used in the multivariate models of Table V-14 is map distance from the mail survey sample population centers (Butte, Billings, etc.) to the Big Hole River at Divide (for Big Hole surveys), the Bitterroot at Hamilton (for Bitterroot surveys) or the average of these two (for five river surveys). The aggregation calculated here is for a five rivers trust fund. Accordingly, Table X-10 lists population by county, distance to the Big Hole River at Divide, distance to the Bitterroot River at Hamilton, the average of these distances and the corresponding logit mean and median and open-ended (participants only) donation.

Table X-10 also displays the algorithm used to estimate total values for the state. Each county center estimate is inflated by 1/.854 (to account for the 25 county centers not modeled), multiplied by population of that county 18 and over in 1980, and multiplied by a factor of 809,000/768,690 (the ratio of current to 1980 population) to bring county level population estimates up to date.

Results of this aggregation are reported in Table X-11 for the various aggregation methods. Method 1, using estimated population means, results in a Montana trust fund valuation for instream flows in five protected rivers of $6.7 million based on a logit mean. The median-based value is $2.0 million. Method 2 (weighted stratified sample) is used for the open-ended format.

Including nonparticipants, the value is $4.2 million. Method 3, the unadjusted sample-based estimate, is somewhat higher than the adjusted method for the logit ($7.5 million for the mean and 2.3 million for the median) and somewhat lower than the adjusted for the open-ended format ($3.3 million). The latter is lower because the overall mean for the mail survey (5.03, Table X-6) is actually lower than the weighted average open-ended overall mean ($6.35). Method 4, including nonrespondents at zero value, results in the lowest estimates: $2.4 million for the logit mean and $1.1 for the open-ended mean.

XI. CONCLUSIONS

This study introduces a general framework for estimating the recreational value of instream flows. The theoretical model incorporates the influence of instream flow levels directly on both the quality of the recreational experience and on the quantity of users. Additionally, the quality of the recreational experience can be indirectly affected by flow through the effect of flow on total use (congestion) and flow on quantity demanded (seasonal use). This framework provides a convenient structure for comparing results of previous instream flow research. The model is aggregated at the day level and can be used to value a changed increment to flow over a season or alternative flow regimes.

The recreational value model is demonstrated in an application to the Big Hole and Bitterroot Rivers in Montana. Valuation is based on experienced flow levels within a current trip valuation model, while use is actual observed. A broad range of flows was experienced during the May to August sample season as the summer of 1988 happened to be one of the driest on record. Marginal values per acre foot at low flow levels were found to be in the $10 to $15 dollar range. Estimates are also made on this onsite sample data base that demonstrate the limitations of previous models of instream flow valuation. The use of an experienced flow valuation approach failed to yield a relationship to discharge on the Big Hole River. In cases where there is a dramatic change in sample composition (residence, income, etc.) over the study season, the method of "unexperienced scenarios" introduced by Daubert and Young (1981) may be superior for measuring the effect of flows on the quality of the recreational experience.

A user-defined scenario, "preferred flows", was developed and applied for an onsite trust fund valuation exercise. Marginal acre foot values of $4 to $10 were derived for a flow increment from historical to preferred flows in July and August based on the study river section users. If flows delivered to these study sections could be assumed to have similar impacts on users of the entire river, acre foot values are $25 to $35.

Valuation varied by user group, with anglers having values that were roughly double those of general shoreline recreationists on the Bitterroot and with float anglers having somewhat higher values than bank anglers on the Big Hole.

A mail survey trust fund vehicle was used to estimate total recreation and preservation values for a set of Montana rivers. Three versions of the survey were utilized varying with regard to which and how many rivers were to be protected by the trust fund donation. One version was for the Bitterroot

only, another for the Big Hole only and the multiple river version was for five rivers (including the Bitterroot, Big Hole, Clark Fork, Gallatin and Smith). This variation in number of rivers was introduced to facilitate analysis of the additivity of responses across different combinations of environmental goods.

Multivariate valuation models were estimated for both dichotomous choice and open-ended question formats. Responses were significantly correlated to the number of rivers protected. Criteria for testing the theoretical consistency of responses with consumption theory were developed by examining the analytical implications of the nonsatiation axiom and the law of demand. The theoretical constraints on model parameters were identified for our specific functional form (double log). For this specification of a total willingness to pay function, it is only necessary that the estimated coefficient on quantity demanded by greater than zero and less than 1.0. All models estimated met this criteria. Analysis of single and multiple river subsample means support the conclusion that responses were consistent with theory with respect to additivity.

These results provide evidence that valuation of environmental goods, even where existence or preservation motives may be important, is consistent with consumption theory. Instream flow trust fund responses indicate that individuals will donate more if more rivers are protected, but that the amount for each additional river (the marginal willingness to pay) is declining. Since the basic elements of the consumption theory model are derived from the standard constrained maximization formulation, these results provide some insights into characterizing the trust fund phenomenon. It appears that trust fund donations can be modeled like the purchase of any other commodity and that these purchases reflect the presence of a budget constraint.

A major focus of the mail survey was on identifying the share of total value due to existence as opposed to use and option motives. Little is known about the underlying attitude and belief systems that might explain why people might (or might not) be willing to pay for preservation of natural environments. Purely exploratory research was undertaken to attempt to define and measure basic motives. A five-point Likert-scaled format was used to measure how much people agreed or disagreed with each of 23 statements related to reasons for holding preservation values. The statements were derived from largely untested "hypothesis" posed in the literature. Factor analysis of responses to the 23 statements revealed five factors, each representing a somewhat distinct dimension of possible reasons for valuing instream flows, apart from one's past or intended use of the rivers. A subset of these variables was found to be significantly correlated to willingness to pay.

A new method was introduced, based on an application of Euhler's Theorem, to identify the share of total valuation due to each motive through multivariate regression. The application required the extension of the logit model reparameterization (first introduced by Cameron, 1988) to include other welfare measures including a truncated mean. The traditional apportionment method of identifying share of direct and indirect uses in total value (though a followup direct question) was also employed. The regression and apportionment methods were found to be in close agreement, with approximately

75 percent of total valuation due to existence motives.

The mail sample valuation estimates were extrapolated to an aggregate Montana instream flow trust fund total value. Four different approaches to aggregation of contingent valuation responses (Loomis, 1987c) were applied. One approach was to estimate population sample means for independent variables with an extensive phone nonrespondent survey. A basic finding was that river users were much more likely to respond to the mail survey. (River users were 52 percent of respondents, but 30 percent of nonrespondents.)

The estimated Montana total population value (age 18 and over), corrected for distance from river protected, is $6.7 million based on a logit mean. If nonrespondents are counted at zero value, the more or less realistic return to a trust fund mailing would be only $1.1 to $2.4 million. The nonrespondent survey appears to indicate that response to both the dichotomous choice format and the open-ended question format is sensitive to the choice of media. For dichotomous choice, phone solicitation of responses appeared to double the estimated value, other things equal. Additionally, participation in the open-ended format was somewhat higher with the phone survey.

An important direction for further research is to integrate the elements that have been developed here into a comprehensive model for policy application. An element of this would be to view the trust fund as providing a budget constraint for this subset of environmental services. The appropriate role for the model of the recreational values of instream flow may be to provide a guide to allocation of this "instream flow budget" to a given state or region. This is especially true if meeting recreationists' preferred flows will also ensure achieving biological standards that indicate existence goals are being met. It was found that recreationists' preferred flows exceeded biology-based minimum instream flow standards on the Big Hole and Bitterroot.

A more fundamental issue is the appropriate economic organization of this sector. The trust fund has been treated in this study as little more than a payment vehicle for nonmarket valuation. In fact it is a real institution that has the potential for dramatically impacting the level of environmental services. The success of the Nature Conservancy and the phenomenal growth of the Rocky Mountain Elk Foundation are but two examples. Consideration needs to be given to the appropriateness of basing policy decisions on nonmarket values where considerations of real world institutions are ignored. Specifically, most nonmarket valuation exercises (including the one presented here) ignore transaction costs. It is possible that nonmarket valuation tools have much broader potential application than developing market surrogates for policy purposes. The underlying reason for the standard nonmarket valuation exercise is market failure. It may be beneficial in some cases to turn the tools around 180 degrees to face the underlying problem. It would appear that nonmarket tools have the potential to influence the design and application of the real world institutions that arise in response to market failure.

This and previous studies have laid the groundwork for understanding peoples' many reasons for valuing natural resources, whether or not the resource is used personally for recreation. However, it's clear that more work is needed before valid, reliable taxonomies of values can be identified. Different

people likely have different taxonomies--ways they value natural resource--so the task is clearly more involved than finding the "right" one. Basic research, preferably personal interviews with many open-ended questions, would go far in exploring the roles of motives such as altruism, philanthropy, sympathy, guilt, self-actualization, commitment, and imitation.

The findings have implications not only for further research, but for private trusts or similar efforts to raise money for natural resource conservation and enhancement. People who use the resource are more likely to contribute than non-users, but there are probably far more nonusers out there. Appeals to altruistic values, effective to both users and nonusers, should include descriptions of the likely vicarious uses that could be enhanced, as well as benefits to plants, fish, wildlife, and other resources.

The lowball and highball techniques may be effective ways to get at least a small donation from a great many respondents. People who have donated before are more likely to donate, even if the cause differs. Appeals for donations should introduce the trust fund (or other) concept clearly and objectively to familiarize people with the concept. Providing behavioral role models for people to follow also should boost donation rates.

The ethics of research efforts exploring willingness to pay for memberships in natural resource trust funds should not be overlooked. Many of the comments we received suggested that people thought this was an outright request for money (although only one person actually sent a check for his amount). While this is great in terms of reducing hypothetical bias, it poses the same problem as fund-raising efforts that disguise themselves as research.

Two recent examples were 1989 mailings by the Sierra Club and Greenpeace. Both were one-page questionnaires, accompanied by cover letters that stressed the extreme importance of this research effort and of obtaining peoples' responses. The questions, however, especially on the Greenpeace questionnaire, were ridiculously biased and distorted, and the survey was nothing but an obvious introduction to a fund-raising pitch. Cloaked as research, this misleading sales tactic may have worked, but it does all research efforts a disservice.

The point really is that if we make our survey efforts too realistic, we are creating the same impression. Ironically, the research needed most at this point is further field testing of the principles learned to date. A legitimate trust fund, set up to maintain instream flows and relying on private donations, would be an ideal mechanism for testing hypotheses--as well as for maintaining river resources. As long as the purpose and intent is clear and not misleading and the research practice sound, such efforts would test hypotheses in a market in an ethically sound manner. If accompanied by the type of basic research on preservation values described above, our understanding of this characteristic of human behavior would increase greatly.

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TABLES

TABLES

Table III-1

Summary of Survey Sample Sizes

Survey	Sample Size	Response Rate
On-Site Summer 1988		
Bitterroot	319	
Big Hole	590	
TOTAL	909	
Phone Pre-test September 1988		
Missoula/Bighole	100	
Mail Survey Nov. 1988-January 1989		
Total mailing	1850	
Undeliverable	140	
Total Response	582	34%
Nonresponse Phone Survey, April 1989		
Total Sample	251	

NOTE: Response rate (cooperation) for on-site and both phone surveys was nearly 100%

Table IV-1

On Site Activity Shares by River
(Percent of Total Sample)

Activity	Bitterroot	Big Hole
General Shoreline (Picnic, swim)	53.0	7.2
Float	6.4	5.9*
Fish		
Shore fish	24.6	23.6
Fish and camp	1.1	13.6
Boat and fish	14.8	35.3
Fish, float and camp	0.0	14.3
Subtotal Fish	40.5	86.8

*Includes 0.6% float and camp

Table IV-2

Current Trip Characteristics
Comparison of Bitterroot and Bighole

Variable & Measure	Bitterroot	Big Hole
Total Sample	319	590
DSGRG-Mean	1498	648
Income-Mean	31079	41494
TRIPSF-Mean	8.583	2.808
TRIPIM-Mean	6.761	25.528
YEARS - Mean	10.768	15.754
FSIVST - % yes	7.42	11.60
RES - % nonresident	16.3	28.9
ONEWAYD - Mean	272.3	441.2
- Median	10	100
EXPENSE - Mean	133.16	329.89
- Median	10	60
MNPVRP - % yes	61	62
MNSITE - % yes	69	58
CROWDED - % yes	6.6	19.5
GUIDE - % yes	0.3	8.3

Table IV-3

Current Trip Characteristics
By Month By River

Measure	May	June	July	August
	(A) Bitterroot River			
SAMPLE	53	69	118	17
NSAMPLE (Mean)	6.6	6.9	9.8	4.3
SAMPLE DAYS	8	10	12	4
DSCRG (Mean)	2959	2783	460	216
INCOME (Mean)	30865	30667	30887	34833
RES (% NonRes)	2	19	19	29
FSTVST (% yes)	10	10	5	13
YEARS (Mean)	12.1	10.9	10.8	5.9
TRIPSF (Mean)	6.1	9.5	8.1	10.9
TRIPIM (Mean)	4.6	5.6	5.4	4.8
	(B) Bighole River			
SAMPLE	83	263	71	40
NSAMPLE (Mean)	13.8	19.0	8.9	4.4
SAMPLE DAYS	6	14	8	9
DSCRG (Mean)	1165	705	168	52
INCOME (Mean)	34815	43601	40869	42929
RES (%NonRes)	16	22	52	63
FSTVST (% Yes)	6	12	15	13
YEARS (Mean)	15.6	16.4	13.1	16.5
TRIPSF (Mean)	2.1	3.0	2.1	3.1
TRIPIM (Mean)	16.5	21.2	38.0	49.7

Table IV-3b

Fishing Quality by Month

Measure	May	June	July	August
	(A) Bitterroot River			
TROUTSF	.5	.7	.4	1.3
HOURSF	1.1	1.4	1.2	4.2
SUCCESS	.28	.28	.35	.55
	(B) Big Hole River			
TROUTSF	5.3	6.1	3.9	7.9
HOURSF	4.9	6.6	7.7	7.3
SUCCESS	.77	.90	.55	.85

Notes:
TROUTSF = number of trout caught.
HOURSF = number hours fished.
SUCCESS = number of trout caught per hour.

Table IV-4

Summary of On-Site Flow-Related Responses by River

Variable	Bitterroot	Big Hole
ADQFLOW - % Yes	92.8	87.8
Preference For:		
Current Flow (%)	66	59
Higher Flow (%)	19	31
Lower Flow (%)	14	10
July-August Preference:		
Current Flow (%)	69	41
Higher Flow (%)	30	59
Lower Flow (%)	1	0
COMADFL - % Had Comment	23	19
Comment:		
Too Low (%)	21	65
A Little Low (%)	29	23
KNOWFL - % Yes		
FLINFO		
Post Experience (%)	40.8	30.7
Friends (%)	2.2	6.3
Fly Shops/Guides (%)	1.6	5.3

Table V-1

Current Trip Logit Equations
Variable Definitions

P =	proportion responding yes to given bid amount.
BIDT =	dollar bid offer for current trip
INC =	household income in dollars
TRIPSF =	trips taken so far this year to the given river
TRIPTM =	hours on site for this trip
DSCRG =	daily average flow in CFS on study sections based on USGS guages at Wise River and Melrose (BigHole) and Darby and Bell Crossing (Bitterroot)
AGE =	age of respondent
HISTAGE =	average stage height if respondent prfers higher flows or zero if respondent prefers current or lower flows
SQHISTAG =	square of HISTAGE
RES =	dummy variable with 1 = Montana Resident, 0 if nonresident

Table V-2

Current Trip Logit Equations
Bitterroot River

Variable/Statistic	Estimated Parameters (1) ALL	(2) SHORELINE	(3) FISH/FLOAT
Intercept (t-statistic)	-7.985 (.64)	-16.1639 (-1.71)	-5.8612 (1.99)
ln BIDT	-1.2450 (-7.47)	-1.5079 (-4.61)	-1.1184 (-5.59)
ln INCOME	+.9425 (+3.29)	1.8169 (3.25)	.5905 (1.66)
ln TRIPSF	-.3580 (-2.00)	-.8108 (-2.83)	—
ln TRIPIM	+.6795 (+2.86)	—	.7897 (2.34)
ln DSCRG	+.4663 (2.44)	.7574 (2.36)	.4897 (1.79)
SAMPLE SIZE	231	114	115
DF	225	109	110
Chi-square	152.05	64.91	86.41
P	1.0	1.0	.953
Sample Means:			
Income	31740.1	28678.9	34796.7
TRIPSF	7.937	9.855	—
TRIPIM	7.005	—	10.135
DSCRG	1451.9	1044.3	1875.3

Table V-3

Current Trip Logit Equations
Big Hole River

Variable/Statistic	Estimated Parameters			
	(1) ALL	(2) ALL	(3) FLOAT ANGLER	(4) BANK ANGLER
Intercept	-2.1633	-1.6066	-8.3208	6.2499
ln BIDT	-1.2599 (-11.17)	-1.1856 (-11.16)	-1.4900 (-7.30)	-1.0492 (-8.51)
ln INCOME	.3466 (1.74)	.7474 (3.99)	1.3383 (3.68)	—
ln TRIPSF	-.4789 (-2.22)	-.8190 (-3.96)	-.4606 (-1.6521)	-.7001 (-2.18)
ln AGE	1.5908 (3.10)	—	—	—
RES	(-1.3447) (3.93)	—	—	-1.9871 (-3.93)
HISTAGE	—	+.9246 (1.83)	—	—
SQHISTAG	—	-.3532 (-1.89)	—	—
TRIPIM	—	—	.6449 2.77	—
SAMPLE SIZE	503	—	241	278
DF	497	—	236	274
Chi-square	864.32	—	201.6	354.13
P	.00	—	.949	.001

Table V-3, P.2

Variable/Statistic	ALL	ALL	FLOAT ANGLER	BANK ANGLER
Sample Means:				
Income	42894	41494	48117	—
TRIPSF	2.406	2.808	2.780	2.071
AGE	42.017	41.802	—	—
RES	.649	—	—	.596
HISTAGE	—	.649	—	—
SQHISTAG	—	1.517	—	—
TRIPTM	—	—	22.976	—

Table V-4

Reparameterized Current Trip Logit Equations

	Estimated Parameters	
Variable/Statistic	Bitterroot	Big Hole
Intercept	.001638	.17964
(P/1 - P)	-.8032	-.7939
INCOME	.7571	.2751
TRIPSF	-.2875	-.3801
TRIPTM	.5458	—
DSCRG	.3745	—
AGE	—	1.2626

Table V-5

Variable Definitions for Daily Use Equations

Variable	Definition
NSAMPLE =	number of users samples per day
DSCRG =	CFS daily average at Melrose and Wise River guages (Big Hole) and at Bell Crossing and Darby guages (Bitterroot)
SQDSCRG =	DSCRG squared
DSCRG3 =	DSCRG cubed
WKEND =	dummy variable for weekend
DUMSTR=	dummy variable for strong winds
DUMCOLD =	dummy variable for cold temperature
Saldate =	dummy variable for day when greater than 20% of anglers reported fishing the Salmon fly hatch

Table V-6
Daily Use as a Function of Flow Levels
Big Hole and Bitterroot Rivers

	Estimated Parameters	
Variable/Statistic	Bitterroot	Big Hole
Intercept (t-statistic)	.6255228 (4.187)	6.142113 (3.627)
DSCRG	.006336 (1.797)	.020839 (2.446)
SQDSCRG	-3.65522E-06 (-2.051)	-1.07858E-05 (-1.929)
DSCRG3	4.3699E-10 (1.935)	-----
WKEND	4.565572 (2.803)	3.39069 (1.735)
DUMSTR	-5.618895 (-2.521)	-----
DUMCOLD	-----	-7.278494 (-2.728)
SALDATE	-----	5.193589 (1.802)
R^2	.432	.579
Sample Size	34	37
Variable Means:		
NSAMPLE (dep)	7.50	12.892
DSCRG	1553.06	507.87
SQDSCRG	4,941,342	478,283
DSCRG3	1.9725E10	---
WKEND	.294	.432
DMSTR	.088	---
DUMCOLD	---	.135
SALDATE	---	.162

Table V-7

Variable Definition for On-Site Logit Trust Fund

Variable	Definition
BIDF =	dollar bid offer for trust fund contribution
INCOME =	household income in dollars
TRIPL2 =	trips taken to this river in last 2 years
YEARS =	number of years visiting this river
FISHACT =	dummy variable for fishing activity (1=fish)
DSCHRG =	daily average CFS

Table V-8

On-Site Logit Trust Fund Equations

Variable/Statistic	Estimated Parameters: Bitterroot	BigHole
Intercept (t-statistic)	-1.91756 (4.166)	-3.1614 (4.29)
ln BIDF	-.81238 (-7.129)	-.70126 (-10.94)
ln INCOME	.44516 (2.262)	+.26628 (1.817)
ln YEARS	-.4118 (-2.275)	———
ln TRIPL2	.21318 (1.89)	.39402 (4.682)
ln DSCRG	———	.29582 (2.644)
Sample Size	218	506
Chi-square	202.9	504.4
dF	211	497
P	.643	.40
Variable Means: Sample,(mail*)		
Income	31740.9 (27470)	42894 (24286)
YEARS	10.785 ———	———
TRIPL2	34.156 (6.44)	12.994 (3.88)
DSCRG	———	611.86

*On-site sample means biased by over-representing more frequent users. Mail survey means are not.

