A STUDY OF METHODS FOR ASSESSING ECONOMIC BENEFITS AND ALLOCATING COSTS OF LARGE WATER DEVELOPMENT PROJECTS

Part One: Research of Literature on Methods for Evaluation of Benefits

Part Two: Evaluation of Methods of Determining Fish, Wildlife, Outdoor Recreation, and Tourism Benefits of Water Development

- Prepared for -

Natural Resources Commission
State of Nebraska

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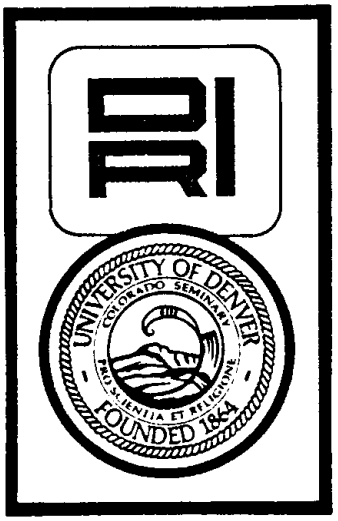

September 1985

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EXECUTIVE SUMMARY

Background and Purpose

This report summarizes the first two parts of a research study intended to analyze existing methods for determining economic benefits (i.e., positive impacts) of large water development projects and for allocating costs of those projects among various groups of beneficiaries. The study is intended to assess the applicability to, and suitability for use in, the State of Nebraska.

The applicability of existing procedures to the determination of total state benefits from large water developments has been questioned. When the Nebraska Natural Resources Development Fund was established, federal guidelines and procedures were used as much of the basis for state evaluations because there were not any others available and there were not enough funds to design a totally new system. As a result, total state benefits (similar to regional development benefits) have not been defined, and their magnitude is unknown.

Much of the difficulty involved in determining total state benefits revolves around quantification of benefits from activities that do not have final products that are marketable. Primary benefits from those activities with markets for final products (e.g., irrigation) can be quantified because all inputs and outputs are bought and sold through the marketplace. However, benefits from activities such as recreation do not have markets where all inputs and outputs are traded. The same is true for fish and wildlife, which are protected from normal market forces. Consequently, the real value of these activities must be quantified through other methods which are subject to debate. Until these benefits are defined and quantified, they will remain a source of controversy and their values may be ignored or overlooked.

Scope of the Study

Part One of the study involves research of available literature concerning methods, procedures and criteria for determining economic benefits of water projects and for allocating costs among beneficiaries. In Part One, particular emphasis is given to analysis of literature dealing with fish, wildlife, outdoor recreation and tourism benefits, although the literature search has identified documents dealing with methods for determining other types of benefits as well.

Part Two of the study involves analysis and evaluation of methods of determining fish, wildlife, outdoor recreation, and tourism benefits of water development projects. This analysis includes an examination of current Nebraska procedures for evaluating those benefits to determine in what cases benefits currently are not fully counted.

Literature Search

A computer-based, on-line search strategy was used to search for pertinent literature in appropriate data bases. Titles were reviewed and, if pertinent to the study, DRI arranged to have abstracts printed. The abstracts were reviewed by study team members and copies of documents obtained from the University of Denver library (by loan or photocopy), by interlibrary loan, or by purchase. About 460 abstracts of documents found in the computer-based literature search were reviewed and approximately 145 books, articles and dissertations were ordered or photocopied. The literature search included review of over 300 documents from the Denver Research Institute's Water Resources Library.

Evaluation of Methods Used to Value Benefits of Recreation, Etc.

Economic literature, notably writings in welfare economics and natural resource economics, contains descriptions and discussions of a variety of methods used to determine the value of benefits stemming directly or indirectly from an activity or a physical development. This report describes several major categories of methods that could be adopted by the State of Nebraska for use in determining fish, wildlife, outdoor recreation, and tourism benefits of large water development projects.

As an aid to evaluation of these methods, the Denver Research Institute proposed several criteria to the Natural Resources Commission and its advisory committees in May 1985. These criteria, which were used to evaluate the methods, are: credibility, accuracy, simplicity, comprehensiveness, ability to distinguish private and public benefits, and consistency of viewpoint.

The methods that have been evaluated by DRI are:

- The current method used by the State of Nebraska
- Gross expenditures method
- Cost-base method
- Methods based on willingness to pay
- Market value method
- Interview methods
- Travel cost method
- Market value of fish method

No single method, of those evaluated, fully meets the needs of the State of Nebraska in determining the benefits of fish, wildlife, outdoor recreation, and tourism. Given sufficient time and money, Nebraska could sponsor a series of economic studies, i.e., travel cost and gross

expenditure studies in various parts of the state, that could form a basis for determining future benefits, using experienced judgment and a regional estimator model. However, it is believed that the resources for such studies and surveys are not now available and may not become available. Furthermore, even if they were, the adaptation of such studies to a specific funding application would require a significant level of economics expertise that a typical funding applicant may not possess. Rather than forcing a funding applicant to retain an economic consultant at significant expense, or placing this analysis burden on state agency (e.g., NRC) personnel, Denver Research Institute has proposed a method that, while admittedly not precise, should be within the ability of a typical funding applicant to conduct and should be both more accurate and more comprehensive in its measure of benefits than the existing method.

The Recommended Method

Denver Research Institute recommends a new method borrowing heavily from the existing method described in the Nebraska Natural Resources Fund Guidelines, but modifying it in several ways to:

- Consider net values of outdoor recreation days, i.e., subtracting recreation days lost from new recreation activity days supplied.
- Consider the consumer surplus value received by residents living near the site, i.e., day users, versus the users in the outlying parts of the market area.
- Distinguish recreation value received by users from the economic benefits of tourism based on direct and indirect spending by tourists, which would be determined from other studies.
- Distinguish the local and regional impacts of tourist spending from the smaller amounts which day-users spend, and which would largely be spent in the locality whether or not engaged in recreational activity, i.e., spending transfers.
- Choosing a more reasonable, yet defensible value of a recreation day, based on travel cost, value of travel time and consumer surplus principles.

Case Studies to Compare the Current and Proposed Methods

The Denver Research Institute recommended method was applied to two actual Nebraska water projects to determine what benefits would have been estimated using the new method. For comparison, the current Nebraska method (based on NRDF guidelines) was used on the same projects to estimate benefits. The projects were the Willow Creek Dam and Recreation Project near Pierce, Nebraska, and the Long Branch Watershed on tributaries of the Nemaha River in southeastern Nebraska.

	Willow Creek	Nemaha-Long Branch
NRDF Guidelines method:	$ 514,025	$ 59,486
DRI recommended method:		
• Recreation benefits	795,853	155,895
• Tourism benefits	1,513,416	147,081
Total benefits	$2,309,269	$302,976

DRI also compared the recreation use forecast from the Bureau of Reclamation in 1950-1951 with an economic study of the University of Nebraska in 1960 for three reservoirs of the Frenchman Cambridge Project in southwestern Nebraska. The original USBR projection of 33,380 visitor days per year was already exceeded nearly three times by the 98,000 visitor days of recreation recorded in 1960. Another 73,000 visitor days of sightseeing was recorded in 1960.

Methods for Allocation of Project Costs

The report discusses three methods for allocation of water development project costs. The methods examined are the Separable Costs--Remaining Benefits method, Alternative Justifiable Expenditure method, and Use of Facilities method. To aid in the evaluation of these methods, six criteria were developed: efficiency, equity, credibility, accuracy, simplicity, and comprehensiveness.

All three methods described have problems in distributing costs equitably. However, for the most part, these problems relate to qualitative, not quantitative judgments. Thus, equity in cost allocation becomes a policy decision of the State of Nebraska. The recommended method for the State of Nebraska is the Separable Costs--Remaining Benefits Method, which is judged superior to the other methods on the criterion of economic efficiency. The difficulties inherent with this method should be resolvable for projects that are located entirely within Nebraska.

After the costs have been allocated to purposes by the Separable Costs--Remaining Benefits method, it is then necessary to determine the costs to be borne by the local, state, or federal governments, financing agencies, and groups involved.

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The methods and procedures listed in the report have been critically reviewed by water resources economists representing divergent points of view on what types of benefits should be allowed, and who have evaluated the positive and negative aspects of each method. Their comments, together with the authors' responses, appear in the Appendix.

PREFACE

Throughout this project, the authors have been gratified by the support of officials of the Nebraska Natural Resources Commission, who have offered assistance, information, constructive suggestions, and encouragement. Dayle Williamson, Executive Secretary, and Verlon (Tony) Vrana, Chief of the Planning Division, have been consistently helpful. Special thanks go to Steve Gaul, Planning and Review Process Coordinator, who has been unfailingly helpful and supportive throughout the period of the study and its review, setting high standards for the research and aiding us in its accomplishment.

Within DRI, we are grateful for the help of Loretta C. Lohman and for the dedicated typing of Beverly Doyle, whose efforts on behalf of schedule deadlines and report quality are deeply appreciated.

The Authors

I. INTRODUCTION

This document contains reports of the first two parts of a research study intended to analyze existing methods for determining economic benefits of large water development projects and for allocating costs of those projects among various groups of beneficiaries. The study is intended to assess the applicability to, and suitability for use in, the State of Nebraska.

Background of the Study

After several decades of leadership in planning, financing and constructing water development projects, the federal government has, over the past ten years, shown a reduced willingness to continue to lead in water resource development. Because the needs for wise development of water resources continue to be unmet, particularly in the western U.S., most of the western states are exploring new ways to achieve them.[1]

The State of Nebraska has acted responsibly to meet its needs; notably through legislative and executive initiative in assuming greater responsibilities for development of the state's natural resources while assuring that development plans include attention to environmental concerns and to conservation of nongame, endangered and threatened species of wildlife.

In 1974, the Nebraska Legislature passed the Nebraska Resources Development Fund Act of 1974, which established the Resources Development Fund to assist the state in the development and wise use of Nebraska's water and land resources. The fund can be used to provide grants and/or loans to local political subdivisions of the state, agencies of the state, or can be used by the Natural Resources Commission to acquire an interest in a project in the name of the state. No project shall receive more than $10 million from the Resourcs Development Fund.[2]

Prior to its phasing out in February 1985, the Nebraska Resources Development Fund Advisory Board (composed of representatives from eight state agencies), which shared administrative responsibilities for the fund with the Natural Resources Commission, had prepared guidelines for preparing project funding applications and feasibility reports. These

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[1] New Challenge, New Direction: The Water Policy Report of the Western Governors' Association, Denver, 1984.

[2] Nebraska Statute 2-1588.

guidelines[3] include instructions for completing reports on technical, economic, and financial feasibility and environmental acceptability.

In 1984, the legislature and the governor approved Legislative Bill 1106 which expands the role of the State of Nebraska in water resources development. A new Water Management Board was created and charged with assuming responsibility for state interest in projects costing over $10 million.

Until the Water Management Board develops new criteria for determining the economic and financial feasibility of proposed projects, it will probably use the existing criteria of the Natural Resources Development Fund, which are based in part on federal procedures and criteria.

The applicability of existing procedures to the determination of total state benefits from large water developments has been questioned. Over the years, the methods and assumptions used by the federal government for determining benefits and allocating costs have been challenged by some on the grounds that they do not include all benefits. Economic evaluations under the federal Principles and Guidelines[4] are required to use only benefits to national economic development. Past procedures and standards developed by the federal government recognized regional development benefits but did not allow them to be used to justify projects, partially on the grounds that such benefits to one region were taken from another region. However, from a state standpoint the benefits from federal infusions of money alone can be substantial. When the Nebraska Natural Resources Development Fund was established, federal guidelines and procedures were used as much of the basis for state evaluations because there were not any others available, and there were not enough funds to design a totally new system. As a result, total state benefits (similar to regional development benefits) have not been defined, and their magnitude is unknown.

Much of the difficulty involved in determining total state benefits revolves around quantification of benefits from activities that do not have final products that are marketable. Primary benefits from those activities with markets for final products (e.g., irrigation) can be quantified because all inputs and outputs are bought and sold through the marketplace. However, benefits from activities such as recreation do not have markets where all inputs and outputs are traded. The same is true for fish and wildlife, which are protected from normal market forces. Consequently, the real value of these activities must be quantified through other methods which are subject to debate. Until these benefits are defined and quantified, they will remain a source of controversy and their values may be ignored or overlooked.

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[3] Nebraska Resources Development Fund Guidelines, as revised January 1984.

[4] U.S. Water Resources Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Washington, D.C.: GPO, 1983.

Impacts, Benefits, and Costs

The terminology used in this report, particularly the terms "impacts," "benefits," and "costs," can be confusing to readers who are unfamiliar with the usage of these terms in economic analysis--and occasionally to some who are familiar with economic usage. It may help to provide some definitions.

- Economic impacts are the economic effects caused by an event or activity or policy on persons, organizations, or on the economy in general. There are several types of impacts other than economic ones, such as physical, social, and technological. Impacts can be good or bad from the viewpoint of the person or organization impacted. Frequently impacts are positive to some and negative to others. Some impacts, such as the effects of earthquakes or hurricanes, are negative to nearly everything or everyone impacted. It is important to use "nearly," because of the well-known saying, "It's an ill wind that blows no good."

- Benefits are positive or favorable impacts. They can be economic, environmental, or social. Economic benefits, as defined in the Principles and Guidelines[5] include:

  a. National benefits: increases in the economic value of the national output of goods and services from a plan; the value of output resulting from external economies caused by a plan; and the value associated with the use of otherwise unemployed or underemployed labor resources.

  b. Regional benefits: regional income benefits, which are the sum of the national benefits that accrue to that region plus transfers of income to the region from outside the region; regional employment benefits, which are the sum of the value of national employment benefits that accrue to that region plus transfers of employment to the region from outside the region.

- Costs, or adverse effects (sometimes called disbenefits) are the opportunity costs of resources used in implementing a plan, including implementation outlays, associated costs, and other direct costs. There are both national and regional income and employment costs (or negative effects); as in the case of benefits, the regional costs are the sum of the region's share of national costs and the costs of adverse transfers out of the region.

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[5]Ibid.

- Opportunity costs are the costs of using resources (labor, capital, land) to carry out a plan, as measured by the value of the products that would have been produced with these resources if used in the most productive alternate way. In other words, this is the cost of the lost opportunity.

Purpose and Scope

The complete four-part study has as its purposes: (a) a comprehensive review of methods, procedures and criteria for determining all kinds of economic benefits from water development projects and for allocating project costs to beneficiaries; and (b) evaluating and assessing their applicability to, and suitability for use in, the State of Nebraska. The kinds of benefits include direct and indirect, primary and secondary. The types of benefits include:

- Fish and wildlife
- Outdoor recreation and tourism
- Irrigation
- Public water supply
- Flood control and streambank erosion

Part One of the study involves research of available literature concerning methods, procedures and criteria for determining economic benefits of water projects and for allocating costs among beneficiaries. In Part One, particular emphasis is given to analysis of literature dealing with fish, wildlife, outdoor recreation and tourism benefits, although the literature search has identified documents dealing with methods for determining other types of benefits as well.

Part Two of the study involves analysis and evaluation of methods of determining fish, wildlife, outdoor recreation, and tourism benefits of water development projects. This analysis includes an examination of current Nebraska procedures for evaluating those benefits to determine in what cases benefits currently are not fully counted.

Only Parts One and Two of the study are reported here.

Relation to Future Phases of the Study

Depending on availability of additional funding after July 1, 1985, the Nebraska Natural Resources Commission may contract for completion of Parts Three and Four of the four-part study.

Part Three involves an analysis of available literature on methods to measure irrigation benefits of water projects, and an examination of current Nebraska procedures for evaluating those benefits to determine in what cases benefits currently may not be fully counted. The final product of Part Three will be a report which: (1) identifies, describes, and evaluates major methods of determining irrigation benefits associated with water development projects; (2) examines current Nebraska procedures for evaluating those benefits and determines whether there may be other methods which would allow additional benefits to be counted; (3) evaluates those other methods in regard to the Nebraska situation; and (4) examines allocation of water project costs with special regard to beneficiaries of irrigation.

Part Four of the study involves an analysis of available literature on methods to measure flood control and streambank erosion and public water supply benefits of water development projects, and an examination of current Nebraska procedures for evaluating those benefits to determine in what cases benefits currently may not be fully counted. The final product of Part Four will be a report which: (1) identifies, describes, and evaluates major methods of determining flood control and streambank erosion and public water supply benefits associated with water development projects; (2) examines current Nebraska procedures for evaluating those benefits and determines whether there may be other methods which would allow additional benefits to be counted; (3) evaluates those other methods in regard to the Nebraska situation; and (4) examines allocation of water project costs with special regard to flood control and streambank erosion and public water supply beneficiaries.

The methods and procedures listed in the report have been critically reviewed by water resources economists representing divergent points of view on what types of benefits should be allowed, and who have evaluated the positive and negative aspects of each method. Their comments, together with the authors' responses, appear in the Appendix.

II. RESEARCH OF LITERATURE ON METHODS FOR EVALUATION OF BENEFITS

The Nebraska Natural Resources Commission specified in the statement of work for this project that the first work component should be a review of available literature dealing with: (1) methods for determining fish, wildlife, outdoor recreation and tourism benefits of water development projects; and (2) methods, procedures and criteria for determining economic benefits of water development projects and allocation of project costs. This section of the report describes the strategy and scope of the literature search and the resulting preparation of a bibliography categorized by subject.

Technique of Search

A computer-based, on-line search strategy was used to search for pertinent literature in appropriate data bases. The study team worked with the science reference librarian of the University of Denver library to develop a study strategy involving combinations of key words. Various combinations of key words (e.g., economic impact, water resource development, recreation, cost allocation, cost sharing, pricing, benefit, value, evaluation, reservoir, fish, lake, boat, hunting) were used to locate documents in appropriate data bases.

The data bases searched were selected as those which would thoroughly cover the topics of study. They were:

- Economics Abstracts International, which includes coverage of the world's literature on research in economic science, beginning in 1974. DRI searched from 1974 to the most recent date available (October 1984).

- Economic Literature Index, which includes journal articles and book reviews from 260 economics journals and approximately 200 monographs per year, beginning in 1969. DRI searched from 1969 to the most recent date available (September 1984).

- Water Resources Abstracts, which includes materials collected by over 50 water research centers and institutes in the U.S., including documents on water resource economics. These are predominantly English-language materials including monographs, journal articles, reports, patents and conference proceedings beginning in 1968. DRI searched from 1968 to the most recent date available (November 1984).

- Dissertation Abstracts, which includes every American doctoral dissertation since academic doctoral degrees were first granted in the U.S. in 1861, and thousands of Canadian dissertations. DRI searched this data base to the most recent date available (January 1985).

DRI obtained on-line computer printouts of titles of documents which had been identified with the key words or combinations of key

words of interest to the study. After reviewing and omitting certain titles that clearly were not on topics of interest, DRI arranged to have abstracts printed, either on-line or off-line. The abstracts were reviewed by study team members and copies of documents obtained from the University of Denver library (by loan or photocopy), by interlibrary loan, or by purchase from National Technical Information Service, University Microfilms, or publishers.

Scope of Search

The literature search included review of over 300 documents from the Denver Research Institute's Water Resources Library, a collection of books, reports and articles gathered since 1968. About 460 abstracts of documents found in the computer-based literature search were reviewed and approximately 145 books, articles and dissertations were ordered or photocopied.

Categorization of Documents

Many of the documents obtained relate either to methods for determining or evaluating economic benefits, or to one or more specific types of benefits. Accordingly, a complete bibliography of documents considered useful to the present study, or to the proposed Part Three or Part Four study, has been prepared. That bibliography appears as the last subject in this report. Each of the documents has been categorized according to subject matter, and an entry noted in one or more of the columns corresponding to the following categories:

- Benefit evaluation methods
- Fish and wildlife benefits
- Outdoor recreation and tourism benefits
- Irrigation benefits
- Municipal and industrial water supply benefits
- Flood control benefits
- Streambank erosion benefits
- Other benefits

III. EVALUATION OF METHODS FOR DETERMINATION OF BENEFITS

Economic literature, notably writings in welfare economics and natural resource economics, contains descriptions and discussions of a variety of methods used to determine the value of benefits stemming directly or indirectly from an activity or a physical development. This chapter describes several major categories of methods that could be adopted by the State of Nebraska for use in determining fish, wildlife, outdoor recreation and tourism benefits of large water development projects.

The first section of this chapter contains a discussion of criteria proposed by the Denver Research Institute to Nebraska policymakers, for use in evaluating the various methods. These proposed criteria were considered by the Nebraska Natural Resources Commission and the committees which advise the commission concerning this study (Executive Committee and Technical Work Group) during their review of the May 1985 review draft of the Part One and Part Two report. The Natural Resources Commission and its committees did not propose different criteria for evaluation. DRI has included in a later section of this chapter an analysis of how closely the various methods meet these proposed criteria.

The final portion of Section III lists 96 documents from the Categorized Bibliography which deal with one or more of the seven methods for determination of benefits of fish, wildlife, outdoor recreation and tourism described in Section III. Symbols in one or more of the seven columns with the names of methods have the following significance:

S = significant discussion of the method

M = minor comment on the method

O = view opposed to the method

Criteria for Evaluation

The method adopted by the State of Nebraska for determining the value of fish, wildlife, outdoor recreation and tourism benefits can influence significantly which water development projects are selected for funding and construction. The method also can influence how beneficiaries are determined and, perhaps, how costs are allocated among these beneficiaries. Because water resource development has become increasingly controversial in recent years among organized proponents and opponents, the method adopted should be as free as possible from criticism over inequity or bias. Furthermore, because the value of benefits and identification of beneficiaries can affect allocation of costs, the

method should be defensible against charges of unfairness among beneficiaries.