Table V-9

Mail Survey Trust Fund Equations
Variable Definitions

Variable	Definition
BIDT =	dollar bid offer for trust fund donation
QUANT =	number of rivers protected by trust
INC =	household income
DIST =	distance of respondent from river(s) to be protected
SEX =	gender = dummy variable (1=male)
ACTDAY =	days of recreational activity on rivers per year
FUTURE =	dummy variable for plan future trip to this (these) river(s) in next three years
NONUSE =	altruism factor defined in Section VIII
HELP =	personal contribution factor (Section VIII)
PROTECT =	environmental concern factor (Section VIII)
USER =	dummy variable with value of 1 if visited this (these) river(s) in last three years
DUMFREQ =	dummy variable with value of 1 if visit rivers for recreation sometime, frequently, or very frequently

Table IX-1

Share of Total Willingness to Pay
Due to Existence vs. Option/Use Motives
Mail Survey Open-ended CVM Trust Fund Equations

	Equation		
Variable/Statistic	1	2	3
(A) Coefficients#			
ACTDAY	.1193	.1039	.1160
FUTURE	.3427	.2660	.2596
HELP	---	1.2553	1.7952
PROTECT	2.1190	1.3549	---
(B) Computation of Share to Motives			
$\Sigma B_i + \Sigma B_j Z_j$*	2.4395	2.8702	2.0847
Sum of Use/Option Bi	.3205	.2600	.2895
Sum of Existence B_i	2.1190	2.6102	1.7952
Share to Use/Option	.131	.091	.139
Share to Existence	.869	.909	.861

* Future is a dummy variable. Share evaluated at Sample mean of .587.
# See Table V-13 for source of coefficients.

Table VIII-1
Level of Agreement with Statements Regarding Direct and Indirect Values.
(in percent)

	SA	A	D	SD	NS
Montana's free-flowing rivers and streams are a unique and irreplaceable resource.	55	38	2	1	4
Our society should consider the needs of future generations as much as we consider our needs today.	53	43	2	1	2
People can think a river is valuable even if they don't actually go there themselves.	40	57	1	1	2
I enjoy knowing that my friends and family can visit rivers for recreation if they want to.	39	58	1	0	3
I'm glad there is wilderness in Alaska even if I never get there to see it.	39	46	5	1	9
I have a great deal of concern for endangered species.	38	46	6	1	8
I have been concerned about how the recent drought may affect fish and wildlife that depend on rivers.	36	55	3	1	6
Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.	30	43	11	2	13
It's important to protect rare plants and animals to maintain genetic diversity.	29	54	4	1	12
Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.	26	30	24	13	8
I enjoy hearing about experiences my friends or family have had on rivers.	22	67	1	1	9

(SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree, NS = No opinion

Table VIII-1. (continued)

	SA	A	D	SD	NS
I enjoy looking at picture books or going to movies that have rivers in them.	22	63	3	1	12
I have had inspirational experiences on rivers	17	45	9	2	27
The main reason for maintaining resources today is so we can develop them in the future if we need to.	16	41	27	9	7
Donating time or money to worthy causes is important to me.	12	56	9	1	22
I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.	9	49	18	6	18
I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.	7	38	26	7	23
I feel that I should be doing more for Montana's rivers and streams.	7	34	23	2	33
I would like to see more hydroelectric dams on Montana rivers	5	19	30	21	25
Rivers do not have many spiritual or sacred values to me	4	20	30	30	17
The decision to develop resources should be based mostly on economic grounds.	3	17	45	24	10
Endangered species should not be protected if they don't have any benefits to humans.	3	5	35	50	7
I think that most rivers already have enough water in them to be healthy resources.	1	19	47	20	13

(SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree, NS = No opinion)

Table VII-6

Comparison of On-Site Trust Fund
To Preferred Flow Requirements by River

Item	Bitterroot	Big Hole
(A) Trust Fund Total Value		
dollar/user-mean	80.16	119.70
total summer study section users	1854	3724
trust fund total ($)	148,617	445,762
(B) Preferred Flow Request		
Average Cfs needed per month		
July	176	103
August	306	598
Annual Average acre-feet [1] needed:		
July	10821.8	6333.2
August	18819.2	36769.6
Total	29641.0	43102.8
(C) Average dollar budget/acre-foot	5.01	10.34
(D) Average dollar budget/acre-foot if entire river same as study section [2]	43.98	24.05

Notes: [1] Cfs * 1.983 * days/month = acre-feet needed per month

[2] Estimates in (C) inflated by 1/.114 for Bitterroot and 1/.43 for Big Hole based on ratio of use in study section to use in entire river.

Table VII-5

Estimated Recreational Use in River Study Section

	Bitterroot	Big Hole
Angler days in study section [1]	6371	20411
Estimated angler summer use @ 65 percent [2]	41421	13267
Ratio of angler/total use from on-site survey	.396	.869
Estimated May-August days of use	10457	15267
Average use/day study section (123 day session)	85.02	124.12
On-site survey averageobserved users/day [3]	6.90	11.47
Sample fraction (weight)	.0812(12.32)	.0924(10.82)
Average days of recreation/year (mail survey)	5.64	4.10
Estimated summer session river users	1854	3724
Average days/trip (on-site sample)	1.453	2.28

Notes: [1] Derived from Montana Dept. of Fish, Wildlife and Parks 1985 angler survey and Bitterroot study section is about 19.5 river miles, mainly in DFWP river section 2 with a density of 326.7 angler/mile-year or 11.4% of total Bitterroot angler use. Big Hole study section is about 52 river miles in river sections 7 and 2 with an angler density of 392.5 days/mile-year or 43% of total Big Hole use.

[2] Based on rates of May-August use/year for the Clark Fork River (Hagmann, 1973)

[3] Based on weighted average by month

Table VII-2

On-Site Respondent Preferred Flow Level: Average of Higher, Lower, or Current Preferred Flow Level

River —

Bitterroot:

MONTH	NCURRENT	MNSTAG3	NHI	MNPRFHI	NLO	MNPRFLO
May	36	5.13	2	7.52	17	3.49
June	49	4.73	4	5.22	26	3.77
July	109	2.55	45	3.61	2	1.72
August	14	1.99	9	3.95	0	—
Big Hole:						
May	60	3.32	5	4.2	29	1.76
June	208	2.79	74	4.21	27	1.82
July	55	2.03	53	3.15	1	1.11
August	17	1.52	50	3.48	0	—

Variable Definition:

NCURRENT = number of respondents preferring current flow level

NHI = respondents preferring higher flow level

NLO = respondents preferring lower flow level

MNSTAG3 = current average daily stage height (guage height in feet)

MNPRFH1 = average stage height preferred by respondents wanting higher flows

MNPRFLO = average stage height preferred by respondents wanting lower flows

Table VII-3

On-Site Respondent Preferred Flow Levels By Month

River —

Bitterroot:

MONTH	AVEPRFSTAG	AVEPRFCFS	AVECFS	AVEPRFCFS-AVECF
May	4.80	2750.27	2953.00	-207.73
June	4.44	2396.83	2779.00	-382.17
July	2.85	836.00	462.00	373.6
August	2.76	747.45	216.00	531.32
Big Hole:				
May	2.89	816	1160.27	-344.27
June	3.05	928	708.2	219.8
July	2.57	592	168.16	423.84
August	2.98	879	52.05	826.76

Variable Definition:

AVEPRESTAG = average preferred stage height in feet

AVEPRFCFS = average preferred flow in CFS

AVECFS = actual average daily flow in CFS

Table VII-4

Summary of Monthly Flow Data (average CFS)

River/Sample	May	June	July	August
Bitterroot:				
1988-Bell/Darby	2953	2779	462	216
Historical-Darby	3008	3196	1012	377
Est. Historical Bell/Darby	2534	2692	852	318
Preferred	2750	2396	836	747
Average 20 year Deviation from Pref.	—	—	176	306
Big Hole:				
1988-Wise R./Melrose	1160	708	168	52
Historical-Melrose	3428	4055	1346	479
Est. Historical Wise R./Melrose	1839	2176	722	257
Preferred	816	928	592	879
Average 20 year Deviation from Pref.	—	—	103	598

Notes: Need extra water to meet preferred on Bitterroot in 7 of 20 years in July and all 20 years in August. On Big Hole need water in 8 of 20 years in July and all 20 in August.

Table VII-1

Welfare Measures for On-Site Logit Trust Fund
(1988 dollars)

Measure	River	
	Bitterroot	Big Hole
Median	12.47	16.36
Mean-truncated at:		
1000	80.16	119.70
500	62.19	86.82

Table VI-2

Variable Definition for Recreation Value
of Instream Flow

Variable	Definition
DSCRG =	daily average flow in cubic feet per second
USEi =	predicted daily use on river i (i = 1 for Bitterroot and i = 2 for Big Hole)
DAYWiMN =	current trip value per day for river i based on logistic mean (1988 dollars)
DAYWiMD =	current trip value per day for river i based on logistic median
QUTiMN =	marginal value in dollars/acre-foot of increased number of users due to increasing daily flow by one acre-foot (logistic mena)
QUTiMD =	same as QUTiMN but for median
QUALiMN =	marginal value in dollars/acre-foot of increased quality of recreational experience (logistic mean)
QUALiMD =	same as QUALiMN, but using median
TOTiMN =	total recreational value in dollars per day for river i (logistic mean)
TOTiMD =	same as TOTiMN but based on median
DTOTiMN =	marginal value of changed flows in dollars per acre-feet [equals sum of QUALiMN and QUTiMN] based on logistic mean
DTOTiMD =	same as DTOTiMN but based on median
QUDYMNi =	quality cahnge (parallels QUALiMN), but with use held constant
QUINMNi =	quantity change (parallels QUTiMN), but quality held constant

Table VI-7

Total and Marginal Recreational Value as a Function of Big Hole River Instream Flow Levels

DSCRG	TOT2MN	TOT2MD	DTOT2MN	DTOT2MD
50	12197.31	5474.24	14.33	6.43
100	13579.55	6094.60	13.55	6.08
150	14884.23	6680.15	12.77	5.73
200	16111.35	7230.89	11.99	5.33
250	17260.90	7746.82	11.20	5.03
300	18332.89	8227.93	10.42	4.63
350	19327.31	8674.24	9.64	4.33
400	20244.17	9085.75	8.86	3.97
450	21083.47	9462.41	8.07	3.62
500	21845.21	9804.24	7.29	3.27
550	22529.38	10111.23	6.51	2.92
600	23135.98	10383.38	5.73	2.57
650	23665.03	10621.68	4.94	2.22
700	24116.51	10824.13	4.16	1.87
750	24490.42	10991.74	3.38	1.51
800	24786.77	11124.50	2.60	1.17
850	25005.56	11222.41	1.81	.81
900	25146.79	11285.47	1.03	.46
950	25210.45	11313.68	.25	.11
1000	25196.55	11307.04	-.53	-.24
1050	25105.09	11266.55	-1.31	-.59
1100	24936.06	11191.21	-2.09	-.94
1150	24689.47	11081.02	-2.87	-1.29
1200	24365.31	10935.98	-3.65	-1.64
1250	23963.59	10756.09	-4.43	-1.99
1300	23484.30	10541.35	-5.21	-2.34
1350	22927.46	10291.76	-5.99	-2.69
1400	22293.05	10007.32	-6.77	-3.04
1450	21581.08	9688.03	-7.57	-3.40
1500	20791.54	9333.89	-8.35	-3.75

Table VI-1

Welfare Measures for On-Site Current Trip Valuation
(1988 dollars)

River/Sample	Bid Level at which Mean is Truncated			
	$2000	$1400	$500	Median
Bitterroot				
Total Sample	$244.38	$226.58	$168.21	$102.18
Fish/Float	$419.24	$372.64	$250.00	$184.17
Shoreline	$104.03	$101.12	$ 88.97	$ 49.84
Big Hole				
Total Sample	$303.07	$278.85	$200.00	$136.02
Float Angler	$315.29	$296.04	$222.48	$170.66
Bank Angler	$239.07	$216.41	$151.56	$ 76.39

Table VI-3

Effect of Flow on Recreational Use and Values
Bitterroot River

DSCRG	USE1	DAYW1MN	DAYW1MD	QUT1MN	QUT1MD	QUAL1MN	QUAL1MD
100	94.87	61.74	26.57	2.16	.93	11.06	4.62
200	101.36	80.04	34.44	2.45	1.05	7.66	3.20
300	107.02	93.17	40.09	2.47	1.06	6.28	2.62
400	111.87	103.77	44.65	2.33	1.00	5.48	2.29
500	115.95	112.81	48.54	2.11	.91	4.94	2.06
600	119.30	120.73	51.97	1.82	.78	4.54	1.89
700	121.93	127.96	55.06	1.48	.64	4.21	1.76
800	123.89	134.52	57.88	1.11	.48	3.93	1.64
900	125.21	140.59	60.49	.72	.31	3.69	1.54
1000	125.92	146.25	62.92	.31	.13	3.48	1.45
1100	126.05	151.56	65.21	-.11	-.05	3.28	1.37
1200	125.64	156.53	67.37	-.53	-.23	3.10	1.29
1300	124.71	161.34	69.42	-.95	-.41	2.92	1.22
1400	123.30	165.89	71.33	-1.37	-.59	2.76	1.15
1500	121.45	170.23	73.24	-1.78	-.76	2.60	1.09
1600	119.17	174.39	75.04	-2.17	-.93	2.45	1.02
1700	116.52	178.40	76.76	-2.55	-1.10	2.31	.96
1800	113.51	182.26	78.42	-2.92	-1.25	2.17	.91
1900	110.18	185.98	80.02	-3.26	-1.40	2.04	.85
2000	106.57	189.59	81.58	-3.58	-1.54	1.91	.80
2100	102.70	193.09	83.08	-3.83	-1.67	1.78	.75
2200	98.61	196.48	84.54	-4.15	-1.79	1.66	.69
2300	94.33	199.78	85.96	-4.40	-1.89	1.55	.65
2400	89.89	202.99	87.34	-4.61	-1.98	1.44	.60
2500	85.33	206.12	88.69	-4.80	-2.06	1.33	.56
2600	80.67	209.17	90.00	-4.95	-2.13	1.23	.51
2700	75.95	212.14	91.28	-5.07	-2.18	1.13	.47
2800	71.21	215.05	92.53	-5.15	-2.22	1.03	.43
2900	66.46	217.90	93.75	-5.20	-2.24	.94	.39
3000	61.76	220.68	94.95	-5.20	-2.24	.86	.36

Table VI-4

Total and Marginal Recreational Value as a Function of Bitterroot River Instream Flow Levels

DSCRG	TOT1MN	TOT1MD	DTOT1MN	DTOT1MD
100	5857.52	2520.31	13.22	5.55
200	8113.32	3490.91	10.11	4.25
300	9970.77	4290.11	8.74	3.68
400	11608.56	4994.60	7.82	3.29
500	13080.77	5628.25	7.05	2.97
600	14408.81	6199.66	6.35	2.68
700	15602.33	6713.20	5.69	2.40
800	16666.19	7170.95	5.04	2.12
900	17603.19	7574.10	4.41	1.85
1000	18415.31	7923.53	3.78	1.58
1100	19104.37	8220.02	3.17	1.32
1200	19672.31	8464.38	2.56	1.06
1300	20121.34	8657.59	1.97	.81
1400	20454.05	8800.74	1.39	.56
1500	20673.44	8895.14	.83	.32
1600	20782.90	8942.24	.28	.09
1700	20786.30	8943.70	-.24	-.13
1800	20687.86	8901.35	-.74	-.35
1900	20492.27	8817.19	-1.22	-.55
2000	20204.57	8693.40	-1.67	-.74
2100	19830.19	8532.32	-2.10	-.92
2200	19374.95	8336.44	-2.49	-1.09
2300	18844.99	8108.41	-2.85	-1.25
2400	18246.81	7851.03	-3.18	-1.38
2500	17587.23	7567.24	-3.47	-1.51
2600	16873.40	7260.10	-3.72	-1.62
2700	16112.75	6932.82	-3.94	-1.71
2800	15313.03	6588.72	-4.12	-1.78
2900	14482.26	6231.27	-4.25	-1.84
3000	13628.73	5864.03	-4.35	-1.88

Table VI-5

Comparison - Alternative Models for Measuring Effect of Instream Flow on Recreational Value Bitterroot River (dollars/acre-foot)

DISCRG	QUALITMN	QUALITMD	QUDYMN1	QUDYMD1	QUTIMN	QUTNMN1
100	11.06	4.62	13.69	5.72	2.16	5.87
200	7.66	3.20	8.57	3.71	2.45	5.15
300	6.23	2.62	6.38	2.88	2.47	4.45
400	5.48	2.29	5.75	2.40	2.33	3.78
500	4.94	2.06	5.00	2.09	2.11	3.14
600	4.54	1.89	4.46	1.86	1.82	2.53
700	4.21	1.76	4.05	1.69	1.48	1.94
800	3.93	1.64	3.73	1.56	1.11	1.39
900	3.69	1.54	3.46	1.45	.72	.86
1000	3.48	1.45	3.24	1.35	.31	.35
1100	3.28	1.37	3.05	1.28	-.11	-.12
1200	3.10	1.29	2.89	1.21	-.53	-.57
1300	2.92	1.22	2.75	1.15	-.95	-.99
1400	2.76	1.15	2.63	1.10	-1.37	-1.39
1500	2.60	1.09	2.52	1.05	-1.78	-1.75
1600	2.45	1.02	2.42	1.01	-2.17	-2.09
1700	2.31	.96	2.33	.97	-2.55	-2.41
1800	2.17	.91	2.24	.94	-2.92	-2.69
1900	2.04	.85	2.17	.91	-3.26	-2.95
2000	1.91	.80	2.10	.88	-3.58	-3.18
2100	1.73	.75	2.04	.85	-3.88	-3.38
2200	1.66	.69	1.98	.83	-4.15	-3.55
2300	1.55	.65	1.93	.80	-4.40	-3.70
2400	1.44	.60	1.87	.73	-4.61	-3.82
2500	1.33	.54	1.83	.76	-4.80	-3.91
2600	1.23	.51	1.78	.74	-4.95	-3.98
2700	1.13	.47	1.74	.73	-5.07	-4.02
2800	1.03	.43	1.70	.71	-5.15	-4.03
2900	.94	.39	1.67	.70	-5.20	-4.01
3000	.86	.36	1.63	.68	-5.20	-3.97

Table VI-5 Cont.

DSCRG	QUT1MD	QUTNMD1
100	.93	2.46
200	1.05	2.15
300	1.06	1.86
400	1.00	1.58
500	.91	1.31
600	.78	1.06
700	.64	.81
800	.43	.58
900	.31	.36
1000	.13	.15
1100	-.05	-.05
1200	-.23	-.24
1300	-.41	-.42
1400	-.59	-.58
1500	-.76	-.73
1600	-.93	-.88
1700	-1.10	-1.01
1800	-1.25	-1.13
1900	-1.40	-1.23
2000	-1.54	-1.33
2100	-1.67	-1.41
2200	-1.79	-1.49
2300	-1.89	-1.55
2400	-1.98	-1.60
2500	-2.06	-1.64
2600	-2.13	-1.66
2700	-2.18	-1.68
2800	-2.22	-1.69
2900	-2.24	-1.68
3000	-2.24	-1.66

Table VI-6

Effect of Instream Flow on Recreational Use and Value
Big Hole River

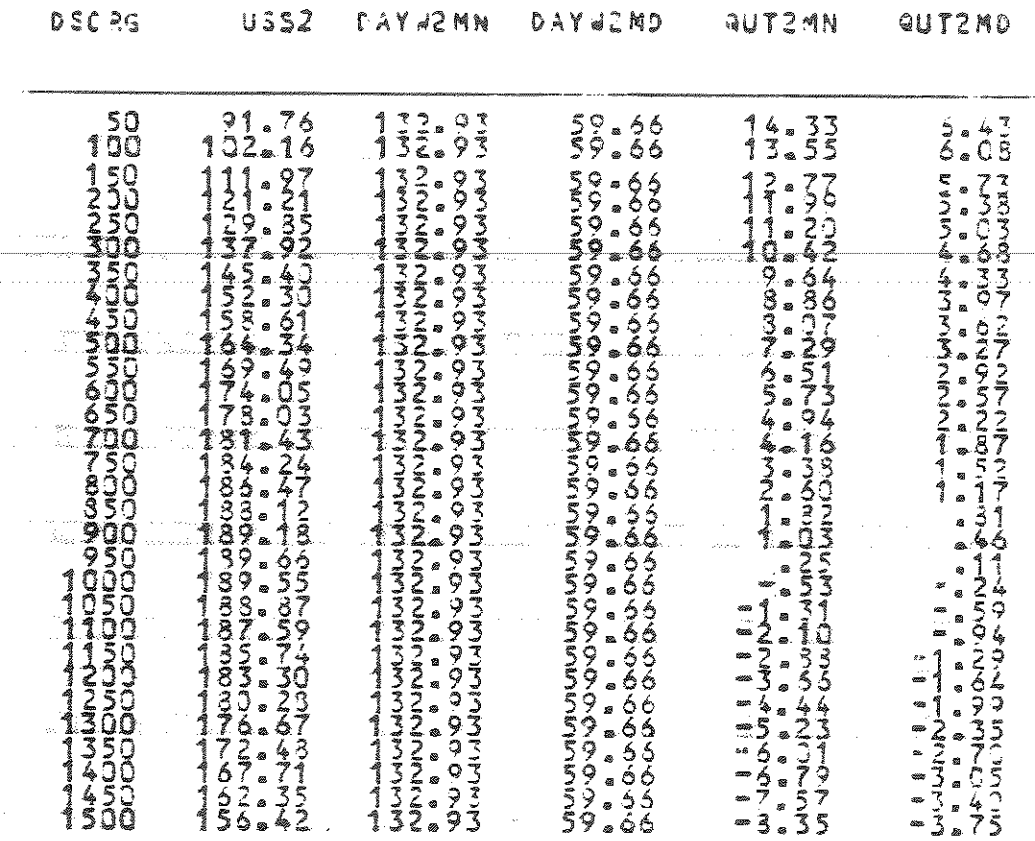


Table V-10

Mail Survey Logit Trust Fund Equations

Variable/Statistic	Estimated Parameters			
	Equation 1	Equation 2	Equation 3	Equation 4
Intercept (t-statistic)	-10.9117 (-.19)	-15.3965 (-1.03)	-19.4827 (-1.80)	-39.1690 (-2.31)
ln BIDT	-1.3293 (-5.89)	-1.4109 (-5.96)	-1.5788 (-5.85)	-1.7345 (-5.23)
ln QUANT	1.0421 (3.26)	.7163 (2.248)	.6117 (1.85)	1.0115 (2.41)
ln INC	.6004 (2.16)	.5434 (1.90)	.3937 (1.44)	.4202 (1.27)
ln DIST	-.7843 (-3.09)	-.3992 (-1.51)	-.3870 (-1.45)	-.6255 (-1.82)
SEX	—	—	—	1.5106 (1.96)
ln ACTDAY	+.5589 (2.48)	—	—	-.0443 (-.1357)
FUTURE	—	2.9364 (2.69)	2.5882 (2.31)	6.0160 (1.06)
ln NONUSE	+2.6787 (2.12)	3.6802 (2.63)	—	.0831 (.09)
ln HELP	—	—	7.2602 (4.099)	6.1397 (2.56)
ln PROTECT	—	—	—	5.5520 (1.47)

Table VO-10 (cont.)

Variable/Statistic	Equation 1	Equation 2	Equation 3	Equation 4
Sample Size	379	386	384	319
DF	372	379	377	308
Chi-square	326.62	196.84	148.810	259.56
P	.597	1.00	1.00	.979

Sample Means:

Quant	2.366
INC	28434.39
DIST	157.42
SEX	.697
ACTDAY	25.561
FUTURE	.587
NONUSE	19.228
HELP	10.048
PROTECT	24.861

Table V-11

Pearson Correlation Coefficients
for Motive Variables

	LNPROTEC	LNNONUSE	LNDEVEL	LNHELP	LNVICAR	FUTURE
LNPROTEC	1.0000	.5675	-.3428	.5241	.5869	.2006
	(532)	(521)	(517)	(505)	(506)	(472)
	P= .	P= .000	P= .000	P= .000	P= .000	P= .000
LNNONUSE	.5675	1.0000	-.2520	.4883	.5391	.0525
	(521)	(536)	(522)	(504)	(511)	(476)
	P= .000	P= .	P= .000	P= .000	P= .000	P= .127
LNDEVEL	-.3423	-.2520	1.0000	-.2072	-.2800	-.0738
	(517)	(522)	(531)	(499)	(503)	(472)
	P= .000	P= .000	P= .	P= .000	P= .000	P= .055
LNHELP	.5241	.4883	-.2072	1.0000	.5268	.2906
	(505)	(504)	(499)	(523)	(496)	(467)
	P= .000	P= .000	P= .000	P= .	P= .000	P= .000
LNVICAR	.5869	.5391	-.2800	.5268	1.0000	.2186
	(506)	(511)	(503)	(496)	(520)	(464)
	P= .000	P= .000	P= .000	P= .000	P= .	P= .000
FUTURE	.2006	.0525	-.0738	.2906	.2186	1.0000
	(472)	(476)	(472)	(467)	(464)	(506)
	P= .000	P= .127	P= .055	P= .000	P= .000	P= .

(COEFFICIENT / (CASES) / 1-TAILED SIG)

Table V-12

Reparameterized Mail Survey Logit
Trust Fund Equations

	Estimated Parameters			
Variable/Statistic	Equation 1	Equation 2	Equation 3	Equation 4
Intercept	2.723E-4	1.8228E-5	4.372E-6	1.5582E-10
(P/1-P)	.7523	.7088	.6334	.5765
QUANT	.7839	.5077	.3874	.5832
INC	.4517	.3851	.2494	.2423
DIST	-.5900	-.2829	-.2451	-.3606
SEX	—	—	—	.8709
ACTDAY	.4204	—	—	-.0255
FUTURE	—	2.0812	1.6393	3.468
NONUSE	2.0151	2.6084	—	.0479
HELP	—	—	4.5986	3.5398
PROTECT	—	—	—	3.2009

NOTE: Where functional form is:
$WTP = EXP\ [B_0 + B_3\ FUTURE]\ \ (P/1-P)^{B1}\ QUANT^{B2}.....$

Table V-13

Mail Survey Open-Ended CVM Trust Fund Equations

	Estimated Parameters		
Variable/Statistic	Equation 1	Equation 2	Equation 3
Intercept (t-statistic)	-8.2630 (-3.42)	-8.0534 (-3.34)	-4.6773 (-3.25)
ln QUANT	.2457 (2.61)	.2377 (2.49)	.1925 (2.04)
ln INC	.3432 (3.95)	.2723 (2.95)	.2344 (2.64)
ln DIST	-.1629 (-2.07)	-.1485 (-1.84)	-.1242 (-1.58)
ln ACTDAY	.1193 (1.79)	.1039 (1.52)	.1160 (1.69)
FUTURE	.3427 (1.80)	.2660 (1.35)	.2956 (1.53)
ln HELP	—	1.2553 (2.10)	1.7952 (3.64)
ln PROTECT	2.1190 (3.17)	1.3549 (1.69)	—
Sample Size	165	159	164
Adjusted R^2	.199	.203	.184
F(Significance)	7.780 (.000)	6.744 (.000)	7.130 (.000)

Sample Means:

QUANT	2.366
INC	28434.4
DIST	157.42
ACTDAY	25.561
FUTURE	.587
HELP	10.048
PROTECT	24.861

Table V-14

Mail Survey Trust Fund Equations
Including Use Variables

Variable/Statistic	Estimated Parameters: Logit	Estimated Parameters: Open-ended
Intercept (t-statistic)	2.08188 (9.33)	2.79479 (7.545)
ln BIDF	-1.20388 (-6.247)	—
ln QUANT	.6567 (2.494)	.198808 (2.291)
ln DIST	-.4270 (-1.940)	-.210185 (-3.073)
USER	.97688 (1.970)	—
SEX	.32584 (.727)	-.114316 (.4495)
DUMFREQ	—	+.318298 (1.724)
Sample Size	387	206
Chi-square	338.3	—
F	—	4.21
df	381	201
p	.943	.0027
Variable Means		
QUANT	2.366	
DIST	157.42	
USER	.520	
SEX	.697	
DUMFREQ	.725	

Table IX-2

Share of Total Willingness to Pay
Due to Existence vs. Option/Use Motives
Mail Survey Logit Trust Fund Equations

	Equation			
Variable/Statistic	1	2	3	4
(A) Reparameterized Coefficients#				
ACTDAY	.4204	--	--	-.0255
FUTURE	--	2.0812	1.6393	3.468
NONUSE	2.0151	2.6084	--	.0479
HELP	--	--	4.5986	3.5398
PROTECT	--	--	--	3.2009
(B) Computation of Share to Motives				
$\Sigma B_i + \Sigma B_j Z_j$ *	2.4355	3.8301	5.5609	8.7988
Sum of Use & Option Bi	.4204	1.2217	.9623	2.0102
Sum of Existence B_i	2.0151	2.6084	4.5986	6.7886
Share to Use & Option	.173	.319	.173	.228
Share to Existence	.827	.681	.827	.772

* Future is a dummy variable. Share evaluated at sample mean of .587.
# See Table V-12 for source of coefficients.

Table IX-3

Summary
Option/Use vs. Existence Share
of Total Instream Flow Valuation

Method/Statistic Equation		Relative Share by Motive: Option/Use	Existence
(A) Regression Method			
Logit Model	1	.173	.827
	2	.319	.681
	3	.173	.827
	4	.228	.772
Open-Ended CVM	1	.131	.869
	2	.091	.909
	3	.139	.861
(B) Apportionment Method			
Mean		.246	.651
Standard error		.0154	.0297
n		277	282

Table IX-4

Additivity and Consistency With Theory:
Magnitude and Sign of Coefficient on Quantity

Method	Equation	Estimated Parameter	
		$-b_2/b_1$	C_1
Logit Model	1	.7839	
	2	.5077	
	3	.3874	
	4	.5832	
Open-Ended CVM	1		.2457
	2		.2377
	3		.1925

Note: Total WTP function for rivers protected for instream flows is consistent with consumption theory if $0<-b_2/b_1$ or $C_1<1$.

Table IX-5

Mail Survey Dichotomous Choice CVM
Instream Flow Trust Fund by User and Survey Type
(1988 dollars)*

User Type**		All	Big Hole	Bitterroot	5 River	Big Hole & Bitterroot
		mean (N)	mean (N)	mean (N)	mean (N)	mean (N)
User						
	mean	14.04	7.03	11.09	20.22	9.52
	N	(269)	(64)	(89)	(116)	(153)
	SE	2.73	4.10	3.04	5.77	2.52
NonUser						
	mean	4.07	2.46	4.01	5.24	3.81
	N	(254)	(92)	(105)	(57)	(197)
	SE	1.46	1.63	2.30	2.93	1.67
All						
	mean	9.40	4.49	8.19	15.45	6.38
	N	(554)	(162)	(206)	(186)	(368)
	SE	1.55	2.08	2.08	4.02	1.43

*Values based on nonparametric estimator, dollars per respondent.

**Defined by response to question No. II, 1 "Have you visited this (these) river(s) in the last 3 years."

Table IX-6

Comparison of Mean Values Across
Site and User Type

Comparison	t-statistic	Significant difference at 10% level
(A) Cross Site for Users		
Bighole v. Bitterroot	.74	no
Bitterroot v. 5 River	1.40	no
Bitterroot & Bighole v. 5 River	1.70	yes
(B) Across Site for Nonuser		
No significant differences for any site combination.		
(C) Across Site for All		
Big Hole v. Bitterroot	1.25	no
Bighole v. 5 River	2.42	yes
Bitterroot v. 5 River	1.60	no
Bighole & Bitterroot v. 5 River	2.13	yes
(D) Across User Group		
All	3.22	yes
5 River	2.31	yes
Bighole plus Bitterroot	1.89	yes

Table IX-7

Mail Survey Open-ended CVM
Instream Flow Trust Fund By User and Survey Type

	All Surveys	Big Hole River	Bitterroot River	Multiple River
User				
Mean	15.12	10.60	14.42	18.07
Mean S.E.	1.70	1.96	1.75	3.60
Nonuser				
Mean	9.45	11.38	7.26	11.70
Mean S.E.	.99	2.11	.94	2.67
All				
Mean	12.96	10.62	11.14	16.49
Mean S.E.	1.13	1.39	1.10	2.68

Table IX-8

Comparison of Average WPT at Subsample Means
For Mail Survey Logit Trust Fund

(1988 dollars)

	Mean for Single River[1]	Mean for River Share of Multiple River[1]				Significant Difference[3]
		Mult R Mean		Share Ratio	Allocated Share	
Bitterroot	8.19	15.45	*	.1475	= 2.27	yes
Standard Error	(2.08)	(4.02)			(5.93)[2]	
N	206	186				
Big Hole	4.49	15.45	*	.130	= 2.01	no
Standard Err	(2.08)	(4.02)			(.523)[2]	
N	162	186				
Big Hole & Bitterroot	6.38	15.45	*	.139	= 2.15	yes
Standard Error	(1.43)	(4.02)			(.559)[2]	
N	368	186				

Notes: 1 means and standard errors from nonparamater method.
2 standard error assumes share ratio a known constant.
3 paired, t-test of significant difference between single river mean and allocated share. T statistic values are 2.73, 1.2, and 2.75.

Table X-1

Variable Definition for Survey of Nonrespondents

Variable	Definition
RIVREC =	how frequently visit Montana Rivers (1-5 scale)
FISH =	participate in fishing
HHRIVREC =	how frequently household members participate in river recreation
VISRIV =	visit this river in last three years
DAYS =	number of days users recreate
PLANMT =	plan to visit a Montana River in next three years
BIDF =	bid offer for trust fund
RESPFL =	response (yes, no) to bid
RESPFL1 =	response to $1 bid
MAX =	open-ended CVM
PERC =	percent of donation for use or future use
PROTH =	percent of donation for other (existence) motives
MEMBER =	member of conservation group
SEX =	gender

Table X-2

Comparison of Nonresponse Phone Survey and Mail Survey

Nonresponse Variable	Nonresponse Survey Sample	Mean	Standard Deviation	Mail Survey Sample	Mean	Standard Deviation
RIVREC[1]	251	51.0	———	575	27.7	———
FISH[2]	238	62.6	———	—	59.7	———
HHRIVREC[1]	231	56.3	———	538	31.5	———
VISRIV[2] (VISIT is dummy)	251	30.3	———	547	52.1	———
DAYS	77	23.143	27.015	121	25.479	32.27
PLANMT[2, 6]	190	58.9	———	507	58.8	———
BIDF	251	90.378	85.401	578	90.929	86.85
RESPFL[2]	250	12.8	———	555	7.9	———
RESPFL[2]	218	56.4	———	523	52.0	———
MAX	150	11.753	18.648	227	12.903	16.929
PERC	143	31.713	30.891	277	24.60	25.577
PROTH	143	68.287	30.891	282	65.074	32.484
MEMBER[3]	245	13.5	———	566	20.8	———
SEX[4]	249	66.3	———	577	68.8	———

NOTES:

1 percent never or rarely (1,2)
2 percent yes (1)
3 percent member
4 percent male
5 share of respondents to "number of days shorefush"
6 not an exact comparison; plan to visit Montana River (nonresponse) vs. plan to visit "this" river

Table X-3

Comparison of Trust Fund Dichotomous Choice
Responses: Mail Survey and Nonrespondent Phone Survey

	Sample Size	Mean	Standard Error
Mail Survey	554	9.40	1.55
Nonrespondents	250	18.09	3.62

Table X-4

Comparison of Trust Fund
Open-Ended Valuation Responses: Mail Survey
and Nonrespondent Phone Survey

Variable/Statistic	Nonrespondent	Mail
Open-ended CVM		
Mean	11.753	12.903
Standard deviation	18.648	16.929
Sample Size	150	227
Median	5	10
Range	1-100	0-200
Participation (%)	59.8	39.4

Table X-5

Mail Survey Trust Fund
Average Logit-based Donations as a Function of Specification

Specification/Equation	Intercept	Slope[2]	Mean[1]	Median
Nonparametric	———	———	9.40	———
Bivariate	1.3682	-1.17126	10.82	3.22
Multivariate[3]				
Equation #1, Table V-10	1.90655	-1.3293	10.98	4.20
Table V-14	1.22253	-1.2038	8.99	2.76

Notes: 1 Truncated at $300.00
2 Slope coefficient on Bid
3 Evaluated at sample means

Table X-6

Estimated Population Means for Use, Gender, and Mail Trust Fund Valuation

Variable/Statistic	Mail Survey	Nonresponse	Weighted Average[1]
USER	.520	.303	.376
DumFREQ	.725	.490	.570
SEX	.697	.663	.675
Logit Mean[2]	8.99	——	8.07
Logit Median[2]	2.76	——	2.44
Open-ended Mean[2] (Predicted)	7.80	——	7.26
Open-ended Mean[3] (Participants)	12.90	11.75	12.14
Open-ended Mean (Overall)	5.03[4]	7.03[5]	6.35

Notes: 1 Based on 34% response on mail survey. All values are with QUANT and Distance at sample averages (2.366 at 157.42 respectively).