The following criteria are proposed for evaluation of the methodologies:

Credibility. The most important characteristic of the methodology should be its credibility both to knowledgeable professionals (e.g., economists) and to lay observers. To the extent possible, it should be acceptable to proponents and opponents of water development. A key part of credibility is the use of a conservative approach wherever questions arise as to the proper method or proper quantitative information to be used.

Another element of the credibility factor is recognition of interdependency of economic effects. The concern is that in crediting benefits to water development projects, recognition is given to the other contributions (building of roads, provision of labor, supplying of fertilizers to irrigated crops, etc.) which make possible the economic output from the project. This means that in cases where assigning of credit is debatable, the method should be conservative in attributing the economic impact to the water project.

Other aspects relating to the credibility factor is the avoidance of any methodological errors, particularly double counting, and the desirability for the adopted methodology to provide year-to-year consistency of data.

Accuracy. There are several considerations in determining the accuracy of the methodology used to determine the value of benefits. It is fundamental that the methodology include means for estimating future levels of use. This involves projection of demographic changes, e.g., forecasts of population in the age groups that are likely to engage in recreation, within the market area of the facility. Another factor promoting accuracy is the use of direct measures, where possible, rather than indirect measures. The third important aspect of accuracy is the use of net rather than gross measures. In the case of outdoor recreation, for example, it is desirable to measure the additional recreational activity (e.g., lake fishing, swimming) resulting from the development, subtracting the "without project" activity (e.g., stream fishing, river kayaking) which would exist in the absence of the project.

Another factor relating to accuracy of a methodology is its ability to give consistent results regardless of the person who uses it. This means that the procedural steps should be explained in sufficient detail, and standard data sources should be identified, so the results obtained by one user can be replicated by a second user.

Simplicity. It should be relatively easy to gather the data required for the estimate of benefits, particularly since the responsi-

bility for gathering data and preparing the estimate is expected to fall on those preparing proposals for project funding rather than on specialists employed by the State of Nebraska. Thus, it is preferable to use readily available statistical measures rather than to rely upon special data collections and individual judgments.

The methodology should be adaptable to computer calculation, i.e., a simple home computer, to simplify calculations and changes in statistical data.

It is desirable that the data can be updated without disturbing the basic methodology. From time to time, as new data (such as the periodic revisions of the Census of Population) become available, revised calculation factors and data tables should be made available.

Finally, the adopted method should keep the computation time and the level of effort required to a minimum consistent with accuracy and credibility of results.

Comprehensiveness. The method should consider all types of impacts resulting from water projects, and should include all significant impacts. It also should place the magnitude of the impacts in perspective. In other words, it is desirable to know what proportion of the total economic benefits comes from agriculture as compared to recreation and the other specific types of activity. It also is desirable to be able to discuss the nonquantifiable impacts which have qualitative significance, e.g., quality of outdoor recreation activity. For certain types of presentations, for example, it may be desirable to talk about the economic impacts plus certain types of qualitative impacts which are not included in economic calculations. Many environmental considerations will fall in this category, such as preservation of habitat of threatened species.

Ability to distinguish private and public benefits. The method should permit careful distinction between private-good benefits and collective-good benefits.

Consistency of viewpoint. A potentially dangerous source of error and misuse of the data is failure to maintain a consistent viewpoint, which logically should be a state viewpoint rather than a national or local viewpoint. Economic multipliers should be selected with this in mind to avoid distortion of results. For example, if the employment multiplier effect of local spending is included in the benefit estimate, the local economic impacts of a number of projects, when aggregated, are greater than the total state impact. Inconsistency of viewpoint is likely to destroy credibility.

Current Method Used by State of Nebraska

The current method for determining outdoor recreation benefits of water and land resources developments in Nebraska is described in the Nebraska Resources Development Fund Guidelines. Outdoor recreation benefits per visitor day are estimated using a form of travel cost method to establish demand and a fixed market value per visitor day. Travel cost and market value are two of the general methods described in a later subsection of this chapter. The Guidelines do not, however, estimate fish, wildlife, or tourism benefits. That is, they include benefits of recreation relating to fishing and hunting, but not economic benefits accruing from the existence of fish and wildlife, separate from the value of recreation they provide. The Guidelines (p. 25 of the January 1984 revision) state:

> Because of the difficulty of quantifying the economic benefits from fish and wildlife habitat, no method has been developed and benefits claimed will not be allowed.

The method used to estimate outdoor recreation benefits is based upon these implicit assumptions:

a. Demand for outdoor recreation is uniformly distributed throughout the Nebraska population and is directly proportional to the number of persons residing within the recreation market area, i.e., a circular area enclosing the region from where 80 percent of the project's users originate.

b. The proportion of Nebraska residents wishing to participate in a specific outdoor recreation activity, and the average number of days per year in which participation is sought, are reflected in survey data published in the 1979 Nebraska State Comprehensive Outdoor Recreation Plan.

c. The size of the recreation market area is directly proportional to the total land and water area of the development project; and inversely proportional to the population living within 25 miles of the project.

d. The size of the recreation market area is reduced whenever competing recreational facilities exist within 25 miles of the recreation market area of the proposed project. Each competing recreational facility or reservoir has its own recreation market area determined in accordance with the principles of paragraph c, above. When recreation market areas overlap, the overlapping area population is equally shared among those facilities.

e. Whenever a proposed project will supply recreational facilities to meet some or all of the unmet recreational demand of persons living in the recreation market area of the project, benefits

can be counted. The total amount of recreational demand in the recreation market area must be offset by the supply of recreational facilities that already exist in the market area.

f. The benefit of meeting any previously unmet recreational demand can be determined by assigning a fixed value to each recreation day (i.e., visitor day) provided; this value is the same for all types of recreation activity.

The assumptions underlying the Nebraska method for determining benefits of outdoor recreation appear basically sound and parallel generally accepted principles of market research, i.e., that customers tend to gravitate to shopping centers according to a formula that is directly proportional to the size of the center and inversely proportional to the travel time to the center. The calculation of unmet recreation demand also appears to be sound, although it is questionable whether the attraction of a new recreational complex can properly be measured only by the acreage of the land and water area of the project. Such a measure is straightforward and readily calculated, thus procedurally simple to use. However, it ignores the qualitative measures of a recreational facility: scenic attractiveness; relative scarcity of similar types of recreation activity in the region; quality of recreation available, etc. The use of linear measures may well underestimate the attraction of a unique recreational feature that draws recreationists from across the state or from neighboring states.

The formula used by Nebraska to determine the radius of the recreation market area is:

Radius (miles) = (0.009 x total project land and water area in acres) - (0.018 x average population density within 25 miles [persons per sq. mi.]) + 23

The derivation of the formula, and its rationale, are not described in the Guidelines. Nevertheless, the principles appear sound. The Guidelines give helpful instructions for determining population density, i.e., subtract town population from county population to get rural population; assume even density of rural population in each county within the market area circle to get average rural density; then add town population to get total density.

The use of a single value of $2.90 for a recreation day benefit is questionable, both because it is not clearly indexed for inflation and because it seems too low compared with other studies which attribute value per visitor day. (DRI recognizes that the higher values that it proposes on page 30, based on an average of 60 studies, may also be questionable. A more accurate visitor day benefit value would require a specific study of the proposed recreation area.)

Gross Expenditures Method

The gross expenditures method attempts to measure the value of outdoor recreation to the recreationist and of tourism to the community in terms of the total amount spent on the activity by the recreation user. These expenditures usually include travel expenses, equipment costs, and expenses incurred while in the recreation area. The value of fish and wildlife is included as part of the value of outdoor recreation, i.e., fishing or hunting, rather than calculated separately. The gross expenditures method is frequently used by economists to estimate the economic impact of recreation and tourism in a locality.

A basic argument for using the gross expenditures method is that persons making such expenditures must have received commensurate value or they would not have made them. The usual contention is that the value of a day's recreation is worth at least the amount of money spent by a person to experience that recreational activity. However, the method does not attempt to measure the additional value received by the user, i.e., the consumer's surplus. It also tends to undervalue inexpensive outdoor recreational activities such as hiking and swimming.

Another criticism of the method is that it imputes all expenditures (e.g., food) to the value of the recreation activity when in fact purchase of a steak dinner at an expensive restaurant may measure the fisherman's value of a good meal. Gross expenditure data are essential to determining the impact of tourism in a community, but using expenditure data to derive a value of recreation includes expenditures that the visitor would make even if he stayed home.

Expenditure values are useful in indicating the amount of money that is spent on a particular type of outdoor recreation, and thus are a sound measure of direct spending of tourism, but as justification for public expenditure on recreation or for determining the worth or benefit of the recreation opportunity afforded, the gross expenditures method is of little help.

The values of importance are those which show not some gross value, but the net increase in value over and above what would occur in the absence of a particular recreation opportunity. Gross expenditures do not indicate:

1. The value of the losses sustained if the particular recreation opportunity were to disappear, or

2. The net gain in value to current users from an increase in a particular recreation opportunity, i.e., stocking a lake with fish or building a swimming dock.

Cost-Base Method

The cost-base method is based on the assumption that if a facility costs X dollars, its recreational value also must be X dollars. The use of input to measure output is convenient but unconvincing, because of the obvious effect on recreational value of natural setting and other non-cost-related differences. The method was employed between 1950 and 1957 by the National Park Service.

The cost-base method assumes that the value of fish, wildlife, tourism and outdoor recreation is equal to the cost of generating that resource. In some extreme applications a multiple of these costs is used. Since cost is then equal to the value of the resource, any proposed project is justified. This is the main objection to the method.

Recent revelations of extremely high prices charged to the Department of Defense by suppliers of spare parts (e.g., the $7,000 coffee pot, the $400 allen wrench) illustrate that in some limited entry markets, supply and demand forces are distorted and no longer serve to establish fair market prices.

Furthermore, the cost-base method offers no guide in the case of contemplated loss of fish, wildlife, tourism and outdoor recreation opportunities. Also it allows little or no discrimination between relative values of alternative additions.

Methods Based on Willingness to Pay

The total willingness of consumers to pay for a given amount and quality of outdoor recreation (the area under the demand curve) is a relevant measure of recreation value. However, any measurement of effective demand in the current time period or even an attempt to project effective demand in future time periods will not be able to measure option demand or the opportunity effect.

Option demand is that demand from individuals who are not now consumers or are not consuming as much as they anticipate consuming, but who will be willing to pay to perpetuate the availability of the commodities. Opportunity effect derives from the unanticipated increases in demand caused by improving the opportunities to engage in a recreational activity. This acquaints consumers with new and different opportunities, to which they adapt through learning processes.

The major assumptions of this method are: (1) the effective demand is likely to be the predominant component of the aggregate demand for outdoor recreation activities and (2) this quantity can be estimated in a useful way.