2 Based on Table V-14 equation

3 Table X-4

4 Based on number of individuals participating in open-ended (227/582) or 39.0%.

5 Based on nonresponse participation in open-ended of 59.8%.

Table X-7

Mail Survey Trust Fund Total and Marginal
Average Donations as a Function of Number of Rivers Protected

Number of Rivers	Logit Mean	Logit Median	Open-ended Mean
	(A) Total Average Individual Donation[1]		
1	5.04	1.53	10.23
2	7.36	2.23	11.74
3	9.19	2.78	12.73
4	10.75	3.25	13.48
5	12.14	3.67	14.087
	(B) Total Marginal Individual Donation		
1	2.75	.83	2.03
2	2.01	.61	1.17
3	1.67	.51	.84
4	1.47	.44	.67
5	1.32	.40	.56

Notes: 1 Derived from equations in Table V-13 as:

logit mean = 30.3492 * (QUANT ** (.5455)) * (DIST ** (-.3547))

logit median = 9.17621 * (QUANT ** (.5455)) * (DIST ** (-.3547))

open-ended = 29.62447 * (QUANT ** (.198808)) * (DIST ** (-.210185))

Results are for distance equal to sample mean of 157.42 and for participants only (no adjustment for nonparticipation or nonresponse.

Table X-8

Effect of Distance on Average Mail Trust Fund Donations

Distance	Mean of Participants[1]		Overall Mean[2]	
	Logit	Open-ended	Logit	Open-ended
10	35.94	26.71	11.66	3.54
100	15.88	16.47	5.15	2.18
500	8.98	11.74	2.91	1.56
1000	7.02	10.15	2.28	1.35
2000	5.49	8.77	1.78	1.16

Notes: 1 Based on logit mean = 81.34323 * (AVEDIST ** (-.3547)) and open-ended = 43.34933 * (AVEDIST ** (-.210185)).

2 Adjustment for logit is .34 response ratio times .954 (555/582) participation ratio, Adjustments for open-ended are .34 and .390 (227 of 582).

Table X-9

Montana Population Centers

County	County Seat
1. Beaverhead	Dillon
2. BigHorn	Hardin
3. Carbon	Red Lodge
4. Cascade	Great Falls
5. Custer	Miles City
6. Dawson	Glendive
7. Deer Lodge	Anaconda
8. Fergus	Lewistown
9. Flathead	Kalispell
10. Gallatin	Bozeman
11. Glacier	Cutbank
12. Hill	Havre
13. Lake	Polson
14. Lewis & Clark	Helena
15. Lincoln	Libby
16. Missoula	Missoula
17. Park	Livingston
18. Ravalli	Hamilton
19. Richland	Sidney
20. Roosevelt	Wolf Point
21. Rosebud	Forsyth
22. Sanders	Thompson Falls
23. Silver Bow	Butte
24. Valley	Glasgow
25. Yellowstone	Billings

Table X-10

Data Base and Algorithm for Mail Survey
Trust Fund Aggregation

A. Data Base

COUNTY	DH	DD	AVEDIST	POP18	LOGITMN	LOGITMD	MAX
1	163	41	102.00	5321	14.15	4.23	15.45
2	413	295	356.50	7038	9.08	2.75	11.65
3	379	256	317.50	5364	9.46	2.86	12.16
4	215	178	196.50	57152	11.22	3.39	13.45
5	503	399	451.00	9251	8.35	2.53	11.29
6	566	472	519.00	8154	7.95	2.40	10.96
7	127	33	80.00	8914	15.43	4.67	16.24
8	320	261	290.50	9371	9.77	2.95	12.38
9	163	245	204.00	36232	11.03	3.25	13.35
10	230	107	168.50	32661	11.35	3.58	13.39
11	283	275	279.00	6909	9.96	2.93	12.45
12	330	293	311.50	12534	9.53	2.88	12.20
13	115	200	157.50	12936	12.14	3.67	14.39
14	162	89	125.50	30441	13.15	3.93	14.77
15	237	326	281.50	11741	9.83	2.99	12.47
16	47	136	91.50	55774	14.71	4.45	15.79
17	253	155	194.50	9214	11.26	3.40	13.47
18	[illegible]	160	80.00	15573	15.43	4.67	16.24
19	591	520	555.50	8404	7.76	2.35	10.81
20	537	500	518.50	6366	7.95	2.40	10.97
21	405	355	430.50	6219	8.67	2.62	11.54
22	147	236	191.50	6021	11.32	3.42	13.52
23	143	30	86.50	27335	15.01	4.54	15.93
24	488	451	469.50	6951	8.24	2.49	11.20
25	372	249	310.50	76357	9.54	2.85	12.21

B. Algorithm

```
COMPUTE AVEDIST=(DH+DD)/2
COMPUTE LOGITMN=73.0139*(AVEDIST**(-.3547))
COMPUTE LOGITMD=22.07753*(AVEDIST**(-.3547))
COMPUTE MAX=40.79542*(AVEDIST**(-.210135))
COMPUTE TOTAL1=(1/.354)*POP18*(80000/768690)*LOGITMN
COMPUTE TOTAL2=1.232365182*POP18*LOGITMD
COMPUTE TOTAL3=1.232365182*POP18*MAX
```

Table X-11

Total Montana Instream Flow
Five River Trust Fund Potential
(1988 dollars)

Individual Donation Measure

Method	Logit Mean	Logit Median	Participants	All
1 Based on Estimated Population Means for Independent Variables[1]				
	6,736,000	2,036,700	———	———
2 Based on Weighted Average WTP Means for Stratifield Sample[2]				
	———	———	7,944,000	4,155,200
3 Based on Mail Survey Sample Means for All Variables				
	7,503,900[3]	2,304,000	8,441,300	3,291,500
4 Similar to 3 but Zero Value for Nonrespondents and Nonparticipants[4]				
	2,434,000	735,900	———	1,119,100[5]

Notes: 1 Similar to method of Schultze, et al. (1983).

2 Similar to method of Carson & Mitchell (1984).

3 Similar to method of Walsh, et al. (1984) and Stole and Johnson (1984)

4 Similar to method of Boyle and Bishop (1985). Reflects 34% response rate for mail survey sample and 95.4% participation for logit and 39.0% for open-ended. Is the best approximation to potential actual trust fund.

5 The mean WTP for this case is 5.03 (Table X-6) based on mail survey only (not weighted average as Case 2).

FIGURES

Figure VI-1

Relationship of Use and Flow on the Bitterroot River

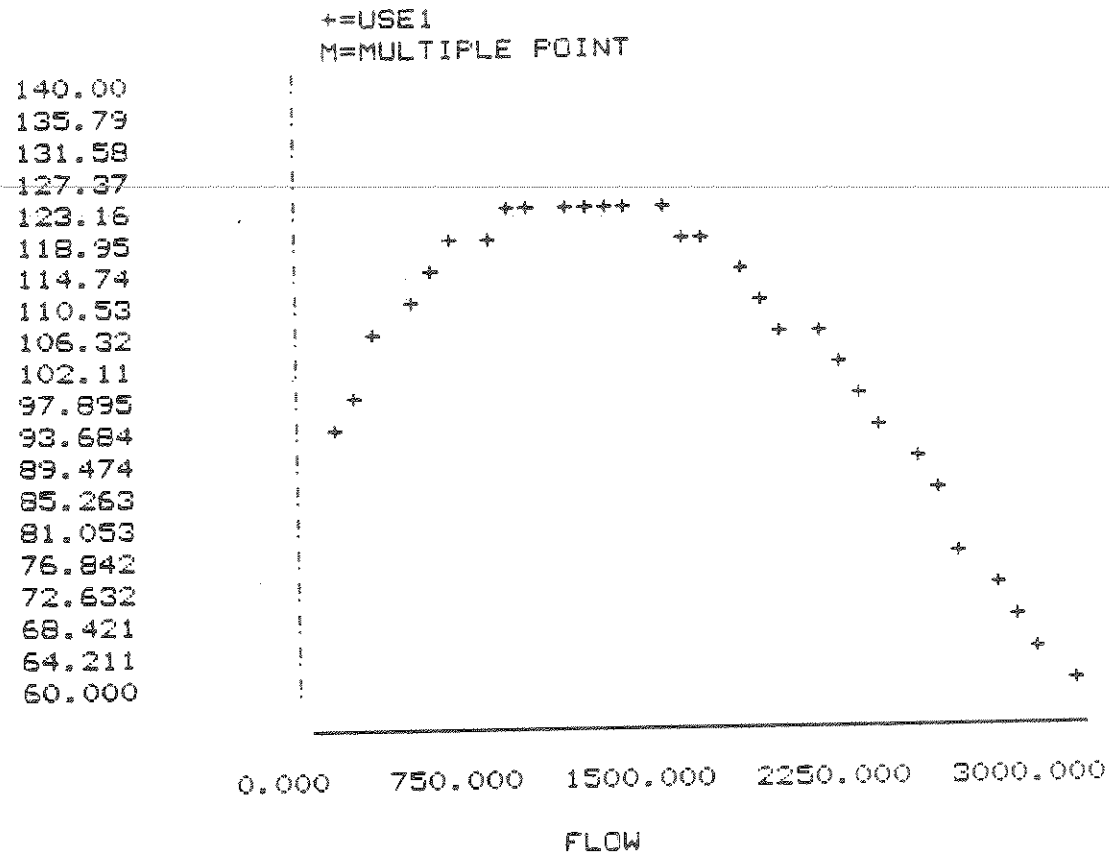


Figure VI-2

Relationship of Total Daily Value and Flow on the Bitterroot River

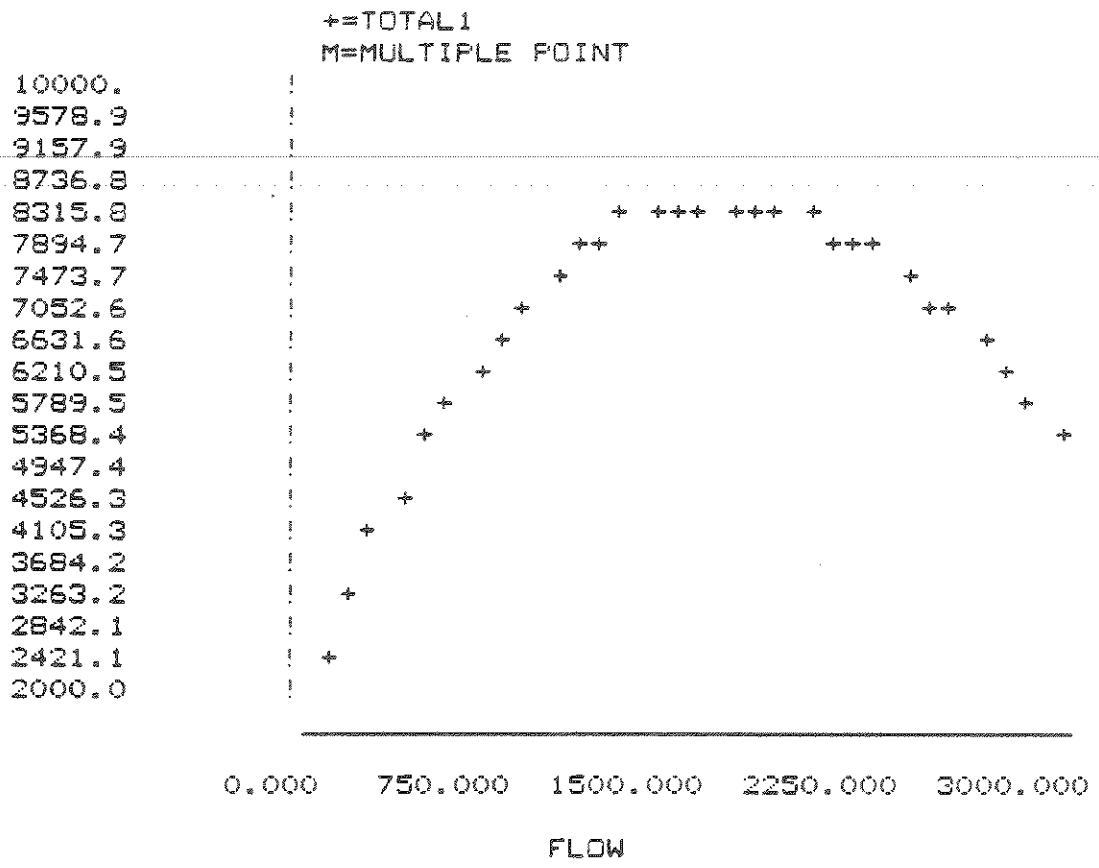
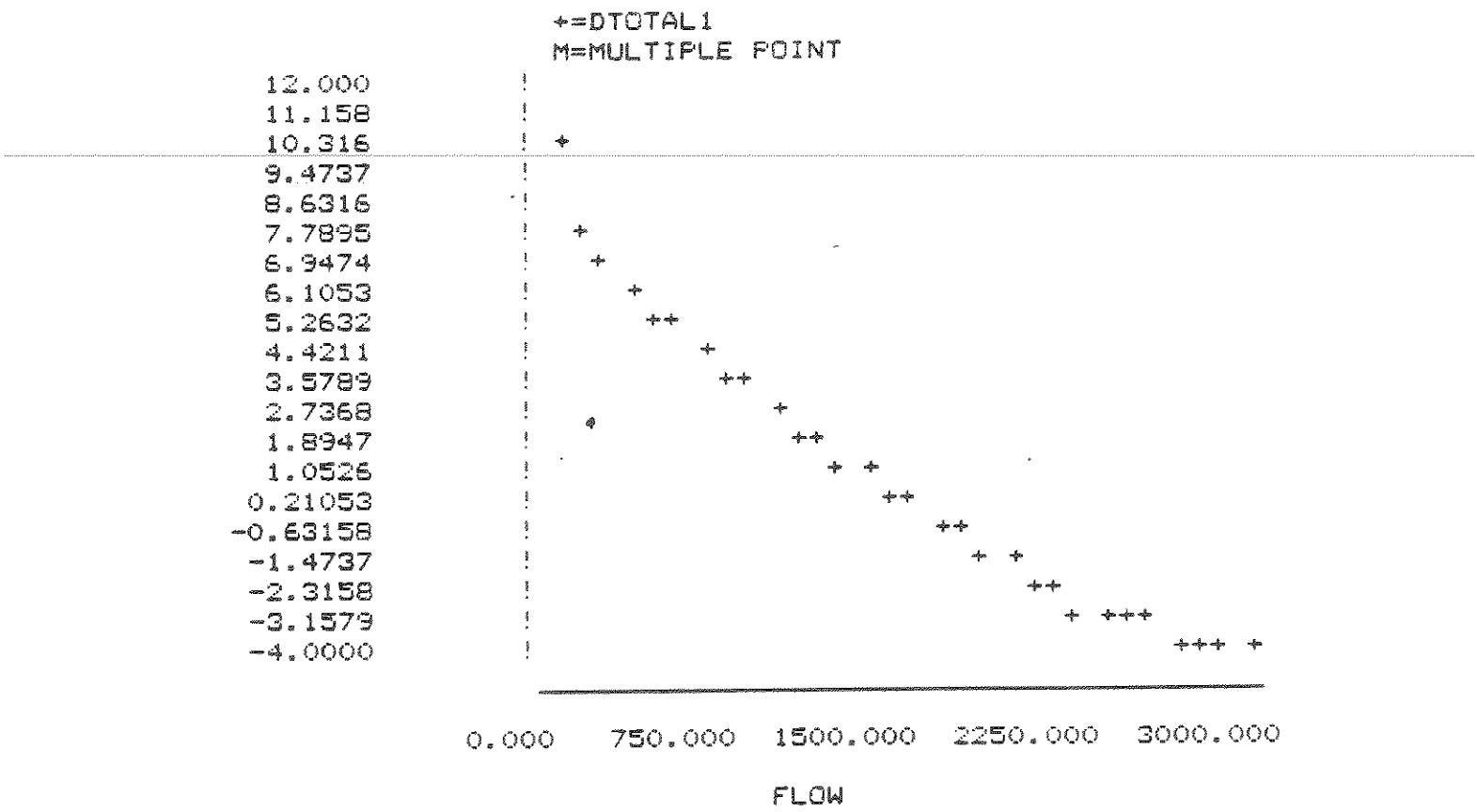


Figure VI-3

Marginal Total Value (Dollars/Acre Foot)
of Flows on the Bitterroot River



APPENDIX A. SURVEY INSTRUMENTS

BIG HOLE ONSITE

Hi, I'm --------- from the University of Montana. We're doing a study of recreational use on the Big Hole River. Could I ask you a few questions?

1. How many hours will you be at the Big Hole today? _____ Hours

2. Are you here just for the day, or longer? (If so, how many?)

_____ One day only _____ # days if more than one

3. Is this your first visit to the Big Hole ? 1 Yes 2 No

4. (If not), How many years have been coming here? _____Years

5. How many trips have you made to the Big Hole this year?

_____ Trips so far this year

6. How many trips have you made to the Big Hole over the last two years?

_____ Trips in last two years

7. About how many trips will you make to the Big Hole in the next two years?

_____ Trips in the next two years

8. What activities are you participating in on this trip to the Big Hole? (Read list and check activities they're doing)

___ Fishing ___ Camping

___ Floating ___ Other: _____

_____

ASK QUESTIONS 9 - 18 IF RESPONDENT IS FISHING ON THIS TRIP

9. What type of fishing equipment are you using?

___ Bait ___ Lure ___ Combination

___ Flies: 10. Did you tie your own? ___ Yes ___No

11. (If fishing flies): Are you fishing a particular hatch (dry flies) or a particular nymph form?

___ No ___ Yes 12. (If yes) Which hatch? _____

13. About how many hours have you been fishing the Big Hole so far on this trip?

_____ Total number of hours

14. How many trout have you caught so far on this trip?

_____ Number of trout caught

15. How many of these trout did you keep? _____ Trout kept

16. Did you hire a fishing guide or outfitter on the Big Hole River on this trip?

_____ Yes _____ No

17. Are you fishing from shore, from a boat, or both?

_____ Shore _____ Boat _____ Both

18. Do you have any other comments about the fishing here?

ASK QUESTIONS 19 - 23 IF RESPONDENT IS USING A BOAT

19. Type of boat used: _____

20. Where did you put in? _____ (site)

21. Where did you take out? _____ (site)

22. Were the flow levels adequate for floating? ___ Yes ___ No

23. ADD DETAIL: _____

24. How long before today did you decide to visit the Big Hole?

_____ Days ago (1 = 1 or less)

25. We are interested in knowing the reasons why you're visiting the Big Hole at this particular time of year. I'm going to read you a list of possible reasons; please tell me whether that reason is very important, important, not very important, or not at all an important reason you're here at this time of year.

26. I have time off from work now	VI	I	U	VU
27. The weather is good	VI	I	U	VU
28. The flow levels are adequate	VI	I	U	VU
29. An insect hatch is going on	VI	I	U	VU
30. It's less crowded now	VI	I	U	VU
31. Other people wanted to come now	VI	I	U	VU

32. Are there any other reasons why you're visiting the Big Hole at this time of year?

_____

33. Did you feel that the river was crowded at any time on this trip?

___ Yes ___ No

34. (If yes) What effects did this have on your experience?

_____

THE NEXT FEW QUESTIONS WILL HELP US TO UNDERSTAND THE VALUE PEOPLE PLACE ON THE RIVER RELATED RECREATION ON THE BIG HOLE RIVER.

WE REALIZE YOU AREN'T USED TO CONSIDERING YOUR RECREATION THIS WAY, BUT PLEASE THINK ABOUT IT AND GIVE US YOUR BEST ESTIMATE.

34a. Is visiting the Big Hole river the main purpose of this trip from your home?

_____Yes _____No

35. Is the Big Hole the main or only recreational site you're visiting this trip?

_____ Yes _____ No

36. About how far is it from your home to this section of the Big Hole?

_____ Miles (one-way)

37. How long did it take to travel from your home to the Big Hole River? ___ Hours (include stops made en route)

38. About how much do you expect to personally spend on this trip? Include expenses such as gas and oil, food and beverages, any lodging or camping fees, car rentals, airfares, equipment purchased just for the trip, guiding fees, shuttle expenses, and other trip expenses. If you don't know what the exact amount was (or will be), please give your best estimate.

_____ Total amount spent on this trip

39. Suppose that your expenses to visit the Big Hole on this trip were higher. Would you have still have visited the Big Hole if your personal expenses were ___ ___ more?

_____ Yes _____ No

40. (If no) Would you still have made the trip if your personal expenses were only $1 more?

_____yes _____no

41. (If no) Could you please briefly explain why not?

THE FOLLOWING QUESTIONS ADDRESS THE PROBLEM OF LOW SUMMERTIME FLOW LEVELS ON THE BIG HOLE RIVER.

42. Was the water level in the Big Hole River today adequate for the activity you participated in?

_____yes _____no

Comments:

43. Did you know what the flow level in the river was going to be today?

_____ Yes _____ No

44. If yes, how did you know?

___ Past experience here

___ Talked to friends

___ Talked to fly shop/outfitter

___ State or federal agency

___ Other: _____

44. Would you prefer to be visiting the river at a different flow level?

_____ Yes _____ No

45. (If yes) What would be a better flow level?

_____inches higher
_____ inches lower

Comments:

46. For the next couple questions, I need to give you a little background information. As you may be aware, this section of the Big Hole from Wise River to Melrose typically has low summertime flows and is severely dewatered in drought years like 1985. Summertime flows on the Big Hole could be improved by purchasing water on the open market from irrigators. Purchases would allow irrigators to offset the costs of reduced water use or the costs of more efficient irrigation techniques. One way this could be done would be by forming a trust fund to buy water as needed. Now here's the question I'd like you to answer.

Would you purchase an annual membership in a trust fund costing_____ to maintain flows in the Big Hole River over the summer at your preferred level?

_____ Yes _____ No

47. (If no), Would you be willing to pay for annual membership in a trust fund to improve minimum flows if the cost was sufficiently low, say only $1 per year?

_____ Yes _____ No

48. (If no), Could you please briefly explain why not?

_____

I have just a few more quick questions to help us understand your responses.

1. Where do you live? City:_____ State_____

2. How old are you? _____ Years

3. What is the highest year of formal education you completed?

___ some grade school
___ finished grade school
___ finished junior high
___ finished high school
___ some college
___ finished college
___ some postgraduate
___ finished postgraduate

4. Are you a member of any conservation, sport, fishing, or boating organizations?

___ Yes ___ No

5. (If yes) About how many of these groups do you belong to?

_____ Groups

6. Can you estimate your total donations over the course of a year for environmental preservation causes (wildlife funds, wilderness preservation, etc.)

_____ Dollars

7. (Hand Card) Could you please give me the letter that corresponds to your household's income before taxes last year:

a. under 5000	e. 20,000-24,999	i. 40,000-49,000
b. 5,000-9,999	f. 25,000-29,999	j. 50,000-74,999
c. 10,000-14,999	g. 30,000-34,999	k. 75,000-100,000
d. 15,000-19,999	h. 35,000-39,999	l. over 100,000

INTERVIEWER SECTION: TO FILL IN AFTER INTERVIEW

ID # _____

Sex of respondent: ____ Male ____ Female

Location: _____

Date: _____ Time started: _____ Time finished: _____

Flow level: _____

Weather: 1 Rain 2 Cloudy 3 Partly cloudy 4 Sunny

Temperature: 1 Hot (>75) 2 Warm (60-75) 3 Cool (<60)

Wind: 1 Strong 2 Moderate or gusty 2 Calm

Major hatches observed: _____

Number of boats observed at take-out today: _____

Hi, I'm --------- from the University of Montana. We're doing a study of recreational use on the Bitterroot River. Could I ask you a few questions?

1. How many hours will you be at the Bitterroot today? _____ Hours

2. Are you here just for the day, or longer? (If so, how many?)

_____ One day only _____ # days if more than one

3. Is this your first visit to the Bitterroot? 1 Yes 2 No

4. (If not), How many years have been coming here? _____Years

5. How many trips have you made to the Bitterroot this year?

_____ Trips so far this year

6. How many trips have you made to the Bitterroot over the last two years?

_____ Trips in last two years

7. About how many trips will you make to the Bitterroot in the next two years?

_____ Trips in the next two years

8. What activities are you participating in on this trip to the Bitterroot? (Read list and check activities they're doing)

___ Fishing ___ Camping

___ Floating ___ Other: _____

_____

ASK QUESTIONS 9 - 18 IF RESPONDENT IS FISHING ON THIS TRIP

9. What type of fishing equipment are you using?

___ Bait ___ Lure ___ Combination

___ Flies: 10. Did you tie your own? ___ Yes ___No

11. (If fishing flies): Are you fishing a particular hatch (dry flies) or a particular nymph form?

___ No ___ Yes 12. (If yes) Which hatch? _____

13. About how many hours have you been fishing the Bitterroot so far on this trip?

_____ Total number of hours

14. How many trout have you caught so far on this trip?

_____ Number of trout caught

15. How many of these trout did you keep? _____ Trout kept

16. Did you hire a fishing guide or outfitter on the Bitterroot River on this trip?

_____ Yes _____ No

17. Are you fishing from shore, from a boat, or both?

_____ Shore _____ Boat _____ Both

18. Do you have any other comments about the fishing here?

ASK QUESTIONS 19 - 23 IF RESPONDENT IS USING A BOAT

19. Type of boat used: _____

20. Where did you put in? _____ (site)

21. Where did you take out? _____ (site)

22. Were the flow levels adequate for floating? ___ Yes ___ No

23. ADD DETAIL: _____

24. How long before today did you decide to visit the Big Hole?

_____ Days ago (1 = 1 or less)

25. We are interested in knowing the reasons why you're visiting the Bitterroot at this particular time of year. I'm going to read you a list of possible reasons; please tell me whether that reason is very important, important, not very important, or not at all an important reason you're here at this time of year.

26. I have time off from work now	VI	I	U	VU
27. The weather is good	VI	I	U	VU
28. The flow levels are adequate	VI	I	U	VU
29. An insect hatch is going on	VI	I	U	VU
30. It's less crowded now	VI	I	U	VU
31. Other people wanted to come now	VI	I	U	VU

32. Are there any other reasons why you're visiting the Bitterroot at this time of year?

_____ _____

33. Did you feel that the river was crowded at any time on this trip?

___ Yes ___ No

34. (If yes) What effects did this have on your experience?

_____

THE NEXT FEW QUESTIONS WILL HELP US TO UNDERSTAND THE VALUE PEOPLE PLACE ON THE RIVER RELATED RECREATION ON THE BITTERROOT RIVER.

WE REALIZE YOU AREN'T USED TO CONSIDERING YOUR RECREATION THIS WAY, BUT PLEASE THINK ABOUT IT AND GIVE US YOUR BEST ESTIMATE.

34a. Is visiting the Bitterroot river the main purpose of this trip from your home?

_____Yes _____No

35. Is the Bitterroot the main or only recreational site you're visiting this trip?

_____ Yes _____ No

36. About how far is it from your home to this section of the Bitterroot?

_____ Miles (one-way)

37. How long did it take to travel from your home to the Bitterroot River? ___ Hours (include stops made en route)

38. About how much do you expect to personally spend on this trip? Include expenses such as gas and oil, food and beverages, any lodging or camping fees, car rentals, airfares, equipment purchased just for the trip, guiding fees, shuttle expenses, and other trip expenses. If you don't know what the exact amount was (or will be), please give your best estimate.

_____ Total amount spent on this trip

39. Suppose that your expenses to visit the Bitterroot on this trip were higher. Would you have still have visited the Bitterroot if your personal expenses were _____ more?

_____ Yes _____ No

40. (If no) Would you still have made the trip if your personal expenses were only $1 more?

_____yes _____no

41. (If no) Could you please briefly explain why not?

THE FOLLOWING QUESTIONS ADDRESS THE PROBLEM OF LOW SUMMERTIME FLOW LEVELS ON THE BITTERROOT RIVER.

42. Was the water level in the Bitterroot River today adequate for the activity you participated in?

_____yes _____no

Comments:

43. Did you know what the flow level in the river was going to be today?

_____ Yes _____ No

44. If yes, how did you know?

___ Past experience here

___ Talked to friends

___ Talked to fly shop/outfitter

___ State or federal agency

___ Other: _____

44. Would you prefer to be visiting the river at a different flow level?

_____ Yes _____ No

45. (If yes) What would be a better flow level?

_____inches higher
_____ inches lower

Comments:

For the next couple questions, I need to give you a little background information.

46. As you may be aware, this section of the Bitterroot River from Hamilton to Stevensville typically has low summertime flows and is severely dewatered in drought years like 1985. However, there is water available in Painted Rocks Reservoir on the West Fork of the Bitterroot River that could be purchased to increase summertime flows on this section of the river. One way this could be done would be by forming a trust fund to buy water as needed. Now here's the question I'd like you to answer.

Would you purchase an annual membership in a trust fund costing _____ to maintain flows in the Bitterroot River over the summer at your preferred level?

_____ Yes _____ No

47. (If no), Would you be willing to pay for annual membership in a trust fund to improve minimum flows if the cost was sufficiently low, say only $1 per year?

_____ Yes _____ No

48. (If no), Could you please briefly explain why not?

_____

I have just a few more quick questions to help us understand your responses.

1. Where do you live? City:_____ State_____

2. How old are you? _____ Years

3. What is the highest year of formal education you completed?

___ some grade school
___ finished grade school
___ finished junior high
___ finished high school
___ some college
___ finished college
___ some postgraduate
___ finished postgraduate

4. Are you a member of any conservation, sport, fishing, or boating organizations?

___ Yes ___ No

5. (If yes) About how many of these groups do you belong to?

_____ Groups

6. Can you estimate your total donations over the course of a year for environmental preservation causes (wildlife funds, wilderness preservation, etc.)

_____ Dollars

7. (Hand Card) Could you please give me the letter that corresponds to your household's income before taxes last year:

a. under 5000	e. 20,000-24,999	i. 40,000-49,000
b. 5,000-9,999	f. 25,000-29,999	j. 50,000-74,999
c. 10,000-14,999	g. 30,000-34,999	k. 75,000-100,000
d. 15,000-19,999	h. 35,000-39,999	l. over 100,000

INTERVIEWER SECTION: TO FILL IN AFTER INTERVIEW

ID # _____

Sex of respondent: ___ Male ___ Female

Location: _____

Date: _____ Time started: _____ Time finished: _____

Flow level: _____

Weather: 1 Rain 2 Cloudy 3 Partly cloudy 4 Sunny

Temperature: 1 Hot (>75) 2 Warm (60-75) 3 Cool (<60)

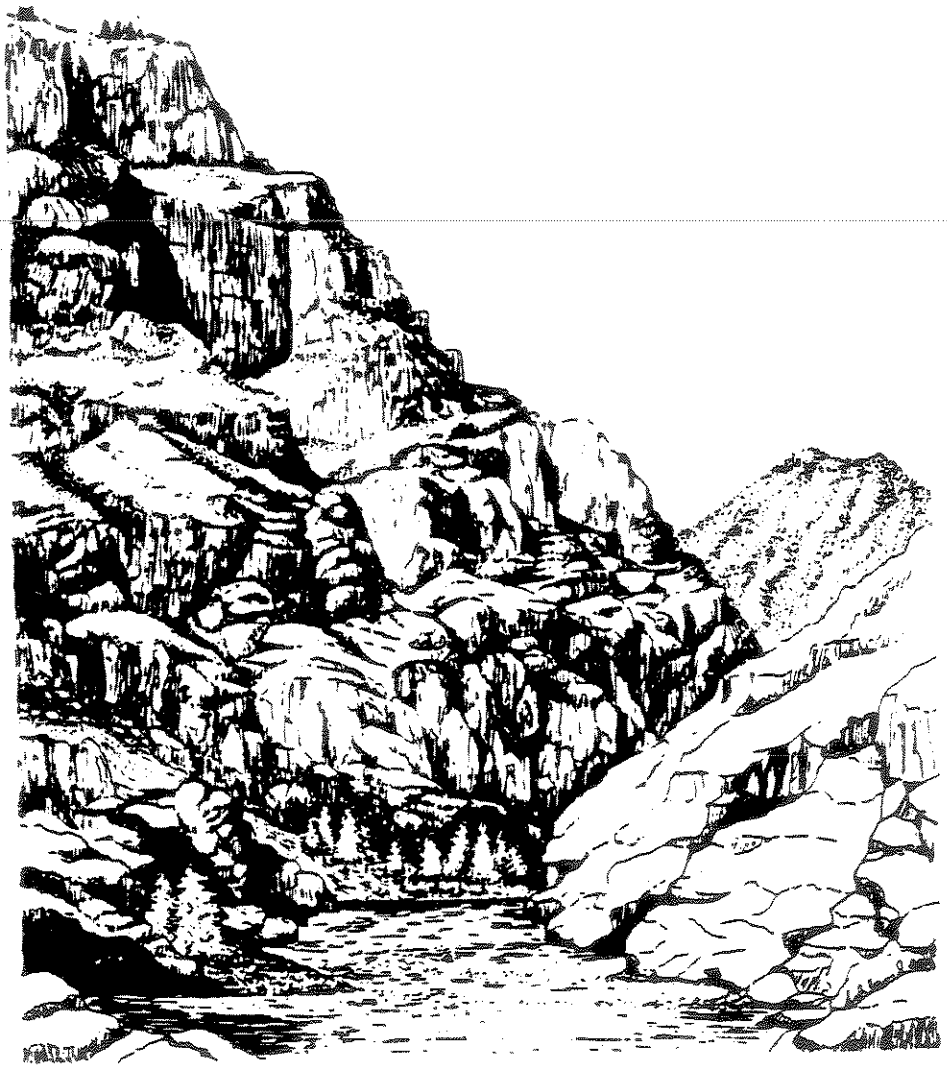
Wind: 1 Strong 2 Moderate or gusty 3 Calm

Major hatches observed: _____

Number of boats observed at take-out today: _____

BIG HOLE - MAIL

Water Now & For The Future
The Value of Montana Rivers



University of Montana
Missoula, Montana 59812

I. FIRST, WE HAVE SOME GENERAL QUESTIONS ABOUT YOUR RECREATIONAL USE OF RIVERS; PLEASE ANSWER EVEN IF YOU RARELY OR NEVER VISIT RIVERS FOR RECREATION.

1. About how often do you currently participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? *(Please check one.)*

   ☐ Never *(Please go to #7.)*

   ☐ Rarely (1 - 3 days per year)

   ☐ Sometimes (4 - 10 days per year)

   ☐ Frequently (11 - 25 days per year)

   ☐ Very Frequently (more than 25 days per year)

2. How many years have you been going to rivers to fish, boat, or participate in other river-related activities?

   _____ YEARS

3. About how many days per year do you spend doing each of the following recreational activities on or along a river?

   _____ Days fishing from shore on rivers or streams

   _____ Days fishing from a boat on rivers or streams

   _____ Days boating on rivers (non-fishing)

   _____ Days swimming in rivers or streams

   _____ Days doing other activities: _____

4. If you fish, what type of equipment do you generally use? *(Please check all that apply.)*

   ☐ Bait ☐ Lures ☐ Flies

5. If you fish, how important to you is each of the following aspects of fishing?

	Very Important	Important	Not Very Important	Not At All Important
a. Catching fish to eat	☐	☐	☐	☐
b. Testing fishing skills	☐	☐	☐	☐
c. Catching wild fish	☐	☐	☐	☐
d. Catching large fish	☐	☐	☐	☐
e. Catching lots of fish	☐	☐	☐	☐

6. People visit rivers for many reasons. Following is a list of possible reasons. Please check the box that says how important that reason is for you.

	Always Important	Frequently Important	Sometimes Important	Never Important
a. To view the scenery	☐	☐	☐	☐
b. To be with my family	☐	☐	☐	☐
c. To experience solitude	☐	☐	☐	☐
d. To be with friends	☐	☐	☐	☐
e. For the fishing	☐	☐	☐	☐
f. For the boating	☐	☐	☐	☐
g. To view wildlife	☐	☐	☐	☐
h. To relax	☐	☐	☐	☐
i. Other: _____	☐	☐	☐	☐

7. How frequently do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? *(Please check one.)*

☐ Never

☐ Rarely (1 - 3 days per year)

☐ Sometimes (4 - 10 days per year)

☐ Frequently (11 - 25 days per year)

☐ Very Frequently (more than 25 days per year)

8. Following is a list of some possible uses of the water in a stream or river. Please rate how important you feel each use is to society in general.

	Critical	Very Important	Somewhat Important	Not At All Important
a. Irrigation	☐	☐	☐	☐
b. Hydropower	☐	☐	☐	☐
c. Recreation	☐	☐	☐	☐
d. Wildlife	☐	☐	☐	☐
e. Fisheries	☐	☐	☐	☐

II. THIS SECTION ASKS ABOUT YOUR FAMILIARITY WITH MONTANA'S BIG HOLE RIVER.

1. Have you ever visited the Big Hole River for recreation?

☐ YES ☐ NO *(Please go to #6.)*

2. What activities have you done along the Big Hole River in the last three years? *(1986 - 1988; please check all that apply.)*

☐ Fishing from shore

☐ Fishing from boat

☐ Boating (non-fishing)

☐ Swimming

☐ Hunting

☐ Other: _____

3. About how many days did you spend recreating on or along the Big Hole River in the past three years?

_____ Days in the last three years (1986, 1987, 1988)

4. When visiting the Big Hole, either this year or before, have you ever had any problems with low flow levels?

☐ YES ☐NO *(Please go to #6.)*

5. If yes, what kind of problems? _____

6. Do you plan to visit the Big Hole River for recreation in the next three years?

☐ YES ☐ NO

7. If yes, how frequently do you plan to visit the Big Hole? *(Please check one.)*

☐ More than I do now

☐ About as frequently as I do now

☐ Less than I do now

☐ I'm not sure

8. If you plan to visit more or less frequently than you do now, could you estimate the number of days per year you're likely to visit the Big Hole?