The major drawback of this method is the procedure in which the data are collected to determine the area under the demand curve. Does

the procedure involve judgment, such as the market value method, or interviews of persons who are asked to set values on experiences for which no market now exists? These two alternative methods are discussed next.

Market Value Method

The market value method, which has been used by the National Park Service to measure recreational benefits since 1957, is essentially a method of assigning a simulated market value to recreation activity when, in fact, no market value (other than perhaps a daily or seasonal access fee) is established.

The method is based on a measure of a schedule of charges judged to be the market value of the fish, wildlife, or recreation services produced. These charges are multiplied by the expected and/or actual attendance figures to arrive at a recreation value for the services.

Both desirability of recreational activity and price sensitivity vary from individual to individual. How, then, is the market value determined? An attempt is made to calculate the amount which a discriminating monopolist would set as the market price of admission to the recreation activity, if total revenue is to be maximized. Judgment is used to establish the value of each specific type of recreation, considering both favorable and adverse conditions, so that a raise in admission price would drive away recreationist admissions and reduce total revenue, and a drop in admission price would not attract enough new admissions to offset the drop in unit revenue. The National Park Service bases the market value on a price schedule adjusted to allow for associated costs, use of privately owned recreation equipment, and changes in the consumer price index.

The U.S. Water Resources Council accepts the market value method (termed "unit day value" or UDV method) as an acceptable method of evaluating recreation benefits although the council considers it inferior to both the travel cost method (TCM) and the interview method, termed the contingent valuation method (CVM), if TCM or CVM models applicable to the region exist. To promote consistency of establishing market value, the council has established a table (see Exhibit 1) for assigning points to general recreation activity and a table for converting these points to dollar values. The council also has established a second table, used for special or relatively unique recreation activity whose values are lowered by development. It should be noted that the special recreation table gives values four times as great for certain activities for which "a high degree of skill, knowledge, and appreciation by the user may often be involved." Thus a wilderness pack trip or a river canoeing activity may be valued at four times the value of recreation activities associated with water projects such as swimming, lake fishing, and boating. This valuation scheme may reflect an undesirable elitist bias that undervalues widely popular outdoor recreation activity.

EXHIBIT 1. GUIDELINES FOR ASSIGNING POINTS FOR GENERAL RECREATION

Criteria	Judgment factors				
(a) Recreation experience [1]	Two general activities [2]	Several general activities	Several general activities; one high quality value activity [3]	Several general activities; more than one high quality high activity	Numerous high quality value activities; some general activities
Total points: 30 Point value:	0–4	5–10	11–16	17–23	24–30
(b) Availability of opportunity [4]	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 30 min. travel time	One or two within 1 hr. travel time; none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total points: 18 Point value:	0–3	4–6	7–10	11–14	15–18
(c) Carrying capacity [5]	Minimum facility development for public health and safety	Basic facilities to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total points: 14 Point value:	0–2	3–5	6–8	9–11	12–14
(d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site; limited access within site	Fair access, fair road to site; fair access, good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good access within site
Total points: 18 Point value:	0–3	4–6	7–10	11–14	15–18
(e) Environmental quality	Low esthetic factors [6] exist that significantly lower quality [7]	Average esthetic quality; factors exist that lower quality to minor degree	Above average esthetic quality; any limiting factors can be reasonably rectified	High esthetic quality; no factors exist that lower quality	Outstanding esthetic quality; no factors exist that lower quality
Total points: 20 Point value:	0–2	3–6	7–10	11–15	16–20

[1] Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
[2] General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.
[3] High quality value activities include those that are not common to the region and/or Nation and that are usually of high quality.
[4] Likelihood of success at fishing and hunting.
[5] Value should be adjusted for overuse.
[6] Major esthetic qualities to be considered include geology and topography, water, and vegetation.
[7] Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

CONVERSION OF POINTS TO DOLLAR VALUES

Activity categories	Point values										
	0	10	20	30	40	50	60	70	80	90	100
General recreation (Points from Table VIII-3-2)	1.60	1.90	2.10	2.40	3.00	3.40	3.70	3.90	4.30	4.60	4.80
General fishing and hunting (Points from Table VIII-3-2)	2.30	2.60	2.80	3.10	3.40	3.70	4.10	4.30	4.60	4.70	4.80
Specialized fishing and hunting (Points from Table VIII-3-3)	11.20	11.50	11.70	12.00	12.30	13.50	14.70	15.60	16.80	18.00	19.00
Specialized recreation other than fishing and hunting (Points from Table VIII-3-3)	6.50	6.90	7.40	8.00	8.50	9.60	10.60	12.80	14.90	17.00	19.00

Note.—Adjust dollar value for subsequent years to reflect changes in the Consumer Price Index after July 1, 1982.

Source: U.S. Water Resources Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 10, 1983, pp. 84-85.

The method is sound in that it emphasizes the willingness of users to incur expenses to make choices. However, the market for outdoor recreation, fish and wildlife is normally not a commercial one. Except for user fees for admission to a recreation area, there is no commercial market for those services provided publicly. There is to some extent a market for recreational services provided privately. It is in part because private areas are not fully comparable with public areas, i.e., because of controls on overcrowding, that users are willing to pay the fees or charges. Therefore, it is inappropriate to use charges paid for use of a private recreation area to estimate the value of recreational activity on public areas, unless the quality of recreation in both is equal.

Furthermore, the method ignores the satisfaction (i.e., consumer surplus) gained by some recreationists over and above the monopolist-established market value. That is, the simulated market value is set equal to the value received by the least satisfied user who would still pay the admission price, whereas most other users will receive a greater value and would be willing to pay a higher admission. Thus, use of the market value method would underrate the true value received and could result in a bias against recreational use of multipurpose resources.

Interview Methods

The interview method of measuring fish, wildlife, and recreation benefits is based on the premise that in a properly constructed interview accurate information can be obtained on the monetary value which respondents place on a day of recreation activity. Other forms of interview attempt to elicit from recreationists information concerning the maximum price they would pay in order to avoid being deprived of the use of a particular recreation area for whatever use they may make of it. Other interviews have been used to ask nonparticipants, and persons who say they never will participate in recreation activities, what value they receive just from knowing that the recreation area exists.

The argument for the interview method rests on the conception that the recreationist is engaged in the utility maximizing process and has made a rational series of allocations of time and money in order to participate in the activity being evaluated. Since the opportunity itself is available free or at a nominal price, the interview provides the means for discovering the maximum price the person would pay if this opportunity were marketed, other things being equal.

The chief problem in evaluating interview responses is the degree of reliability that can be attached to the information the respondent provides the interviewer. Particularly on questions dealing with matters of opinion, the responses are subject to many kinds of bias.

One possible bias stems from the gaming strategy that a consumer of a public good may pursue. This theory supposes that if a person understates his preference for a good, he will escape being charged as much as he is actually willing to pay before being deprived of the amount of the good he desires. This may be a false issue.[1]

Counterbalancing the possibility that the recreationist may purposely understate his willingness to pay in order to escape charges is the possibility that he may wish to overstate his apparent benefits from public recreation areas to support a case for preserving the area in its current use, e.g., as wilderness or as a free-flowing river.

The problem then is one of phrasing the question to minimize bias from the recreationist. A survey would have to be designed in a way that the recreationist is not to give his opinion on the propriety of charging for the use of recreation areas. A principle in survey methodology is that the less hypothetical and abstract the question, the more realistic and reliable the response. By this principle, the respondent should be a user of the recreation activity rather than a potential user or nonparticipant. Thus the data collected will reflect effective demand rather than potential demand. It may be preferable to impose conditions on the interview that the person being interviewed is engaged in the recreational activity. This may increase accuracy of the response by decreasing the requirement that a person project beyond actual experience.

The U.S. Water Resources Council, in its Principles and Guidelines (pp. 79-83), has published detailed guidelines for the conduct of interview methods (termed "contingent valuation" methods) and considers them acceptable methods which may be applied to a site-specific study or a regional model.

Recent writings by authorities on wildlife valuation[2] recommend the interview method as the preferred one for valuing wildlife. There are several difficulties with wildlife valuation:

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[1]Although it is unwise to draw conclusions from a single example, Denver Research Institute conducted a 1979 survey of Colorado residents asking about alternative ways of financing state parks and recreation areas. A majority of respondents favored alternatives more costly than the pass then in effect.

[2]See, for example, William A. Langford and Donald J. Cocheba, The Wildlife Valuation Problem: A Critical Review of Economic Approaches, Occasional Paper No. 37, Canadian Wildlife Service [n.d.], and William W. Shaw, "Problems in Wildlife Valuation in Natural Resource Management," in George L. Peterson and Alan Randall (eds.), Valuation of Wildland Resource Benefits, Boulder, Colo.: Westview Press, 1984.

- Since wildlife are not exchanged through a market system, other indices of user benefits must be used (e.g., travel cost methods, survey or interview methods).

- There are three major categories of wildlife users, and surveys indicate that they value wildlife differently. These are: (a) direct, consumptive users, such as hunters and fishermen; (b) direct nonconsumptive users, such as birdwatchers and wildlife photographers; and (c) indirect or vicarious users, who do not see the wildlife but obtain value from knowing that ducks and eagles exist in their habitat.

- In multiple resource situations, it is difficult to distinguish consumption, existence and option values of wildlife, or to distinguish the value of the wildlife from the amenity value of the outdoor recreation experience.

Travel Cost Method

The travel cost method of estimating user demand utilizes travel-cost data as a proxy for price in developing a demand curve for recreation facilities. Price-quantity reactions of consumers are found by examining their actual current spending behavior with respect to travel cost. The method can be explained by using a simple, hypothetical example. Assume a free recreation area at varying distances from three cities:

City	Population	Cost of Visit	Visits Made	Visits/1000 Population
A	1,000	$1.00	400	400
B	2,000	$3.00	400	200
C	4,000	$4.00	400	100

The cost of visiting the area includes such items as transportation, lodging and food cost above those incurred if a trip was not made. Each cost varies with distance from the recreation area to the city involved. Consequently, the rate of visits per unit total population of each city would also vary. The visits per unit of population may then be plotted against the cost per visit. Thus the demand curve relates visits as a simple function of cost of visits.

There are several variations to the travel cost method which should be discussed.

The consumers' surplus method creates a hypothetical schedule of economic demand for recreation based on the costs (such as transportation) required for participation in recreation activity. The value of

recreation to the recreationist is estimated from the consumers' surplus (i.e., value received which exceeds costs) calculated by comparing the estimated demand schedule with actual costs of the activity.

One form of the consumers' surplus is the Trice-Wood method. This method determines a unit travel expense per visitor-day, chosen in the range of travel expenses to exceed that of 90 percent of visitors. The 90th percentile travel expense figure is considered to be the typical value per visitor-day to all recreationists in the area. From this figure, the median (50th percentile) travel expense figure is subtracted to obtain an estimate of consumers' surplus over costs received by the typical visitor. The difference in the expense figures is called "free value received." Although this method has been widely accepted, it has certain drawbacks. It is doubtful whether the results are comparable for different recreation sites, let alone comparable with methods of measuring other resource uses. Also, the assumption that individual preference scales are identical has been questioned, as has the assumption that visitors living closer to the recreational site actually obtain a consumers' surplus. Two other criticisms center on the relationship of travel cost per visitor-day to the number of visitor-days, and the arbitrary choice of the 90th percentile as a basis of calculations.