_____ Days per year

9. Have you experienced difficulties because of low flow levels on other rivers?

☐ YES ☐ NO *(Please go to Section III.)*

10. If yes, what kind of problems, and on what rivers?

River: _____ Problem: _____

River: _____ Problem: _____

III. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES—AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this.

   How familiar are you with these efforts? *(Please check one.)*

   ☐ I have never heard of such trust funds.

   ☐ I have heard of them but don't know much.

   ☐ I know a fair amount about them.

   ☐ I know a great deal about them.

2. Have you ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I have

   ☐ No, I have not

3. Do you know anyone else who has ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I do

   ☐ No, I do not

4. Did you know that the Montana Department of Fish, Wildlife and Parks has purchased water from reservoirs during recent drought years, to maintain adequate flow levels on Montana rivers? *(Please check one.)*

   ☐ No, I never knew this

   ☐ I knew this but not much about it.

   ☐ I know a fair amount about these efforts.

   ☐ I know a great deal about these efforts.

5. As you may know, major sections of the Big Hole River typically have very low levels of water during the summer. The river reached record low flow levels in recent years. This season the water level became so low that fishing catch limits had to be reduced to maintain healthy trout populations.

   If flows were higher, people would be able to float the river later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

   Available water could be purchased when needed from upstream irrigators to increase summertime flows in the Big Hole. This water could be purchased when needed to avoid damaging low flows in the river. A trust fund could be developed specifically to purchase water when needed.

   If enough people contribute to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use the Big Hole for recreation, you would know you are helping to keep an important Montana river clean and healthy.

   If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy water needed to increase summer flows on the Big Hole River?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #6.)*

6. Would you be willing to donate a smaller amount, such as $1.00 per year, to purchase water when needed for the Big Hole?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #7.)*

7. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

   _____

   (After answering #7, please go to #10.)

8. What is the maximum amount you would be willing to pay for an **annual** membership in this trust fund?

   _____ Dollars

9. People can value the improvement of instream flows in the Big Hole for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes?

A. Payment to guarantee high enough flows for boating and fishing when I actually visit the Big Hole for recreation, either now or in the future: _____ %

B. Payment for reasons other than my own use, such as just knowing that the Big Hole has sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels: _____ %

TOTAL: 100 %

10. Who do you feel should be responsible for maintaining adequate flow levels in Montana rivers and streams like the Big Hole? *(Please check all that apply.)*

- ☐ No one
- ☐ State government
- ☐ Federal government
- ☐ People who use the Big Hole for recreation should pay
- ☐ Private trust funds
- ☐ Other: _____

IV. THE NEXT QUESTIONS ASK HOW YOU FEEL ABOUT RIVERS AND VARIOUS ENVIRONMENTAL ISSUES.

1. For each statement, check the box that shows how you feel about that statement. You always have an opportunity to agree with the statement, disagree with it, or say you have no opinion.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
a. I have a great deal of concern for endangered species.	☐	☐	☐	☐	☐
b. Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.	☐	☐	☐	☐	☐
c. I would like to see more hydroelectric dams on Montana rivers.	☐	☐	☐	☐	☐
d. I have had inspirational experiences on rivers.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
e. The main reason for maintaining resources today is so we can develop them in the future if we need to.	☐	☐	☐	☐	☐
f. I'm glad there is wilderness in Alaska even if I never get there to see it.	☐	☐	☐	☐	☐
g. Rivers do not have many spiritual or sacred values to me.	☐	☐	☐	☐	☐
h. Our society should consider the needs of future generations as much as we consider our needs today.	☐	☐	☐	☐	☐
i. Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.	☐	☐	☐	☐	☐
j. I enjoy knowing that my friends and family can visit rivers for recreation if they want to.	☐	☐	☐	☐	☐
k. Endangered species should not be protected if they don't have any benefits to humans.	☐	☐	☐	☐	☐
l. People can think a river is valuable even if they don't actually go there themselves.	☐	☐	☐	☐	☐
m. I enjoy hearing about experiences my friends or family have had on rivers.	☐	☐	☐	☐	☐
n. The decision to develop resources should be based mostly on economic grounds.	☐	☐	☐	☐	☐
o. I have been concerned about how the recent droughts may affect fish and wildlife that depend on rivers.	☐	☐	☐	☐	☐
p. I enjoy looking at picture books or going to movies that have rivers in them.	☐	☐	☐	☐	☐
q. I think that most rivers already have enough water in them to be healthy resources.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
r. I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.	☐	☐	☐	☐	☐
s. I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.	☐	☐	☐	☐	☐
t. Montana's free-flowing rivers and streams are a unique and irreplaceable resource.	☐	☐	☐	☐	☐
u. I feel that I should be doing more for Montana's rivers and streams.	☐	☐	☐	☐	☐
v. It's important to protect rare plants and animals to maintain genetic diversity.	☐	☐	☐	☐	☐
w. Donating time or money to worthy causes is important to me.	☐	☐	☐	☐	☐

V. THIS FINAL SECTION WILL HELP US TO UNDERSTAND YOUR RESPONSES. THANK YOU FOR YOUR TIME AND EFFORT:

1. Are you a member of any conservation, sport, fishing, or boating organizations?

☐ YES ☐ NO

2. If yes, which ones?

3. Do you or your household have a fairly specific budget for donating to various causes or charities that you support?

☐ YES 4. If yes, about how much? _____ $ per year

☐ NO

5. Where do you live? City: _____ State: _____

6. What is your age? _____ Years

7. Are you: ☐ Male ☐ Female

8. What is the highest year of formal education you completed?

☐ Some grade school ☐ Some college

☐ Finished grade school ☐ Finished college

☐ Finished junior high ☐ Some postgraduate

☐ Finished high school ☐ Finished postgraduate

9. During this past summer, were you: *(Please check all that apply.)*

☐ Employed full time ☐ Retired

☐ Employed part time ☐ Homemaker

☐ Unemployed ☐ Other: _____

10. Please check your household's income before taxes last year:

☐ under 5000 ☐ 20,000-24,999 ☐ 40,000-49,999

☐ 5,000-9,999 ☐ 25,000-29,999 ☐ 50,000-74,999

☐ 10,000-14,999 ☐ 30,000-34,999 ☐ 75,000-100,000

☐ 15,000-19,999 ☐ 35,000-39,999 ☐ over 100,000

THANK YOU FOR YOUR HELP. IS THERE ANYTHING ELSE YOU'D LIKE TO TELL US ABOUT FLOW LEVELS IN MONTANA'S RIVERS, OR OTHER RELATED ISSUES? WE WOULD APPRECIATE ANY COMMENTS.

If you would like to receive a copy of the results of this study, please write your name and address on the back of the return envelope (not on this questionnaire).

BITTERROOT- MAIL

Water Now & For The Future
The Value of Montana Rivers

University of Montana
Missoula, Montana 59812

I. FIRST, WE HAVE SOME GENERAL QUESTIONS ABOUT YOUR RECREATIONAL USE OF RIVERS; PLEASE ANSWER EVEN IF YOU RARELY OR NEVER VISIT RIVERS FOR RECREATION.

1. About how often do you currently participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? *(Please check one.)*

   ☐ Never *(Please go to #7.)*

   ☐ Rarely (1 - 3 days per year)

   ☐ Sometimes (4 - 10 days per year)

   ☐ Frequently (11 - 25 days per year)

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2. How many years have you been going to rivers to fish, boat, or participate in other river-related activities?

   _____ YEARS

3. About how many days per year do you spend doing each of the following recreational activities on or along a river?

   _____ Days fishing from shore on rivers or streams

   _____ Days fishing from a boat on rivers or streams

   _____ Days boating on rivers (non-fishing)

   _____ Days swimming in rivers or streams

   _____ Days doing other activities: _____

4. If you fish, what type of equipment do you generally use? *(Please check all that apply.)*

   ☐ Bait ☐ Lures ☐ Flies

5. If you fish, how important to you is each of the following aspects of fishing?

	Very Important	Important	Not Very Important	Not At All Important
a. Catching fish to eat	☐	☐	☐	☐
b. Testing fishing skills	☐	☐	☐	☐
c. Catching wild fish	☐	☐	☐	☐
d. Catching large fish	☐	☐	☐	☐
e. Catching lots of fish	☐	☐	☐	☐

6. People visit rivers for many reasons. Following is a list of possible reasons. Please check the box that says how important that reason is for you.

	Always Important	Frequently Important	Sometimes Important	Never Important
a. To view the scenery	☐	☐	☐	☐
b. To be with my family	☐	☐	☐	☐
c. To experience solitude	☐	☐	☐	☐
d. To be with friends	☐	☐	☐	☐
e. For the fishing	☐	☐	☐	☐
f. For the boating	☐	☐	☐	☐
g. To view wildlife	☐	☐	☐	☐
h. To relax	☐	☐	☐	☐
i. Other: _____	☐	☐	☐	☐

7. How frequently do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? *(Please check one.)*

☐ Never

☐ Rarely (1 - 3 days per year)

☐ Sometimes (4 - 10 days per year)

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	Critical	Very Important	Somewhat Important	Not At All Important
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b. Hydropower	☐	☐	☐	☐
c. Recreation	☐	☐	☐	☐
d. Wildlife	☐	☐	☐	☐
e. Fisheries	☐	☐	☐	☐

II. THIS SECTION ASKS ABOUT YOUR FAMILIARITY WITH MONTANA'S BITTERROOT RIVER.

1. Have you ever visited the Bitterroot River for recreation?

☐ YES ☐ NO *(Please go to #6.)*

2. What activities have you done along the Bitterroot River in the last three years? *(1986 - 1988; please check all that apply.)*

☐ Fishing from shore

☐ Fishing from boat

☐ Boating (non-fishing)

☐ Swimming

☐ Hunting

☐ Other: _____

3. About how many days did you spend recreating on or along the Bitterroot River in the past three years?

_____ Days in the last three years (1986, 1987, 1988)

4. When visiting the Bitterroot River, either this year or before, have you ever had any problems with low flow levels?

☐ YES ☐ NO *Please go to #6.)*

5. If yes, what kind of problems?

6. Do you plan to visit the Bitterroot River for recreation in the next three years?

☐ YES ☐ NO

7. If yes, how frequently do you plan to visit the Bitterroot? *(Please check one.)*

☐ More than I do now

☐ About as frequently as I do now

☐ Less than I do now

☐ I'm not sure

8. If you plan to visit more or less frequently than you do now, could you estimate the number of days per year you're likely to visit the Bitterroot?

_____ Days per year

9. Have you experienced difficulties because of low flow levels on other rivers?

☐ YES ☐ NO *(Please go to Section III.)*

10. If yes, what kind of problems, and on what rivers?

River: _____ Problem: _____

River: _____ Problem: _____

III. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES—AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this.

   How familiar are you with these efforts? *(Please check one.)*

   ☐ I have never heard of such trust funds.

   ☐ I have heard of them but don't know much.

   ☐ I know a fair amount about them.

   ☐ I know a great deal about them.

2. Have you ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I have

   ☐ No, I have not

3. Do you know anyone else who has ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I do

   ☐ No, I do not

4. Did you know that the Montana Department of Fish, Wildlife and Parks has purchased water from reservoirs during recent drought years, to maintain adequate flow levels on Montana rivers? *(Please check one.)*

   ☐ No, I never knew this

   ☐ I knew this but not much about it.

   ☐ I know a fair amount about these efforts.

   ☐ I know a great deal about these efforts.

5. As you may know, major sections of the Bitterroot River typically have very low levels of water during the summer. The river reached record low flow levels in recent years.

   If flows were higher, people would be able to float the river later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

   Water available in Painted Rocks Reservoir could be used to increase summertime flows in the Bitterroot. This water could be purchased when needed to avoid damaging low flows in the river. A trust fund could be developed specifically to purchase water when needed.

   If enough people contribute to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use the Bitterroot for recreation, you would know you are helping to keep an important Montana river clean and healthy.

   If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy water needed to increase summer flows on the Bitterroot River?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #6.)*

6. Would you be willing to donate a smaller amount, such as $1.00 per year, to purchase water when needed for the Bitterroot?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #7.)*

7. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

   _____

   (After answering #7, please go to #10.)

8. What is the maximum amount you would be willing to pay for an annual membership in this trust fund?

   _____ Dollars

9. People can value the improvement of instream flows in the Bitterroot for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes?

A. Payment to guarantee high enough flows for boating and fishing when I actually visit the Bitterroot for recreation, either now or in the future: _____ %

B. Payment for reasons other than my own use, such as just knowing that the Bitterroot has sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels: _____ %

TOTAL: 100 %

10. Who do you feel should be responsible for maintaining adequate flow levels in Montana rivers and streams like the Bitterroot? *(Please check all that apply.)*

- ☐ No one
- ☐ State government
- ☐ Federal government
- ☐ People who use the Bitterroot for recreation should pay
- ☐ Private trust funds
- ☐ Other: _____

IV. THE NEXT QUESTIONS ASK HOW YOU FEEL ABOUT RIVERS AND VARIOUS ENVIRONMENTAL ISSUES.

1. For each statement, check the box that shows how you feel about that statement. You always have an opportunity to agree with the statement, disagree with it, or say you have no opinion.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
a. I have a great deal of concern for endangered species.	☐	☐	☐	☐	☐
b. Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.	☐	☐	☐	☐	☐
c. I would like to see more hydroelectric dams on Montana rivers.	☐	☐	☐	☐	☐
d. I have had inspirational experiences on rivers.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
e. The main reason for maintaining resources today is so we can develop them in the future if we need to.	☐	☐	☐	☐	☐
f. I'm glad there is wilderness in Alaska even if I never get there to see it.	☐	☐	☐	☐	☐
g. Rivers do not have many spiritual or sacred values to me.	☐	☐	☐	☐	☐
h. Our society should consider the needs of future generations as much as we consider our needs today.	☐	☐	☐	☐	☐
i. Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.	☐	☐	☐	☐	☐
j. I enjoy knowing that my friends and family can visit rivers for recreation if they want to.	☐	☐	☐	☐	☐
k. Endangered species should not be protected if they don't have any benefits to humans.	☐	☐	☐	☐	☐
l. People can think a river is valuable even if they don't actually go there themselves.	☐	☐	☐	☐	☐
m. I enjoy hearing about experiences my friends or family have had on rivers.	☐	☐	☐	☐	☐
n. The decision to develop resources should be based mostly on economic grounds.	☐	☐	☐	☐	☐
o. I have been concerned about how the recent droughts may affect fish and wildlife that depend on rivers.	☐	☐	☐	☐	☐
p. I enjoy looking at picture books or going to movies that have rivers in them.	☐	☐	☐	☐	☐
q. I think that most rivers already have enough water in them to be healthy resources.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
r. I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.	☐	☐	☐	☐	☐
s. I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.	☐	☐	☐	☐	☐
t. Montana's free-flowing rivers and streams are a unique and irreplaceable resource.	☐	☐	☐	☐	☐
u. I feel that I should be doing more for Montana's rivers and streams.	☐	☐	☐	☐	☐
v. It's important to protect rare plants and animals to maintain genetic diversity.	☐	☐	☐	☐	☐
w. Donating time or money to worthy causes is important to me.	☐	☐	☐	☐	☐

V. THIS FINAL SECTION WILL HELP US TO UNDERSTAND YOUR RESPONSES. THANK YOU FOR YOUR TIME AND EFFORT:

1. Are you a member of any conservation, sport, fishing, or boating organizations?

☐ YES ☐ NO

2. If yes, which ones?

3. Do you or your household have a fairly specific budget for donating to various causes or charities that you support?

☐ YES 4. If yes, about how much? _____ $ per year

☐ NO

5. Where do you live? City: _____ State: _____

6. What is your age? _____ Years

7. Are you: ☐ Male ☐ Female

8. What is the highest year of formal education you completed?

☐ Some grade school ☐ Some college

☐ Finished grade school ☐ Finished college

☐ Finished junior high ☐ Some postgraduate

☐ Finished high school ☐ Finished postgraduate

9. During this past summer, were you: *(Please check all that apply.)*

☐ Employed full time ☐ Retired

☐ Employed part time ☐ Homemaker

☐ Unemployed ☐ Other: _____

10. Please check your household's income before taxes last year:

☐ under 5000 ☐ 20,000-24,999 ☐ 40,000-49,999

☐ 5,000-9,999 ☐ 25,000-29,999 ☐ 50,000-74,999

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☐ 15,000-19,999 ☐ 35,000-39,999 ☐ over 100,000

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FIVE RIVERS - MAIL

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   ☐ Rarely (1 - 3 days per year)

   ☐ Sometimes (4 - 10 days per year)

   ☐ Frequently (11 - 25 days per year)

   ☐ Very Frequently (more than 25 days per year)

2. How many years have you been going to rivers to fish, boat, or participate in other river-related activities?

   _____ YEARS

3. About how many days per year do you spend doing each of the following recreational activities on or along a river?

   _____ Days fishing from shore on rivers or streams

   _____ Days fishing from a boat on rivers or streams

   _____ Days boating on rivers (non-fishing)

   _____ Days swimming in rivers or streams

   _____ Days doing other activities: _____

4. If you fish, what type of equipment do you generally use? *(Please check all that apply.)*

   ☐ Bait ☐ Lures ☐ Flies

5. If you fish, how important to you is each of the following aspects of fishing?

	Very Important	Important	Not Very Important	Not At All Important
a. Catching fish to eat	☐	☐	☐	☐
b. Testing fishing skills	☐	☐	☐	☐
c. Catching wild fish	☐	☐	☐	☐
d. Catching large fish	☐	☐	☐	☐
e. Catching lots of fish	☐	☐	☐	☐

6. People visit rivers for many reasons. Following is a list of possible reasons. Please check the box that says how important that reason is for you.

	Always Important	Frequently Important	Sometimes Important	Never Important
a. To view the scenery	☐	☐	☐	☐
b. To be with my family	☐	☐	☐	☐
c. To experience solitude	☐	☐	☐	☐
d. To be with friends	☐	☐	☐	☐
e. For the fishing	☐	☐	☐	☐
f. For the boating	☐	☐	☐	☐
g. To view wildlife	☐	☐	☐	☐
h. To relax	☐	☐	☐	☐
i. Other: _____	☐	☐	☐	☐

7. How frequently do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? *(Please check one.)*

☐ Never

☐ Rarely (1 - 3 days per year)

☐ Sometimes (4 - 10 days per year)

☐ Frequently (11 - 25 days per year)

☐ Very Frequently (more than 25 days per year)

8. Following is a list of some possible uses of the water in a stream or river. Please rate how important you feel each use is to society in general.

	Critical	Very Important	Somewhat Important	Not At All Important
a. Irrigation	☐	☐	☐	☐
b. Hydropower	☐	☐	☐	☐
c. Recreation	☐	☐	☐	☐
d. Wildlife	☐	☐	☐	☐
e. Fisheries	☐	☐	☐	☐

II. THIS SECTION ASKS ABOUT YOUR FAMILIARITY WITH FIVE SPECIFIC MONTANA RIVERS.

1. Have you ever visited the Big Hole, Bitterroot, Clark Fork, Gallatin or Smith River for recreation in the last three years?