Another form of the consumer's surplus method is the concentric travel zone method proposed by Hotelling. This method establishes concentric zones, centered on the recreation site, from which the recreationists come. The gross benefit to each recreationist is assumed to be the same for a near zone as for a distant zone. The net benefit varies with the differences in transportation costs for each recreationist. The technique is theoretical and to our knowledge has not been directly applied.

The final consumers' surplus method to be considered is the cost-saving method, which measures the recreation benefit of any site as equaling the savings in costs of the recreationists, as compared with costs at an alternative recreation site. Alternate sites are considered to be of equal value to the recreationist--a highly questionable assumption, in view of the evidence of recreationist travel to distant sites.

The monopoly revenue method was proposed by Marion Clawson and has received wide acclaim in the recreation field. The recreation demand schedule is measured by establishing distance zones centered on the recreation site, then plotting the number of participants per 100,000 population in each zone against the total monetary cost per visit from that zone. The value of recreational opportunity is then derived by assuming that the use of the opportunity by users in one distance zone provides a measure of the use that would be made by people in other distance zones if monetary costs were the same. By noting the degree to which usage declines as travel costs (i.e., distance) increase, the effect of charging entrance fees on use can be estimated. As with the previously described market value method, recreation benefits are assumed to equal

the hypothetical fee revenue that would yield the maximum return to the owner of the area (a monopolist). The monopoly revenue method would probably result in a low measure of value from recreational use of resources since it ascribes no benefits to recreation beyond those which would be realized by a monopolist owner.

The discriminating monopoly revenue method is similar to the above except that it allows the monopolist to practice price discrimination (i.e., the entrance fee can vary according to willingness of recreationists to pay). One criticism of both monopoly revenue methods is their exclusion from consideration of the cost of time; another criticism relates to the treatment of potential attractions of other recreational areas along the travel route.

The modified discriminating monopoly revenue method is similar to both methods mentioned immediately above. The method, however, does not require that demand be a linear function of travel cost. Furthermore, it allows factors other than population and travel costs to explain variations in attendance at recreation areas. Two of the more significant factors used to explain variations are population density and mean income of residents. By using counties rather than zones, the method is able to utilize available county socioeconomic data, and offers a potentially greater number of area classifications.

The major difficulty with some of the travel cost methods is the assumption that overcoming the distance factor is only a function of money. In reality, overcoming distances is a function of money, time and the utility of driving. In total, these three factors would be negative, but little is known of the costs of utility and time. However, the summation of utility and time costs probably imposes extra costs in addition to the costs of money. Therefore when applying the travel cost method, the benefit estimate will be somewhat conservative.

The U.S. Water Resources Council considers the travel cost method as one of two preferred methods (the other is the contingent valuation or interview method) for estimating recreation benefits. Detailed guidelines, which include a technique for adjusting for the opportunity cost of travel time, are contained in the Council's Principles and Guidelines (pp. 75-79).

Market Value of Fish Method

This method proposes an estimation of fishing and recreation benefits. It is given by the benefit imputed to sport fishing by a market value of the fish caught. The primary objection to this procedure is the implied definition that the fish alone are the chief objective of the activity. An arbitrary value must be assigned to each species of fish in a particular area. Potential for error of the true value of a fish is very high when arbitrary values are used.

One reason for arbitrary valuation of fish is that no market value exists for some species. State fish and game laws normally bar sales of game fish that are caught by sportspersons. Other species, e.g., trout, can be raised in private hatcheries for sale, but is the value to be based on hatchery cost or retail price of the fish?

Some states establish values for fish that are illegally possessed or are wrongfully killed by environmental damage, e.g., a chemical spill in a river. For example, Colorado Revised Statute 33-6-110 establishes a minimum value of $35 for each game fish unlawfully taken or possessed. The value increases to $700 if the fish is of a threatened species and to $1,000 if an endangered species. The Florida Department of Air and Water Pollution Control establishes fish value tables to assess damages to be recovered in fish kills. Most of the freshwater fish are valued in categories of weight and length, possibly based on dockside value or on hatchery replacement costs. Marine species were given one set price, ranging from $0.25 for silver perch to $500 for a manatee. The techniques used to establish these values are unclear, and the values are based on 1973 prices and have not been updated.[3]

Analysis of Meeting Criteria

The seven methods for determination of benefits, briefly described above, have been compared against the six criteria proposed at the beginning of this section. The comparison is shown in Table 1.

Current Nebraska method. Nebraska's current method scores highly on consistency and simplicity, because of the detailed instructions and standardized data sources provided in the Guidelines. It scores lower on comprehensiveness and credibility because it does not attempt to measure benefits of fish, wildlife and tourism. It is probably unfair to criticize Nebraska for not determining benefits of fish and wildlife resources because the techniques for doing so are controversial and not broadly credible. The Nebraska method also scores low in accuracy because of the low value ($2.90) given to each day of outdoor recreation supplied, compared to values in other outdoor recreation studies.

Gross expenditures method. The gross expenditures method is rated low as a technique for measuring the value of outdoor recreation activity but is rated high as a measure of the direct spending of tourism. By use of an appropriate economic multiplier, the indirect spending on tourism also can be estimated. Ideally, the method requires a survey of users, but when used to estimate future expenditures in a proposed recreation area no user survey is possible. In such cases, it is necessary to rely on past surveys in similar recreation areas after

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[3]Edward J. Yang, et al. [Environmental Law Institute], The Use of Economic Analysis in Valuing Natural Resource Damages. Washington, D.C: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1984, pp. 92-94.

TABLE 1. ANALYSIS OF METHODOLOGIES FOR DETERMINATION OF FISH, WILDLIFE, OUTDOOR RECREATION, AND TOURISM BENEFITS IN MEETING EVALUATION CRITERIA

Methodology	Criteria					
	Credibility	Accuracy	Simplicity	Comprehen-siveness	Consistency	Distinguishes Private and Public Benefits
Current Nebraska Method	+/0 Ignores some benefits (tourism, fish, wildlife).	+/0 Recreation day value is low.	++ Detailed instructions given.	+ Outdoor recreation only.	++ No judgment required.	0 Includes all recreation facilities if demand unmet.
Gross Expenditures	+/0 Does not measure value of recreation activity. ++/+ Does measure direct spending of tourism.	0 Undervalues inexpensive activities; ignores consumers' surplus.	+/0 Requires survey of users.	+ Can be used to measure value of tourism.	0 Varies with techniques and date of survey.	++ Possible to do so.
Cost-Base	0 Uses input to measure output.	+/0 Accurately measure cost but not value.	++ Agency or county records will show original cost.	++/+ If cost data gathered on recreation, tourism, fish stocking, and habitat land.	0 Varies with time of construction and does not measure value.	++ Possible to do so.
Willingness to Pay	++/+ Depends on specific method used.	++/+ Varies with specific method.	+/0 Requires surveys or reliance on past surveys.	++/+ Some specific methods are comprehensive.	+/0 Depends on specific method used; some vary with judgment or survey design.	++/0 Possible to do so with some specific methods, but not others.
Market Value	+ Value based on judgment.	+/0 Varies with judgment of estimator.	+ No survey required, but may be based on past surveys.	+ Outdoor recreation only.	0 Varies with judgment of estimator.	0 No.

(continues)

TABLE 1. ANALYSIS OF METHODOLOGIES FOR DETERMINATION OF FISH, WILDLIFE, OUTDOOR RECREATION, AND TOURISM BENEFITS IN MEETING EVALUATION CRITERIA (Continued)

Methodology	Criteria					
	Credibility	Accuracy	Simplicity	Comprehensiveness	Consistency	Distinguishes Private and Public Benefits
Interview	+ Varies with design of survey questionnaire.	+/0 Subject to respondent biases.	+/0 Requires survey of users or potential users.	++ Can be used to measure value of recreation, tourism, fish, and wildlife benefits.	+ Varies with design of survey questionnaire.	++ Possible to do so.
Travel Cost	++/+ Is widely used as a proxy for price.	++/+ Relates value to cost and recognizes consumer surplus.	+/0 Requires survey of users to determine residence.	++ Can be used to measure recreation, tourism, fish, and wildlife benefits.	+ Depends on specific method used.	++ Possible to do so.
Market Value of Fish Method	0 Based on arbitrary values.	0 Based on arbitrary values and dubious premise.	++ Very simple.	0 Deals only with fish; value tables also exist for some wildlife.	+/0 Depends if arbitrary values are consistently used.	0 No.

Legend: ++ High
+ Medium
0 Low

indexing for inflation. This reliance on past surveys provides for simplicity and consistency of method, at the cost of accuracy. It is possible to distinguish between private and public benefits based on the types and magnitude of expenditures appropriate to each.

Cost-base method. Although it ranks high in simplicity and comprehensiveness, the cost-base method ranks low in credibility and accuracy because it uses input to measure output, assuming that cost is a measure of value. There are better methods available for measuring the economic benefits of outdoor recreation and tourism. A somewhat better case can be made for using the cost-base method to measure the value of fish and wildlife, because of the lack of broad acceptance of other methods. Where losses of fish and wildlife habitat are expected, usual mitigation measures include replacement stocking of fish and the purchase of alternative lands as wildlife habitat using either of two (or a combination of the two) techniques for calculating mitigation needs: Habitat Evaluation Procedures (HEP) or acre-for-acre replacement. In such cases where mitigation is required, the value is assumed to equal or exceed the cost of providing mitigation. Thus the cost-base method provides at least a minimum estimate of the value of replacing fish and wildlife.

Willingness to pay methods. Conceptually, methods that measure users' willingness to pay for outdoor recreation, fish and wildlife provide sound measures of benefit valuation. However, there are several alternative methods for estimating or observing willingness to pay, and these alternatives differ in the degree to which they meet the proposed evaluation criteria.

Market value method. The market value method relies on judgment to assign a simulated market value to recreation activity because no actual market value, other than a daily or seasonal access fee, exists. Because it relies on the judgment of the estimator, the method ranks low in consistency and accuracy. It does not measure the value of fish and wildlife resources, except as they contribute to the value assigned to outdoor recreation, and it does not distinguish between public and private benefits. Credibility is medium; although the method relies on judgment, it is considered by the U.S. Water Resources Council as an acceptable method of evaluating recreation benefits, although inferior to travel cost and interview methods.