☐ YES ☐ NO *(Please go to #6.)*

2. (If yes) about how many days did you spend at each of the rivers in the last three years? *(If you're not sure, please give your best estimate.)*

_____ Days at the Big Hole

_____ Days at the Bitterroot

_____ Days at the Clark Fork

_____ Days at the Gallatin

_____ Days at the Smith

3. What activities have you done along any of these rivers in the last three years? *(1986-1988; please check all that apply.)*

☐ Fishing from shore ☐ Swimming

☐ Fishing from boat ☐ Hunting

☐ Boating (non-fishing) ☐ Other: _____

4. When visiting these rivers, either this year or before, have you ever had any problems with low flow levels?

☐ YES ☐ NO *(Please go to #6.)*

5. If yes, what kind of problems? _____

_____

6. Do you plan to visit any of these rivers for recreation in the next three years?

☐ YES ☐ NO

7. If yes, how frequently do you plan to visit them? *(Please check one.)*

☐ More than I do now ☐ Less than I do now

☐ About as frequently as I do now ☐ I'm not sure

8. If you plan to visit more or less frequently than you do now, could you estimate the number of days per year you're likely to visit them? *(Estimate the total number of days per year you're likely to spend at the five rivers.)*

_____ Days per year

9. Have you experienced difficulties because of low flow levels on other rivers?

☐ YES ☐ NO *(Please go to Section III.)*

10. If yes, what kind of problems, and on what rivers?

River: _____ Problem: _____

River: _____ Problem: _____

III. THIS SECTION ASKS HOW FAMILIAR YOU ARE WITH EFFORTS TO CONSERVE NATURAL RESOURCES—AND ABOUT YOUR OWN WILLINGNESS TO BECOME INVOLVED.

1. In various parts of the country, trust funds have been set up to purchase water or land resources to conserve unique natural resources. The Nature Conservancy, Ducks Unlimited, and the Rocky Mountain Elk Foundation are examples of the types of groups that can do this.

   How familiar are you with these efforts? *(Please check one.)*

   ☐ I have never heard of such trust funds.

   ☐ I have heard of them but don't know much.

   ☐ I know a fair amount about them.

   ☐ I know a great deal about them.

2. Have you ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I have

   ☐ No, I have not

3. Do you know anyone else who has ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

   ☐ Yes, I do

   ☐ No, I do not

4. Did you know that the Montana Department of Fish, Wildlife and Parks has purchased water from reservoirs during recent drought years, to maintain adequate flow levels on Montana rivers? *(Please check one.)*

   ☐ No, I never knew this

   ☐ I knew this but not much about it.

   ☐ I know a fair amount about these efforts.

   ☐ I know a great deal about these efforts.

5. As you may be aware, major sections of the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork Rivers typically have very low summertime flows. These rivers had very little water in them the past few summers, reaching record low flow levels that harmed fisheries and recreational use.

   If flows were higher, people would be able to float the rivers later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

   Available water could be purchased when needed from upstream reservoirs or irrigators to avoid damaging low flows in these five rivers. A trust fund could be developed specifically to purchase water when needed.

   If enough people contribute to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use these rivers for recreation, you would know you are helping to keep important Montana rivers clean and healthy.

   If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy the water needed to increase summer flows on the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork Rivers?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #6.)*

6. Would you be willing to donate a smaller amount, such as $1.00 per year, to purchase water when needed for these five rivers?

   ☐ YES *(Please go to #8.)*

   ☐ NO *(Please go to #7.)*

7. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

   _____

   (After answering #7, please go to #11.)

8. What is the maximum amount you would be willing to pay for an annual membership in this trust fund?

   _____ Dollars

9. How would you want us to allocate your payment among the five rivers? Please indicate the percent of your donation that you would want to go toward purchasing water for each river *(Percents should total 100%.)*

_____ Percent to purchase water for the Big Hole River

_____ Percent to purchase water for the Bitterroot River

_____ Percent to purchase water for the Gallatin River

_____ Percent to purchase water for the Smith River

_____ Percent to purchase water for the Clark Fork River

100%

10. People value the improvement of instream flows in the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes? *(Please read each option before answering.)*

A. Payment to guarantee sufficient flows for boating and fishing when you actually visit these rivers for recreation, either now or in the future: _____ %

B. Payment for reasons other than your own use, (such as just knowing that these rivers have sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels): _____ %

Total = 100%

11. Who do you feel should be responsible for maintaining adequate flow levels in these five Montana rivers and streams? *(Please check all that apply.)*

☐ No one

☐ State government

☐ Federal government

☐ People who use the rivers for recreation should pay

☐ Private trust funds

☐ Other: _____

IV. THE NEXT QUESTIONS ASK HOW YOU FEEL ABOUT RIVERS AND VARIOUS ENVIRONMENTAL ISSUES.

1. For each statement, check the box that shows how you feel about that statement. You always have an opportunity to agree with the statement, disagree with it, or say you have no opinion.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
a. I have a great deal of concern for endangered species.	☐	☐	☐	☐	☐
b. Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.	☐	☐	☐	☐	☐
c. I would like to see more hydroelectric dams on Montana rivers.	☐	☐	☐	☐	☐
d. I have had inspirational experiences on rivers.	☐	☐	☐	☐	☐
e. The main reason for maintaining resources today is so we can develop them in the future if we need to.	☐	☐	☐	☐	☐
f. I'm glad there is wilderness in Alaska even if I never get there to see it.	☐	☐	☐	☐	☐
g. Rivers do not have many spiritual or sacred values to me.	☐	☐	☐	☐	☐
h. Our society should consider the needs of future generations as much as we consider our needs today.	☐	☐	☐	☐	☐
i. Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.	☐	☐	☐	☐	☐
j. I enjoy knowing that my friends and family can visit rivers for recreation if they want to.	☐	☐	☐	☐	☐
k. Endangered species should not be protected if they don't have any benefits to humans.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
l. People can think a river is valuable even if they don't actually go there themselves.	☐	☐	☐	☐	☐
m. I enjoy hearing about experiences my friends or family have had on rivers.	☐	☐	☐	☐	☐
n. The decision to develop resources should be based mostly on economic grounds.	☐	☐	☐	☐	☐
o. I have been concerned about how the recent droughts may affect fish and wildlife that depend on rivers.	☐	☐	☐	☐	☐
p. I enjoy looking at picture books or going to movies that have rivers in them.	☐	☐	☐	☐	☐
q. I think that most rivers already have enough water in them to be healthy resources.	☐	☐	☐	☐	☐
r. I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.	☐	☐	☐	☐	☐
s. I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.	☐	☐	☐	☐	☐
t. Montana's free-flowing rivers and streams are a unique and irreplaceable resource.	☐	☐	☐	☐	☐
u. I feel that I should be doing more for Montana's rivers and streams.	☐	☐	☐	☐	☐
v. It's important to protect rare plants and animals to maintain genetic diversity.	☐	☐	☐	☐	☐
w. Donating time or money to worthy causes is important to me.	☐	☐	☐	☐	☐

V. THIS FINAL SECTION WILL HELP US TO UNDERSTAND YOUR RESPONSES.

1. Are you a member of any conservation, sport, fishing, or boating organizations?

_____ YES _____ NO

2. If yes, which ones?

3. Do you or your household have a fairly specific budget for donating to various causes or charities that you support?

☐ YES 4. If yes, about how much? _____ $ per year

☐ NO

5. Where do you live? City: _____ State: _____

6. What is your age? _____ Years

7. Are you: ☐ Male ☐ Female

8. What is the highest year of formal education you completed?

☐ Some grade school ☐ Some college

☐ Finished grade school ☐ Finished college

☐ Finished junior high ☐ Some postgraduate

☐ Finished high school ☐ Finished postgraduate

9. During this past summer, were you: *(Please check all that apply.)*

☐ Employed full time ☐ Retired

☐ Employed part time ☐ Homemaker

☐ Unemployed ☐ Other: _____

10. Please check your household's income before taxes last year:

☐ under 5000 ☐ 20,000-24,999 ☐ 40,000-49,999

☐ 5,000-9,999 ☐ 25,000-29,999 ☐ 50,000-74,999

☐ 10,000-14,999 ☐ 30,000-34,999 ☐ 75,000-100,000

☐ 15,000-19,999 ☐ 35,000-39,999 ☐ over 100,000

THANK YOU FOR YOUR HELP. IS THERE ANYTHING ELSE YOU'D LIKE TO TELL US ABOUT FLOW LEVELS IN MONTANA'S RIVERS, OR OTHER RELATED ISSUES? WE WOULD APPRECIATE ANY COMMENTS.

If you would like to receive a copy of the results of this study, please write your name and address on the back of the return envelope (not on this questionnaire).

Big Hole Instream Flow Study
Non-response check telephone survey

Hi, I'm -------- ---------- calling from the University of Montana about a survey we've been conducting on peoples' reactions to low flows in Montana rivers. I'm calling people who didn't respond to our study to just ask a few questions. This is not a request for money. Could I have about five minutes of your time? If NO: Thanks anyway. If YES, proceed with questionnaire.

1. How often do you participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

___ Never (go to #3)
___ Rarely (1 - 3 days per year)
___ Sometimes (4 - 10 days per year)
___ Frequently (10 - 25 days per year)
___ Very Frequently (more than 25 days per year)

2. Do you fish? ___ Yes ___ No

3. How often do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

___ Never
___ Rarely (1 - 3 days per year)
___ Sometimes (4 - 10 days per year)
___ Frequently (10 - 25 days per year)
___ Very Frequently (more than 25 days per year)

4. Have you visited the Big Hole River for recreation in the last three years?

____ Yes About how many days? _____ Days (go to #6)

____ No (Go to 5)

5. Do you plan to visit any Montana rivers for recreation in the next three years?

___ YES ___ NO

6. As you may have known, major sections of the Big Hole River typically have low summertime flows. The river was severely dewatered during the past few summers, reaching record low flow levels. This season the water level became so low that fishing limits had to be reduced to maintain healthy trout populations.

If flows were higher, people would be able to float the river later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

Available water could be purchased when needed from up-stream irrigators so these damaging low flows in the Big Hole would be avoided. A trust fund could be developed specifically to purchase water when needed.

If enough people contributed to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use the Big Hole for recreation, you would know you are helping to keep an important Montana river clean and healthy.

If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy water needed to increase summer flows on the Big Hole River?

____ YES (go to #9) ____ NO

7. Would you be willing to donate a smaller amount, such as 1.00 per year, to purchase water when needed for the Big Hole?

____ Yes (go to #9) ____ No

8. Could you please briefly explain why you would <u>not</u> purchase an annual membership in this trust fund?

_____(go to # 11)

9. What is the maximum amount you would be willing to pay for an annual membership in this trust fund?

_____ Dollars

10. People value the improvement of instream flows in the Big Hole for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes? (read each option before answering)

A. Payment to guarantee sufficient flows for boating and fishing when you actually visit the Big Hole for recreation, either now or in the future: ____%

B. Payment for reasons other than your own use, (such as just knowing that the Big Hole has sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels): ____%

Total = 100 %

11. Are you a member of any conservation, sport, fishing, or boating organizations?

___ YES ___ NO (go to question #13)

12. If yes, about how many of these groups or organizations do you currently belong to?

_____ Groups and organizations

13. Thanks for your help. Is there anything else you'd like to say about flow levels or this survey?

Interviewer Record:

City: _____

___ Male ___ Female

Notes:

Bitterroot Instream Flow Study
Non-response check telephone survey

Hi, I'm -------- ---------- calling from the University of Montana about a survey we've been conducting on peoples' reactions to low flows in Montana rivers. I'm calling people who didn't respond to our study to just ask a few questions. This is not a request for money. Could I have about five minutes of your time? If NO: Thanks anyway. If YES, proceed with questionnaire.

1. How often do you participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

___ Never (go to #3)
___ Rarely (1 - 3 days per year)
___ Sometimes (4 - 10 days per year)
___ Frequently (10 - 25 days per year)
___ Very Frequently (more than 25 days per year)

2. Do you fish? ___ Yes ___ No

3. How often do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

___ Never
___ Rarely (1 - 3 days per year)
___ Sometimes (4 - 10 days per year)
___ Frequently (10 - 25 days per year)
___ Very Frequently (more than 25 days per year)

4. Have you visited the Bitterroot River for recreation in the last three years?

____ Yes About how many days? _____ Days (go to #6)

____ No (Go to 5)

5. Do you plan to visit any Montana rivers for recreation in the next three years?

___ YES ___ NO

6. As you may have known, major sections of the Bitterroot River typically have low summertime flows. The river was severely dewatered during the past few summers, reaching record low flow levels. This season the water level became so low that fishing limits had to be reduced to maintain healthy trout populations.

If flows were higher, people would be able to float the river later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

There is water available in Painted Rocks Reservoir that could be used to increase summertime flows. This water could be purchased when needed so damaging low flows in the Bitterroot would be avoided. A trust fund could be developed specifically to purchase water when needed.

If enough people contributed to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use the Bitterroot for recreation, you would know you are helping to keep an important Montana river clean and healthy.

If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy water needed to increase summer flows on the Bitterroot River?
6.

____ YES (go to #9) ____ NO

7. Would you be willing to donate a smaller amount, such as 1.00 per year, to purchase water when needed for the Bitterroot?

____ Yes (go to #9) ____ No

8. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

_____(go to # 11)

9. What is the maximum amount you would be willing to pay for an annual membership in this trust fund?

_____ Dollars

10. People value the improvement of instream flows in the Bitterroot for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes? (read each option before answering)

A. Payment to guarantee sufficient flows for boating and fishing when you actually visit the Bitterroot for recreation, either now or in the future: ____%

B. Payment for reasons other than your own use, (such as just knowing that the Bitterroot has sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels): ____%

Total = 100 %

11. Are you a member of any conservation, sport, fishing, or boating organizations?

___ YES ___ NO (go to question #13)

12. If yes, about how many of these groups or organizations do you currently belong to?

_____ Groups and organizations

13. Thanks for your help. Is there anything else you'd like to say about flow levels or this survey?

Interviewer Record:

City: _____

___ Male ___ Female

Notes:

5 Rivers Instream Flow Study
Non-response check telephone survey

Hi, I'm -------- ---------- calling from the University of Montana about a survey we've been conducting on peoples' reactions to low flows in Montana rivers. I'm calling people who didn't respond to our study to just ask a few questions. This is not a request for money. Could I have about five minutes of your time? If NO: Thanks anyway. If YES, proceed with questionnaire.

1. How often do you participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

1 ___ Never (go to #3)
2 ___ Rarely (1 - 3 days per year)
3 ___ Sometimes (4 - 10 days per year)
4 ___ Frequently (10 - 25 days per year)
5 ___ Very Frequently (more than 25 days per year)

2. Do you fish? ___ Yes ___ No

3. How often do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

___ Never
___ Rarely (1 - 3 days per year)
___ Sometimes (4 - 10 days per year)
___ Frequently (10 - 25 days per year)
___ Very Frequently (more than 25 days per year)

4. Have you visited the Big Hole, Bitterroot, Clark Fork, Gallatin or Smith River for recreation in the last three years?

____ Yes About how many days? _____ Days (go to #6)

____ No (Go to 5)

5. Do you plan to visit any Montana rivers for recreation in the next three years?

___ YES ___ NO

6. As you may be aware, major sections of the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork Rivers typically have low summertime flows. These rivers were severely dewatered during the past few summers, reaching record low flow levels that harmed fisheries and recreational use.

If flows were higher, people would be able to float the rivers later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

Available water could be purchased when needed from upstream reservoirs or irrigators so damaging low flows in these five rivers would be avoided. A trust fund could be developed specifically to purchase water when needed.

If enough people contributed to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use these rivers for recreation, you would know you are helping to keep important Montana rivers clean and healthy.

If you were contacted within the next month, would you purchase an annual membership in this trust fund for _____ to buy the water needed to increase summer flows on the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork Rivers?

___ YES (go to #9) ___ NO

7. Would you be willing to donate a smaller amount, such as 1.00 per year, to purchase water when needed for these 5 rivers?

___ Yes (go to #9) ___ No

8. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

_____(go to # 11)

9. What is the maximum amount you would be willing to pay for an annual membership in this trust fund?

_____ Dollars

10. People value the improvement of instream flows in the Big Hole, Bitterroot, Gallatin, Smith and Upper Clark Fork for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes? (read each option before answering)

A. Payment to guarantee sufficient flows for boating and fishing when you actually visit these rivers for recreation, either now or in the future: ____%

B. Payment for reasons other than your own use, (such as just knowing that these rivers have sufficient flows for healthy fisheries, plants and animal life, or knowing that future generations will benefit from adequate flow levels): ____%

Total = 100 %

11. Are you a member of any conservation, sport, fishing, or boating organizations?

___ YES ___ NO (go to question #13)

12. If yes, about how many of these groups or organizations do you currently belong to?

_____ Groups and organizations

13. Thanks for your help. Is there anything else you'd like to say about flow levels or this survey?

Interviewer Record:

City: _____

___ Male ___ Female

Notes:

APPENDIX B. LITERATURE REVIEW OF CONTINGENT VALUATION METHODS

The two most widely used methods for estimating net willingness to pay for outdoor recreation are contingent valuation (CVM) and the travel cost method (TCM). These are also the two general methods recommended by the U.S. Water Resources Council for valuing recreation in federal cost benefit analysis. The travel cost approach estimates demand functions for a given site from observed visit rates corresponding to the supply prices (travel costs) from origins surrounding the site. A regional TCM application to Montana fisheries is described elsewhere (Duffield, Loomis and Brooks, 1987). A regional TCM model is not appropriate for this study because of budget limitations and its inability to measure indirect values.

In the CVM approach individuals are directly surveyed on their willingness to pay for the services of a given resource contingent on the existence of a hypothetical market situation. This is a very flexible technique and has been applied to a wide range of environmental and resource issues including air and water quality changes, scenic beauty, and wildlife (Cummings, Brookshire and Schulze, 1986). The only limitation of the method is the ability of the researcher to frame understandable questions and the willingness and ability of the respondent to accurately value the good or service.

Bishop and Heberlein (1985) have described six key methodological choices in a CVM application: 1) target population, 2) product definition, 3) payment vehicle, 4) question format, 5) method of analysis, and 6) supplemental data. With respect to population, the choice generally hinges on what types of values are being addressed. TCM by necessity and often most CVM focus on the values associated with direct use; accordingly the target population is direct users (such as boaters and anglers). However, there is a considerable literature on indirect or nonuser values such as option, existence and bequest values (Fisher and Raucher, 1984). Estimating the latter typically implies a regional population addressed through a household survey.

Product definition and payment vehicle are two key features of the hypothetical market. The resource or service at issue must be clearly described to the individual. This may be difficult for valuing changed conditions, such as the specific physical characteristics of a proposed hydropower installation (Duffield, 1984). Visual aids such as photos and charts have been used (Daubert and Young, 1981; Desvousges, Smith and McGivney, 1983). A problem is that the specific information given the individual can bias the response. A general approach is to vary the level of information and test for benefit sensitivity.

Just as for the product definition, it is generally agreed that a payment vehicle must be specified for the respondent. Mitchell and Carson (1981) suggest two criteria for an appropriate vehicle: realism and neutrality. Taxes or site fees may be means of payment that could be realistically employed for public resource use. However, responses to such vehicles may be more influenced by dissatisfaction with high taxes or aversion to fee fishing (for example) than by the value placed on the resource.

A vehicle that has been used successfully for hunting studies is an increase in trip expenses. Hammack and Brown (1974) used this approach in an innovative study of waterfowl hunting. As Bishop and Heberlein (1985) note, this is an appealing vehicle for such studies since respondents are familiar with paying expenses and expenses appear relatively neutral compared with other vehicles such as hunting fees. Past instream flow studies have used trip cost, entrance fee, and sales tax payment vehicles, while studies of water quality benefits have added willingness to drive and the cost of waterfront property (Walsh, Greenley, Young, McKean and Prato, 1978).

Based on previous studies, this study utilizes a trust fund payment vehicle to identify total willingness to pay for the protection of instream flows and a trip expense vehicle for valuation of direct use alone.

The major methodological choice in a CVM study is the question format or value elicitation procedure. The latter also usually implies the type of analysis that will be undertaken. Three general approaches for asking CVM questions are: open-ended questions, bidding games and dichotomous-choice questions. It is beyond the scope of this paper to review these methods in detail (for a recent review see Cummings, Brookshire and Schulze, 1986); however, the key features of each will be briefly described.

The open-ended is the simplest approach: respondents are asked their maximum willingness to pay for use of the given resource. This approach can be utilized in a mail survey and is therefore low cost. Interpretation is also fairly straightforward, requiring only the calculation of the mean offer amount. One difficulty can be in interpreting extreme values. For example, responses of "zero" may indicate a protest response against the payment vehicle or even against the idea that a given resource has a finite value. Generally, follow-up questions are included that attempt to identify the reasons for a zero response. Similarly, it is often not clear what credibility can be attached to extremely high values. In general, the limitation of this approach is that respondents may not have sufficient information or stimulation to fully consider the value they place on the resource.

The most widely used alternative to the open-ended format is a bidding game, where interviewers ask the respondent for a yes or no response to a specific bid amount. If the respondent is willing to pay, for example, $10, the bid is raised in increments until the maximum willingness to pay is determined. Stoll (1983) argues that such an iterative approach is necessary to force individuals to engage themselves in the hypothetical market and continuously reconsider their willingness to pay.

There is some disagreement in the literature on whether the two approaches in fact yield consistently different results. Cummings, Brookshire and Schulze (1986) conclude that open-ended results are generally lower. However, Bishop, Heberlein, Welsh and Baumgartner (1984) compared open-ended questions and bidding games and found no significant difference. There are two major limitations to the bidding game approach. It is costly in that it requires face to face or telephone interviews. Second, many studies have shown a positive correlation between the initial (and arbitrary) bid and the final

maximum bid. Empirical evidence of this starting point bias has been presented by Duffield (1984) and many others.

The dichotomous choice approach combines some of the better features of both open-ended and bidding. In dichotomous choice, the individual is faced with a single specific dollar bid and (like bidding games) response is a simple market-like yes or no. The dollar bid amount is systematically varied across respondents. Since the format is non-iterative (like the open-ended), it is amenable to mail survey and is therefore relatively low cost. This approach is relatively new, but has been successfully applied to valuation of hunting permits (Bishop and Heberlein, 1979), boating and scenic beauty (Boyle and Bishop, 1984), reservoir recreation (Sellar, Chavas and Stoll, 1985) and beach recreation (Bishop and Boyle, 1985).

The major disadvantage of dichotomous choice is that analysis is more complex. This method exploits some of the considerable advancement in methods for modeling discrete choice over the last decade (Amemiya, 1981). Econometric models, such as the logit model are used to predict the probability of accepting an offer as a function of the stated bid and other socio-economic variables (as detailed below). There is some debate over the appropriate measure of central tendency (Hanneman, 1984 and Cameron, 1988) and issues regarding truncation and functional form are still being resolved.

As for any model of economic demand, the CVM estimates are generally improved and informed by including at least the conventional demand shifter variables such as income, price and availability of substitutes, and measures of tastes and preference. This is most critical for the dichotomous choice case, where incomplete specification could lead to omitted variable bias. As noted, for the open-ended and bidding game methods, analysis amounts to taking the mean of the maximum willingness to pay bids. However, for these two methods it is conventional practice to estimate "bid equations" that relate willingness to pay to demand shifter variables to help establish the credibility of responses.

As is obvious from this review of the CVM literature, there are advantages and disadvantages to each method. The open-ended and dichotomous choice methods were selected for this study. Major considerations were high interview cost and starting point bias associated with the bidding game format.

APPENDIX C. DATA LISTING FOR MAIL SURVEY

Note: All results are reported as percent of total sample unless otherwise specified.

Number of questionnaires of each type: 165 (29%) Big Hole
208 (37%) Bitterroot
190 (34%) Five-rivers

Section I.

1. How often do you participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers? (please check one)

12% Never
15% Rarely (1 - 3 days per year)
31% Sometimes (4 - 10 days per year)
24% Frequently (10 - 25 days per year)
17% Very frequently (more than 25 days per year)

2. How many years have you been going participating in fishing, boating or other river-related activities?

mean = 26 years, median = 25 years

3. About how many days per year do you spend doing each of the following recreational activities on or along a river?

Days fishing from shore on rivers or streams

mean = 8 days, median = 4 days

Days fishing from a boat on rivers or streams

mean = 3 days, median = 0 days

Days boating (non-fishing)

mean = 3 days, median = 0 days

Days swimming in rivers

mean = 4 days, median = 0

Days doing other activities on rivers
mean = 7 days, median = 2 days

4. If you fish, what type of equipment do you generally use? (Please check all that apply)

16% Bait 10% Lures 16% Flies 58% combination

5. If you fish, how important to you is each of the following aspects of fishing?

	Impor-tant	Very Important	Not Very Important	Not At All Important
a. Catching fish to eat	22	37	31	10
b. Testing fishing skills	12	43	33	14
c. Catching wild fish	14	44	27	15
d. Catching large fish	15	46	30	9
e. Catching lots of fish	9	32	45	14

6. People visit rivers for many reasons. Following is a list of possible reasons. Please check the box that says how important each reason is to you.

	tant	Impor- Important	Very Important	Not Very Important	Not At All Important
a. To view the scenery	73	19	8	1	
b. To be with my family	40	30	26	4	
c. To experience solitude	33	33	28	6	
d. To be with friends	19	40	36	5	
e. For the fishing	21	30	32	17	
f. For the boating	8	18	43	30	
g. To view wildlife	41	31	24	3	
h. To relax	64	26	9	1	

7. How frequently do any other members of your household participate in river-related recreation such as stream fishing, boating, swimming in rivers, or picnicking or camping along rivers?

12% Never
19% Rarely (1 - 3 days per year)
32% Sometimes (4 - 10 days per year)
24% Frequently (10 - 25 days per year)

12% Very Frequently (more than 25 days per year)

8. Following is a list of some possible uses of the water in a stream or river. Please rate how important you feel each use is to society in general.

Important	Critical	Very Important	Somewhat Important	Not at All
Irrigation	35	47	17	1
Hydropower	23	50	24	3
Recreation	27	53	18	1
Wildlife habitat	53	40	7	1
Fisheries	45	44	11	1

Section II .

1. Have you ever visited the ------ for recreation?

Big Hole Yes: 42%
Bitterroot Yes: 47%
Five RiversYes: 67%

2. What activities have you done along the ------ in the last three years? (1986 - 1988; please check all that apply)

Big Hole River:

51% Fishing from shore
22% Fishing from boat
16% Boating (non-fishing)
16% Swimming
15% Hunting

Bitterroot River:

48% Fishing from shore
19% Fishing from boat
22% Boating (non-fishing)
39% Swimming
24% Hunting

Five Rivers:

69% Fishing from shore
26% Fishing from boat
34% Boating (non-fishing)
39% Swimming
23% Hunting

2. Five Rivers: number of days spent at each river in last three years:

	Mean	Median
Big Hole	5	1
Bitterroot	11	2
Clark Fork	8	2
Gallatin	2	0
Smith	1	0

3. About how many days did you spend recreating on or along the ---------- in the past three years (total sample)

mean = 15, median = 4

4. When visiting the ---------- either this year or before, have you ever had any problems with low flow levels?

Big Hole: 44% yes
Bitterroot: 45% yes
Five rivers: 48% yes

5. If yes, what kind of problems?

Boating 28%
Fishing 25%
General 17%
Boating and fishing 8%

6. Do you plan to visit the ------ for recreation in the next three years?

Big Hole: 48% yes
Bitterroot: 53% yes
Five rivers: 72% yes

7. If yes, how frequently do you plan to visit the Big Hole? (please check one)

	Big Hole	Bitterroot	Five rivers
About as often as I do now	22%	29%	19%

More frequently than I do now	37%	37%	57%
Not sure	40%	30%	19%

8. If you plan to visit more or less frequently than you do now, could you estimate the number of days per year you're likely to visit the --------- river?

mean = 10 days, median = 5 days

9. Have you experienced difficulties because of low flow levels on other rivers?

Yes: 35%

10. If yes, what kind of problems, and on what rivers? (note: the percents that follow are percent of responses, not people, and include the first river listed)

River:

Jefferson	9%
Smith	5%
Big Hole	5%
Missouri	9%
Clark Fork	6%
Blackfoot	12%
Yellowstone	10%
Bitterroot	8%

Type of problem:

Boating-related	31%
Fishing-related	26%
General	23%

Section III

1. In various parts of the country, trust funds have been set up to purchase water when needed, to keep enough water in the river to avoid low water levels that damage rivers and streams.

How familiar are you with these efforts? (please check one)

16% I have never heard of such trust funds
57% I have heard of them but don't know much about them. 21% I know a fair amount about them.
5% I know a great deal about them.

2. Have you ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

Yes: 30%

3. Do you know anyone else who has ever donated money or time to a trust fund like this, or to other efforts to help conserve natural resources such as rivers or wildlife habitat?

Yes: 51%

4. Did you know that the Montana Department of Fish, Wildlife and Parks has purchased water from reservoirs during recent drought years, to maintain adequate flow levels on Montana rivers?

59% No, I never knew this
27% I knew this but not much about it
11% I know a fair amount about these efforts.
2% I know a great deal about these efforts.

5. As you may have known, major sections of the ------ typically have low summertime flows. The river was severely dewatered during the past few summers, reaching record low flow levels. This season the water level became so low that fishing limits had to be reduced to maintain healthy trout populations.

If flows were higher, people would be able to float the river later in the summer. Flows would be better for trout populations and fishing. Many species of birds, wildlife and plants would benefit; for example, better habitat would exist for osprey and river otters.

Available water could be purchased when needed from upstream irrigators to increase summertime flows in the ----------. This water could be purchased when needed to avoid damaging low flows in the river. A trust fund could be developed specifically to purchase water when needed.

If enough people contributed to this trust fund, the river would be available for more recreational use both now and in the future. Even if you don't use the ---------- for recreation, you would know you are helping to keep an important Montana river clean and healthy.

If we were to contact you within the next month, would you purchase an annual membership in this trust fund for _____ to buy water needed to increase summer flows on the ------?

8% YES

(average dollar amount listed: 91.00; median 50.00)

6. Would you be willing to donate a smaller amount, such as $1.00 per year, to purchase water when needed for the ---------- ?

52% Yes

7. Could you please briefly explain why you would not purchase an annual membership in this trust fund?

21% Money/cost
15% I don't use the river
11% Elderly, age-related
6% I have other interests
4% It's a state/federal problem
4% I contribute to other things already
4% Not interested
3% It wouldn't work
3% Lack information

8. What is the maximum amount your household would pay each year for the next three years for a membership in this trust fund to purchase water for the ---- ------ ?

mean = 13.00 dollars per year
median = 10.00 dollars per year

9. People can value the improvement of instream flows in the ------ for many reasons. What percent of your payment to the trust fund would you assign to each of the following purposes?

A. Payment to guarantee high enough flows for boating and fishing when I actually visit these rivers
for recreation, either now or in the future:

mean = 24%
median = 20%

B. Payment for reasons other than your own use,
such as just knowing that these rivers have
sufficient flows for healthy fisheries, plants
and animal life, or knowing that future
generations will benefit from adequate flow levels:

mean = 65%
median = 70%

9. (on five-rivers survey): How would you want us to allocate your payment among the five rivers?

	Mean	Median
Big Hole	19%	20%
Bitterroot	25%	20%
Gallatin	14%	15%
Smith	13%	10%
Clark Fork	19%	20%

10. Who do you feel should be responsible for maintaining adequate flow levels in Montana rivers and streams like the ---------- ? (please check all that apply)

3% No one
67% State government
27% Federal government
36% Recreational users
22% Private trust funds

Section IV

(SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree, NS = No opinion)

	SA	A	D	SD	NS
I have a great deal of concern for endangered species.	38	46	6	1	8
Some land in the U.S. should be set aside from any human use at all so it can remain completely untouched.	26	30	24	13	8
I would like to see more hydroelectric dams on Montana rivers	5	19	30	21	25
I have had inspirational experiences on rivers	17	45	9	2	27
The main reason for maintaining resources today is so we can develop them in the future if we need to.	16	41	27	9	7
I'm glad there is wilderness in Alaska even if I never get there to see it.	39	46	5	1	9
Rivers do not have many spiritual or sacred values to me	4	20	30	30	17

Our society should consider the needs of future generations as much as we consider our needs today.	53	43	2	1	2
Some days when I'm feeling pressured it reassures me to think that some lands out there are wild and undeveloped, even if I never get to go there.	30	43	11	2	13
I enjoy knowing that my friends and family can visit rivers for recreation if they want to.	39	58	1	0	3
Endangered species should not be protected if they don't have any benefits to humans.	3	5	35	50	7
People can think a river is valuable even if they don't actually go there themselves.	40	57	1	1	2
I enjoy hearing about experiences my friends or family have had on rivers.	22	67	1	1	9
The decision to develop resources should be based mostly on economic grounds.	3	17	45	24	10
I have been concerned about how the recent drought may affect fish and wildlife that depend on rivers.	36	55	3	1	6
I enjoy looking at picture books or going to movies that have rivers in them.	22	63	3	1	12
I think that most rivers already have enough water in them to be healthy resources.	1	19	47	20	13
I would be willing to contribute money or time to help keep adequate water in Montana rivers even if I could never visit them.	7	38	26	7	23
I would be willing to visit Montana rivers less frequently if it meant that the resource would be better off in the long run.	9	49	18	6	18
Montana's free-flowing rivers and streams are a unique and irreplaceable resource.	55	38	2	1	4
I feel that I should be doing more					

for Montana's rivers and streams.	7	34	23	2	33
It's important to protect rare plants and animals to maintain genetic diversity.	29	54	4	1	12
Donating time or money to worthy causes is important to me.	12	56	9	1	22

Section V.

1. Are you a member of any conservation, sport, fishing, or boating organizations?

21% Yes

2. If yes, about how many of these groups or organizations do you currently belong to?

49% One group
20% Two groups
11% Three groups
5% Four groups
4% Five or six groups

3. Do you or your household have a fairly specific budget for donating to various causes or charities?

36% Yes

4. If so, about how much (dollars per year)

mean = 257.00
median = 100.00

5. Where are you from?

19% Missoula
18% Helena
17% Bitterroot valley
17% Billings
14% Spokane
10% Butte

6. What is your age? mean = 47, median = 43

7. Gender: 69% male, 30% female

8. Highest year of formal education completed:

1% Some grade school	28% Some college
1% Finished grade school	20% Finished college
2% Finished junior high	9% Some postgraduate
24% Finished high school	14% Finished postgraduate

5. During this past summer, were you: (please check one)

51% Employed full time	26% Retired
11% Employed part time	4% Homemaker
3% Unemployed	4% Other: _____

9. Please check your household's income before taxes last year:

6% under 5000	11% 20,000-24,999	11% 40,000-49,000
11% 5,000-9,999	12% 25,000-29,999	8% 50,000-74,999
13% 10,000-14,999	7% 30,000-34,999	2% 75,000-100,000
9% 15,000-19,999	7% 35,000-39,999	1% over 100,000

THANK YOU FOR YOUR HELP. IS THERE ANYTHING ELSE YOU'D LIKE TO TELL US ABOUT FLOW LEVELS IN MONTANA'S RIVERS? WE WOULD APPRECIATE ANY COMMENTS.

17% of the respondents added comments.

APPENDIX D. ALGORITHM FOR COMPUTING RECREATION VALUE OF INSTREAM FLOWS

Appendix D
Algorithm for Computing Recreation Value of Instream Flows

```
FILE HANDLE FLOW/NAME='FLOW1500.DAT'
DATA LIST FILE=FLOW/
  DSCRG 1-4
MISSING VALUES DSCRG(9999)
COMPUTE SQDSCRG=DSCRG*DSCRG
COMPUTE DSCRG3=DSCRG*DSCRG*DSCRG
COMPUTE D=DSCRG
COMPUTE D2=SQDSCRG
COMPUTE D3=DSCRG3
COMPUTE NSAMPLE1=7.103043+.006336*D-.00000365522*D2+4.3699E-10*D3
COMPUTE NSAMPLE2=6.021829736-.0000149456*D2+.027498*D
COMPUTE USE1=12.32*NSAMPLE1
COMPUTE USE2=10.82*NSAMPLE2
COMPUTE WTP1MN=15.99*(D**.3745)
COMPUTE WTP1MED=6.88*(D**.3745)
COMPUTE WTP2MN=303.07
COMPUTE WTP2MD=136.02
COMPUTE DAYW1MN=WTP1MN/1.453
COMPUTE DAYW1MD=WTP1MED/1.453
COMPUTE DAYW2MN=WTP2MN/2.28
COMPUTE DAYW2MD=WTP2MD/2.28
COMPUTE DUSE1=12.32*(.006336-.00000731*D+.00000000131097*D2)
COMPUTE DUSE2=10.82*(.027498-.0000298912*D)
COMPUTE QUT1MN=(DUSE1/1.983)*DAYW1MN
COMPUTE QUT1MD=(DUSE1/1.983)*DAYW1MD
COMPUTE QUT2MN=(DUSE2/1.983)*DAYW2MN
COMPUTE QUT2MD=(DUSE2/1.983)*DAYW2MD
COMPUTE DWTP1MN=.3745*15.99*(D**(-.6255))
COMPUTE DWTP1MD=.3745*6.68*(D**(-.6255))
COMPUTE DWTP2MN=0
COMPUTE DWTP2MD=0
COMPUTE DDAW1MN=DWTP1MN/(1.983*1.453)
COMPUTE DDAW1MD=DWTP1MD/(1.983*1.453)
COMPUTE QUAL1MN=DDAW1MN*USE1
COMPUTE QUAL1MD=DDAW1MD*USE1
COMPUTE QUAL2MN=0
COMPUTE QUAL2MD=0
COMPUTE TOT1MN=USE1*DAYW1MN
COMPUTE TOT1MD=USE1*DAYW1MD
COMPUTE TOT2MN=USE2*DAYW2MN
COMPUTE TOT2MD=USE2*DAYW2MD
COMPUTE DTOT1MN=QUT1MN+QUAL1MN
COMPUTE DTOT1MD=QUT1MD+QUAL1MD
```

```
COMPUTE DTOT2MN=QUT2MN+QUAL2MN
COMPUTE DTOT2MD=QUT2MD+QUAL2MD
FINISH
```