Interview methods. Surveys, conducted through personal interviews involving iterative bidding techniques, can be used to value fish, wildlife and recreation benefits. For past or prospective users, interviews can determine spending patterns and thus establish a value for tourism. Interview methods have a middle score on credibility and consistency, which are affected by the design and administration procedure of the survey questionnaire. The methods rank relatively low on accuracy, due to the potential for respondent bias as well as inability of the respondent to place a realistic hypothetical market value on an activity for which no real market exists. The methods are

complex and expensive if a site-specific survey is used. The U.S. Water Resources Council considers interview methods as one of two preferred methods, and suggests use of an existing regional model, where applicable, or development of a regional model or a site-specific survey, using the rigorous survey procedures described in the Principles and Guidelines.

Travel cost methods. Travel cost methods score high on accuracy and comprehensiveness, and fairly high on consistency, depending on the specific method used. They also are highly credible, so long as the costs are limited to out-of-pocket and time costs for travel and entry and use fees, but exclude costs of equipment, food, and lodging. The U.S. Water Resources Council considers travel cost methods one of two preferred methods for valuing recreation benefits. The major drawback to travel cost methods is the complexity and cost of a site-specific survey. If an existing regional model is available, it can be used to estimate use at a proposed site. Alternatively, an existing area with similar geographic, demographic and socioeconomic characteristics can be used as a surrogate for a site-specific study, although at some loss of accuracy and credibility.

Market value of fish method. This method, applicable only to fish and wildlife values, separate from the value of outdoor recreation associated with fish and wildlife, ranks low on accuracy, comprehensiveness and credibility. These deficiencies are not offset by the simplicity of the method.

Recommended Method

There is no single method, of those evaluated, that fully meets the needs of the State of Nebraska in determining benefits of fish, wildlife, outdoor recreation and tourism. Ideally, given sufficient time and financial resources, it would be possible to develop a group of travel cost studies, each covering an existing water-based recreational facility but varying by area of the state, population density, rural/urban location, degree of competition with other recreational areas, variety and quality of recreational activity provided. From this group of travel cost studies, it should be possible to select one with characteristics similar to a proposed new outdoor recreation area and, by experienced judgment and a regional estimator model, to calculate future recreation value benefits.

Similarly, by conducting a group of gross expenditure studies, each covering an existing recreational facility, it should be possible to select one that could be used to calculate gross recreationist expenditures in the market area of the facility and to distinguish day-user expenditures from tourist expenditures. From this information, and through use of an appropriate economic multiplier, the economic impact of tourism in the market area of the facility can be determined.

Finally, a statewide interview survey using contingent valuation methods could be conducted to determine the value placed by Nebraskans living in various areas of the state on fish and wildlife, in consumptive use, direct nonconsumptive use, and indirect or vicarious use. Such information could be used to value changes in fish and wildlife populations, and preservation of nongame fish and wildlife.

Denver Research Institute assumes that the resources for such studies and surveys are not now available and may not become available during the future period in which benefit estimation is needed. Even if they were, it is questionable whether funding applicants would have the expertise and objectivity to develop estimates of these benefits. Requiring state agency (e.g., NRC) personnel to develop the estimates based upon applicant descriptions of changes in recreation activity appears undesirable.

None of the methods for valuing fish and wildlife, separate from the outdoor recreation associated with them, appears sufficiently credible to DRI to justify their use. Should a comprehensive statewide interview survey be conducted, the results could be used in the future to provide supplementary evidence of benefits or disbenefits to qualify the calculation of quantitative benefits of outdoor recreation and tourism.

Denver Research Institute recommends a new method borrowing heavily from the existing method described in the Nebraska Natural Resources Fund Guidelines, but modifying it in several ways to:

- Consider net values of outdoor recreation days, i.e., subtracting recreation days lost from new recreation activity days supplied.
- Consider the consumer surplus value received by residents living near the site, i.e., day users, versus the users in the outlying parts of the market area.
- Distinguish recreation value received by users from the economic benefits of tourism based on direct and indirect spending by tourists, which would be determined from other studies.
- Distinguish the local and regional impacts of tourist spending from the smaller amounts which day-users spend, and which would largely be spent in the locality whether or not engaged in recreational activity, i.e., spending transfers.
- Choosing a more reasonable, yet defensible value of a recreation day, based on travel cost, value of travel time and consumer surplus principles.

The recommended method begins with the determination of the recreation market area of the proposed facility. This would be done in the same way as described on pages 25-26 of the Guidelines. Similarly,

market area circles for all competing recreation projects would be determined and drawn on a map, as described on page 26. Next, the supply and unsatisfied demand of recreation activity days is determined as described on pages 26-29 of the Guidelines, except for the value per recreation day.

Before computing the value per recreation day, any losses of recreation activity days must be calculated. This includes, for example, losses of stream fishing, river kayaking, or other recreation activities lost because of the construction of the proposed project. These losses should be noted and calculated as losses unless the supply of such recreation continues to exceed the demand in the market area following the loss.

In the absence of a travel cost survey applicable to the site, the travel cost should be calculated as follows:

a. The actual road mileage from the recreation site to the perimeter of the market area, passing through the largest population center in the market area, should be determined. It should be divided by two, to establish the mid-point of the area.

b. This mileage should be multiplied by the average variable cost for operating an automobile. Rather than using the average cost per mile figures of the U.S. Department of Transportation (which are not annually updated) suggested in Principles and Guidelines, DRI proposes the annually updated cost per mile allowed by the IRS for voluntary charitable driving (9¢ per mile for 1984).

c. This figure should be doubled for round trip driving and divided by 2.5 persons per car. This gives the travel cost for persons living at the mid-point of the market area radius, which is proposed as the value of a recreation day for all persons using the site. It should be noted that many site visitors, i.e., those living closer than the mid-point of the market area, receive a consumer surplus because their travel cost is less than those living farther away. Persons visiting the site but living outside the market area perimeter, i.e., 20 percent of users, pay a travel cost substantially in excess of the cost used to determine value.

d. The actual round trip driving time from the mid-point of the market area to the recreation site, passing through the largest population center in the market area, should be determined. This is the same route used in (a) above.

e. This round trip driving time (in hours) should be multiplied by the value of the gross state product per hour per capita to

arrive at a value for the travel time. Gross state product per hour per capita is derived as follows:

1. Determine annual per capita personal income for Nebraska ($10,940 in 1983).

2. Multiply by 1.25 to approximate annual per capita state product. (This is analogous to Gross National Product, which annually is about 1.25 times Personal Income.)

3. Divide by 2000 (50 weeks at 40 hours) to obtain gross state product per hour per capita. This would be $6.84 for Nebraska in 1983.

The use of gross state product per hour per capita to measure the value of time spent in driving to a recreation area is somewhat analogous to the Gross National Product method of valuing the benefits of recreation to economic welfare according to its contribution to GNP. The Ripley method, one of two variations of this approach, measures the impact of recreation on the productive efficiency of individuals by assuming that the value of a day spent in recreation is equal to gross national product per day per capita.[4]

Because the gross state product per hour per capita value applies to all Nebraska residents regardless of age or participation in the work force, it can be applied to all recreationist travel to the site.

To illustrate, assume that the market area has a 50-mile radius, and that a party of five persons living on the mid-point of the radius, i.e., 25 miles from the site, drive 50 miles round trip in two cars in one hour for a one-day recreational trip. This would give a combined travel cost and time cost calculation as follows:

Travel cost, 2 cars x 50 miles @ 9¢	= $ 9.00
Time cost, 5 persons x 1 hour x $6.84	= 34.20
Combined travel and time cost, 5 persons	= 43.20
Travel and time cost per recreation day	= $ 8.64

For determining the economic benefits of tourism, a different calculation is made. A day-user market area circle is to be drawn with a radius of 25 miles from the recreation area. It is assumed that users coming from outside this area, beyond 25 miles, are tourists rather than day users. (This is an arbitrary judgment, since some persons living closer than 25 miles may wish to stay overnight for a multiday boating or fishing trip, and some persons living more than 25 miles away may be

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[4]The Ripley method is not among the methods compared earlier in this chapter because it appears to the authors to lack sufficient merit to be included.

day users.) The spending by day-users (i.e., those living within a 25-mile radius of the site) is assumed to be a transfer rather than new spending in the locality. In the absence of an origin-destination study applicable to the area, calculate the population living within the 25-mile radius and subtract it from the population living elsewhere in the market area (the ring) after sharing population with competitive market areas as described on pages 25-26 of the Nebraska Resources Development Fund Guidelines.

Next, calculate the number of tourist recreation days as follows:

$$\frac{\text{Population of Ring}}{\text{Population of Market Area}} \times \text{Recreation activity days supplied to meet unmet demand}$$

Next, multiply the number of tourist recreation days times a value for daily direct tourist spending. In the absence of a gross expenditures study applicable to the site, Denver Research Institute proposes using the value of $20.51. This is the average value of tourist and day-user expenditures, other than transportation, for a day of recreation as determined from an array of 60 studies shown in Table 2. These expenditures include both local and nonlocal spending and have been indexed to the fourth quarter of 1984 by Denver Research Institute, using the GNP implicit price deflator of the U.S. Department of Commerce.

By comparison, a less conservative value of $43.20 per visitor-day expenditure, which probably included transportation, was established in 1967 by Swanson, based on nine studies of tourist expenditures while visiting national parks. These were first indexed to 1967 values by Swanson,[5] then updated to the fourth quarter of 1984 by Denver Research Institute, using the GNP implicit price deflator of the U.S. Department of Commerce.

The final element of the calculation of the economic benefit of tourism is to calculate indirect impact by choice of an appropriate multiplier. Although Swanson proposes a multiplier of 2.5 as best representative of the nation, a multiplier of 2.3 appears more appropriate for Nebraska, based on two earlier studies by the University of Nebraska. The Economic Impact of Irrigated Agriculture on the Economy of

[5]Ernst W. Swanson, Travel and the National Parks: An Economic Study, Raleigh, North Carolina: North Carolina State University, 1969.

TABLE 2. DAILY TOURIST AND DAY-USER RECREATION EXPENDITURE OTHER THAN TRANSPORTATION FROM EARLIER STUDIES

State	Source	Date	Total Daily Recreation Expenditure (Less Transportation)	GNP Implicit Price Deflator	Expenditures in Current $ (1984)**
Colorado	DRI-Horsetooth	1969	.62	86.79	1.61*
Wyoming	Flaming Gorge Reservoir Study	1965	2.07	74.36	6.29*
Colorado	DRI-Shadow Mountain, etc.	1969	2.25	86.79	5.86*
Washington	Olympic Nat'l. Park Study	1968	3.21	82.54	8.79
Virginia	Copeland in Travel Trends	1964	3.25	72.77	10.09
Louisiana	Travel Trends	1966	3.51	76.76	10.33
Arizona	Organ Pipe Cactus Nat'l. Park	1970	2.50	91.45	6.18*
Alabama	Travel Trends	1967	3.47	79.06	9.91
Wyoming	Teton County Study	1964	3.90	72.77	12.11*
Arkansas	Travel Research	1960	4.13	68.70	13.58
Washington	Travel Trends	1964	4.00	72.77	12.42
North Carolina	Dare County Study	1965	5.24	74.36	15.92
Arkansas	Travel Trends	1964	4.47	72.77	13.88
Tennessee	Travel Trends	1967	4.50	79.06	12.86
Kansas	Travel Trends, Travel Research	1956	3.65	62.79	13.13

(continues)

TABLE 2. DAILY TOURIST AND DAY-USER RECREATION EXPENDITURE OTHER THAN TRANSPORTATION FROM EARLIER STUDIES (Continued)

State	Source	Date	Total Daily Recreation Expenditure (Less Transportation)	GNP Implicit Price Deflator	Expenditures in Current $ (1984)**
Florida	Biscayne Bay Study	1967-1968	5.59	79.06	15.97
Oklahoma	Travel Trends, Travel Research	1961	4.23	69.33	13.78
North Dakota	Travel Trends, Travel Research	1962	5.16	70.61	16.51
Minnesota	Travel Trends, Travel Research	1958	5.28	66.04	18.06
Michigan	Travel Trends	1964	5.48	72.77	17.01
Georgia	Travel Trends	1965	5.58	74.36	16.95
Missouri	Travel Research	1959	5.32	67.60	15.20
New Jersey	Travel Trends	1967	6.89	79.06	19.69
West Virginia	Travel Trends	1966	5.99	76.76	17.63
Texas	Travel Research	1963	5.49	71.67	17.30
New Mexico	Marplan	1967	4.62	79.06	13.20
South Dakota	Travel Research	1961	5.95	69.33	19.39
Washington	Travel Research	1959	5.74	67.60	19.18
South Dakota	Travel Trends	1965	5.19	74.36	15.77
Montana	Travel Trends	1964	6.24	72.77	19.37

(continues)

TABLE 2. DAILY TOURIST AND DAY-USER RECREATION EXPENDITURE OTHER THAN TRANSPORTATION FROM EARLIER STUDIES (Continued)

State	Source	Date	Total Daily Recreation Expenditure (Less Transportation)	GNP Implicit Price Deflator	Expenditures in Current $ (1984)**
Colorado	DRI Tourism & Skiing	1968	7.09	82.54	19.40
Texas	Travel Trends	1967	6.76	79.06	19.32
Idaho	Travel Trends	1966	7.03	76.76	20.69
Colorado	Travel Trends	1967	6.91	79.06	19.74
Nebraska	Rec. Aspects of 3 Neb. Lakes	1959	6.00	67.60	20.05
Arkansas	Buffalo Nat'l. River	1968	7.09	82.54	19.40
Colorado	Travel Research	1962	7.05	70.61	22.55
Connecticut	Travel Trends	1966	8.60	76.76	25.31
Montana	Travel & Nat'l. Parks	1962	6.73	70.61	21.53
Montana	Travel Trends	1962	6.54	70.61	20.92
California	Travel Trends	1966	8.20	76.76	24.13
New Mexico	Travel Trends	1965	8.90	74.36	27.04
Utah	Travel Research	1959	10.91	67.60	36.46
Iowa	Travel Trends	1967	10.87	79.06	31.06
Missouri	Travel Trends	1966	11.61	76.76	34.17
Utah	Travel Trends	1965	10.20	74.36	30.99
Arizona	Travel Trends	1964	9.96	72.77	30.92

(continues)

TABLE 2. DAILY TOURIST AND DAY-USER RECREATION EXPENDITURE OTHER THAN TRANSPORTATION FROM EARLIER STUDIES (Continued)

State	Source	Date	Total Daily Recreation Expenditure (Less Transportation)	GNP Implicit Price Deflator	Expenditures in Current $ (1984)**
Nevada	Travel Trends	1963	14.57	71.67	45.92
Florida	Travel Research	1963	14.36	71.67	45.26
Florida	Biscayne (whole trip)	1967-1968	14.49	79.06	41.40
Florida	Travel Trends	1965	14.75	74.36	44.81
Alaska	Travel Trends	1964	8.55	72.77	26.54
Pennsylvania	Travel Trends	1967	14.28	79.06	40.80
Hawaii	Travel Research	1962	30.00	70.61	95.98
Hawaii	Travel Trends	1967	35.07	79.06	100.21
Average of all 65 studies					$19.42
Average of 60 studies that included both local and nonlocal spending					$20.51

*Includes local spending only.

**Fourth Quarter 1984 GNP Implicit Price Deflator is $225.90.

Nebraska[6] (1968) used a multiplier of 2.29, while The Community Economic Base and Multiplier[7] (1958) used a range from 2.2 to 2.4.

More recent thinking on economic multipliers has tended toward greater conservatism in the size of multipliers than was true in the 1950s and 1960s. This is partly true because of recognition that some local and regional economies have underused capacity so that secondary rounds of capital spending are smaller than would be true with economies operating at full capacity.

Nonetheless, Denver Research Institute does not know of more recent economic base studies or input-output studies dealing with Nebraska than those cited above, and cannot justify an arbitrary reduction of the multiplier. It must be noted that DRI has treated all local spending of persons living within 25 miles of the recreational site as a transfer, not recreational spending. This adds conservatism. Palmer, on the other hand, makes a case for including the spending of local residents who visit recreational lakes, even though he notes that "few local visitors camp or take lodging near the lakes; many even bring their lunches from home." He argues:

> There is some further question concerning the local visitors. If they did not spend money on recreation with respect to the lakes, would they not spend it locally in any event? This is to say, are the expenditures by local visitors an independent economic resource, or merely a diversion from other local expenditures? A partial answer is that recreational and vacation-type expenditures, whether their source is local or nonlocal, are wandering dollars. If they were not spent locally, for recreation, they would be likely to be spent elsewhere for the same purpose. This provision does not apply with the same force if we consider the lakes as having developed a demand for recreation among the local population, which would not have existed had the lakes not been built. Under this assumption, the case for diversion of funds from one local expenditure to another is clearer.[8]

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[6]Theodore W. Roesler, F. Charles Lamphear, and M. David Beveridge. The Economic Impact of Irrigated Agriculture on the Economy of Nebraska. Nebraska Economic and Business Reports Number 4. Lincoln, Nebraska: University of Nebraska, Bureau of Business Research, 1968.

[7]Edgar Z. Palmer, et al., The Community Economic Base and Multiplier, Lincoln, Nebraska: University of Nebraska Business Research Bulletin No. 63, 1958, cited in Edgar Z. Palmer, Recreational Aspects of Three Nebraska Lakes, Community Study No. 3, Studies in Community Economics, Lincoln, Nebraska: University of Nebraska, 1960.

[8]Palmer, Recreational Aspects of Three Nebraska Lakes, op. cit., pp. 74-75.

To summarize, the complete calculation of economic benefits of tourism involves multiplying the annual number of tourist recreation days times the daily direct total spending per tourist recreation day (i.e., $20.21 in the fourth quarter of 1984) indexed to the current time by use of an inflation index such as the GNP implicit price deflator. This gives annual direct economic benefit.

Secondary economic benefits are estimated by use of an employment multiplier. For Nebraska, we suggest a multiplier of 2.3, meaning that for each dollar spent in basic industry, e.g., recreation and tourism businesses, another $1.30 is spent in derivative industries that supply goods or services to the basic industry. Examples are construction, wholesale food and beverage suppliers, and boat and sporting goods retailers, wholesalers and manufacturers. Thus annual secondary economic benefit is 1.3 times annual direct economic benefit.

DOCUMENTS RELATING TO FISH, WILDLIFE, OUTDOOR RECREATION, AND TOURISM BENEFITS

Documents	Gross Expenditures Method	Market Value Method	Cost Base Method	Methods Based on Willingness to Pay	Interview Method	Travel Cost Method	Market Value of Fish Method
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IV. APPLICATION OF COMPARATIVE METHODS OF BENEFIT EVALUATION TO SELECTED NEBRASKA WATER PROJECTS

The original study plan proposed that certain existing water resource projects would be selected by the study team in consultation with the study coordinator based on the availability and comprehensiveness of pre-project projections of economic benefits of fish, wildlife, outdoor recreation, and tourism. After selection, original benefit projections would be compared to benefit projections developed by using certain of the identified methodologies, including Nebraska's current method if it was not the method originally used.

Only one group of projects has been found in which a comparison could be made between: (1) the original preconstruction planning report that projected future recreational benefits, and (2) a subsequent economic study that determined actual recreation use and calculated recreational benefits according to a form of gross expenditures method. This comparison of recreational benefits of Enders Reservoir, Harry Strunk Lake, and Swanson Lake in southwestern Nebraska is made in the next major subsection.

Two other more recent Nebraska water projects with recreational features are analyzed in the two subsequent subsections. These are the Long Branch Watershed, on tributaries of the Nemaha River in southeastern Nebraska, and the Willow Creek Dam and Recreation Project near Pierce in northeastern Nebraska. For each of these projects, recreational use was projected in the respective applications for Nebraska Resources Development Fund grants. For comparison, the recreational benefits have been separately calculated for these uses by applying (1) the current methods used by the State of Nebraska, and (2) the recommended method.

Case Study I: Willow Creek Project

Comparison of Nebraska Resources Development Fund Guidelines approach to measuring benefits and DRI's method for assessing economic benefits as applied to the Willow Creek Project.

Guidelines approach. **Step 1: Population.** Based on a population of 167,165 in recreation market area (page A-26 of Willow Creek).

Step 2: Beach swimming.

167,165	Population as defined in Step 1
x .286	Proportion of population participating (Attachment 14 of Guidelines)
47,809	
x 12.2	Participation rate (Attachment 14)
583,270	Activity days of demand in recreation market area
x .40	Percent of activity on peak days (Attachment 15)
233,308	Activity days on peak use days

$$\frac{233,308}{(12)(2.5)(2.5)} = 3,111 \text{ (Attachment 15)}$$

3,111 equals the number of parties (groups) within the recreation market area expected to use beach swimming facilities on peak use days.

$\frac{3,111}{174}$ = 17.88 acres of beach required in the recreation market area (Attachment 15)

30 percent of the parties are in or on the water, thus 17.88 acres x 70 percent = 12.516 acres of beach needed.

3,111	Parties
x .30	Percent of parties in the water (Attachment 15)
933	Parties in the water
x 250	Square feet of surface water per party (Attachment 15)
233,250	Gives total square feet of surface water needed, which needs to be divided by square footage per acre

$\frac{233,250}{43,560}$ = 5.35 total acres of surface water needed for beach swimming

Therefore, 12.516 acres are needed for beach area and 5.35 acres of water are needed for swimming.

Step 3: Picnicking.

167,165 Population as defined in Step 1

x .635 Proportion of population participating (Attachment 14)

106,150

x 7.2 Participation rate (Attachment 14)

764,280 Activity days of demand in area of primary influence

x .60 Percent of activity on peak use days

458,568 Activity days on peak use days

$\frac{458,568}{(21)(4)(2)}$ = 2,730 parties on peak days (Attachment 15)

Therefore, 2,730 tables are needed.

Steps 4 and 5: Activity days.

From page A-34 of the Willow Creek report there are 130,500 total swimming activity days and 224,000 total activity days for picnicking.

Add the activity days together:

Beach swimming	130,500
Picnicking	224,000
Total	354,500

$\frac{354,500}{2}$ = 117,250 total recreation days

177,250

x $2.90 Value per recreation day (page 29 of Guidelines)

$514,025 Total annual recreation benefits

DRI approach.

177,250 Recreation days

x $4.49 Value per recreation day (based on 13-mile distance from site to mid-point of market area)

$795,853

Tourism benefits.

$\frac{\text{Population of ring}}{\text{Population of market area}} = \frac{30,257}{167,165} = 0.181$

0.181 x 177,250 recreation days x $20.51 value per tourism day x 2.3 multiplier = $1,513,416.

Total recreation benefits	$ 795,853
Total tourism benefits	1,513,416
Total annual benefits	$2,309,269

Case Study II: Nemaha-Long Branch Project

Comparison of Nebraska Resources Development Fund Guidelines approach to measuring benefits and DRI's method for assessing economic benefits as applied to the Nemaha-Long Branch Project.

Guidelines approach. **Step 1: Population.** Based on a population of 67,000 in recreation market area (page 11 of Watershed Work Plan of Project).

Step 2: Beach swimming.

67,000	Population as defined in Step 1
x .286	Proportion of population participating (Attachment 14)
19,162	
x 12.2	Participation rate (Attachment 14)
233,776	Activity days of demand in recreation market area
x .40	Percent of activity on peak days (Attachment 15)
93,511	Activity days on peak use days

$\frac{93,511}{(12)(2.5)(2.5)}$ = 1,247 (Attachment 15)

1,247 equals the number of parties (groups) within the recreation market area expected to use beach swimming facilities on peak use days.

$\frac{1,247}{174}$ = 7.167 acres of beach required in the recreation area (Attachment 15)

30 percent of the parties are in or on the water, thus 7.167 acres x 70 percent = 5.017 acres of beach needed.

1,247 Parties

x .30 Percent of parties in the water (Attachment 15)

374.1 Parties in the water

x 250 Square feet of surface water per party (Attachment 15)

93,525 Gives total square feet of surface water needed, which needs to be divided by square footage per acre

$\frac{93,525}{43,560}$ = 2.147 total acres of surface water needed for beach swimming

Therefore, 5.017 acres needed for beach area, and 2.147 surface acres of water are needed for swimming.

Step 3: Picnicking.

67,000 Population as defined in Step 1

x .635 Proportion of population participating (Attachment 14)

42,545

x 7.2 Participation rate (Attachment 14)

306,324 Activity days of demand in area of primary influence

x .60 Percent of activity on peak days

183,794 Activity days on peak use days

$\frac{183,794}{(21)(4)(2)}$ = 1,094 parties on peak days (Attachment 15)

Therefore, 1,094 picnic tables are needed.

Steps 4 and 5: Activity days. Beach swimming:

1,247 Parties per acre of beach

x 75 Peak day use factor (12 x 2.5 x 2.5)

13,050 Activity days on peak use days

$\frac{13,050}{.40}$ = 32,625 total swimming activity days (Attachment 15)

Picnicking:

30 Tables supplied

x 168 Peak day use factor (21 x 4 x 2)

5,040 Activity days on peak use days

5,040 / .60 = 8,400 activity days for picnicking (Percent activity on peak days [Attachment 15])

Add the activity days together:

Beach swimming	32,625
Picnicking	8,400
Total	41,025

41,025 / 2 = 20,512.5 total recreation days

20,512.5

x $2.90 Value per recreation day (page 29 of guidelines)

$59,486 Total annual recreational benefits

DRI approach.

20,512.5 Recreation days

x $7.60 Value per recreation day (based on 22-mile distance from site to mid-point of market area)

$155,895

Tourism benefits.

$$\frac{\text{Population of ring}}{\text{Population of market area}} = \frac{10,196}{67,000} = .152$$

0.152 x 20,512.5 recreation days x $20.51 value per tourism day x 2.3 multiplier = $147,081.

Total recreation benefits	$155,895
Total tourism benefits	147,081
Total annual benefits	$302,976

Comparison Of:

- Recreational Aspects of Three Nebraska Lakes by Edgar Z. Palmer, December 1960; and

- Bureau of Reclamation, Frenchman Cambridge Study, including:

  - "Recreational Planning Report for Swanson Lake-Trenton Dam, Frenchman Cambridge Division, Republican River, Hitchcock County, Nebraska," April 1951.

  - "Recreational Planning Report for Alternate Recreational Site, Medicine Creek Reservoir in the Cambridge Unit-Frenchman Cambridge Division, Nebraska," June 1950.

  - "Project Report on Recreational Potentialities of the Enders Reservoir, Frenchman Creek, Chase County (revised edition), Nebraska," December 1950.

The comparison of these two reports shows that the original Frenchman Cambridge (1950-1951) study estimated 33,380 annual visitor days, whereas the follow-up study, Recreational Aspects of Three Nebraska Lakes (1960), shows 97,684, or approximately three times the number.

Recreational Aspects of Three Nebraska Lakes. This study was concerned with Harry Strunk Lake in Frontier County, damming Medicine Creek; Swanson Lake in Hitchcock County, damming the Republican River; and Enders Reservoir in Chase County, damming Frenchman's Creek. A brief summary of the report follows:

Over a period of one year, visitors may spend some 171,000 visitor days at Enders, Swanson, and Strunk lakes in southwest Nebraska. Of these, 98,000 visitor days are accounted for by visitors who actively participate in recreation, while the remainder are sightseers who stop to look. Excluding sightseers and accounting for duplication due to persons staying more than one day and persons making repeated visits, about 71,000 persons annually make visits to the three lakes.

The study cites the Colorado value per visitor day as $8 (in 1960 or earlier dollars). The three lakes are in a region very close to Colorado, thus the $8 figure should not be too erroneous. However, since most visitors are passing through and not settling down to spend their vacation at the three lakes, the figure is halved to $4 per visitor day.

The study then takes for lake area visitors a 25-mile average distance to arrive at a $4 average, roundtrip automobile cost (50 miles x 8¢ per mile). In addition, $6 is allotted for other costs of the trip. This is applied on a group basis and amounts to $10 per group, or about $3 per person, as compared to $4 for nonlocal users.

The estimated number of visitors per year are shown in the following table.

ESTIMATED NUMBER OF VISITORS PER YEAR

Item	Total	From Lakes Area	Other
Total, including sightseers	171,000		
Persons visiting, excluding sightseers	97,711	65,935	31,776
Groups visiting	29,518	19,919	9,599
Unduplicated visitors	70,748	38,972	31,776
Unduplicated groups	21,374	11,774	9,599
Visitors By Lake			
Enders Reservoir	31,130	20,348	10,782
Swanson Lake	30,640	20,707	9,933
Strunk Lake	35,914	24,880	11,061
TOTAL ANNUAL VISITOR DAYS	97,684		

Frenchman-Cambridge Study. The Frenchman-Cambridge study was a proposal for the construction of three water projects. A highlight of the findings is presented.

Enders Reservoir.

- Estimated to be of local significance only.
- Estimated by 1960: 9,800 annual visitor days.
- Estimated total recreational benefits: $826,000

Swanson Lake.

- Estimated benefits specifically arising from development of recreational facilities: $696,000.
- Estimated joint use benefits: $696,000.
- Total recreational benefits: $1,392,000.
- Estimate 10,500 visitors days within average 25-mile zone.
- Estimate 2,000 visitor days from outside of zone.

- Total estimate equals 12,500 visitor days per year.

Medicine Creek.

- Estimated total recreational benefits: $510,000.
- Annual visitor attendance within 25-mile zone: 10,000.
- Annual visitor attendance outside 25-mile zone: 1,000.
- Total annual visitor days: 11,000.

The total area annual visitor days is estimated to be 33,380.

V. METHODS FOR THE ALLOCATION OF PROJECT COSTS

Introduction

This section of the report discusses the three best-known methods for allocation of water development project costs. Criteria are proposed for evaluating these methods, followed by a discussion of the degree to which the three methods meet each criterion. Following the discussion, DRI recommends the method of cost allocation believed most appropriate for Nebraska.

Next, the related topic of cost sharing is introduced. (See definitions below.) The policies of several U.S. government and state agencies are compared in a series of tables.

Definitions

The terms used in this section of the report are defined here. In the case of cost allocation and cost sharing, which are related but not synonymous, definitions are given from two separate sources: U.S. Soil Conservation Service and Prof. James C. Loughlin.

> Cost Allocation (SCS). Pertains to works of improvement serving more than one purpose. It is the process whereby the cost of the structure is divided equitably among the purposes served, with each purpose receiving its fair share of the advantage resulting from the multipurpose installation.
>
> Cost Allocation (Loughlin). Pertains to the distribution of total project costs among the various purposes served by the project.
>
> Cost Sharing (SCS). The division of the cost allocated for each purpose to the financing agencies or groups involved.
>
> Cost Sharing (Loughlin). Reimbursement policy that dictates what portion of project costs will be shared by federal and nonfederal entities.

Alternate cost. The alternate cost for each purpose is defined as the cheaper cost of achieving the same or equivalent benefits in single purpose structures that will accrue to each purpose in the multiple-purpose structure. The least costly alternative single purpose means of providing benefits equivalent to those provided by each purpose in the multiple-purpose structure should be used in cost allocation. The alternative should be real in the sense that it can be built and if built would produce equivalent benefits.

Separable cost. The separable cost for each project purpose is the difference between the cost of a multiple-purpose structure and the cost of the structure with that purpose omitted. In calculating separable costs, each purpose should be treated as if it were the last increment of a multiple-purpose project. This calculation will show the added costs of increased size, changes in design, or other factors that would be necessary to add the purpose to the project.

Specific cost. The specific cost for each project purpose consists of the cost of facilities that exclusively serve only one project purpose. Special outlet works needed for irrigation or municipal water supply, but not needed for flood prevention, is an example of this kind of facility. All readily identifiable costs of facilities which are clearly for one purpose only should be assigned as specific costs wholly to that purpose in the allocation process. Thus care should be taken to make sure that all specific costs are properly assigned to each purpose.

Joint cost. Joint cost is the difference between the cost of the multiple-purpose structure and the sum of the separable costs for each purpose. When the estimate of separable costs cannot be made or is unduly burdensome to make, joint costs may be considered to be the difference between the multiple-purpose cost and the sum of the specific costs for each purpose.

Separable Costs-Remaining Benefits Method

This method assigns to each function the separable costs of including the function in the multiple-purpose development, plus a share of the joint or common costs of the project. Joint costs are allocated on the basis of the remaining benefits accruing to each function.

The example (Table 3 on the following page) assumes that total project costs (row 7) amount to $350,000 on an average annual basis, which includes investment cost, operation, maintenance, and replacement costs. Benefits, alternative costs, justifiable costs, separable costs, and joint costs are also expressed on an average annual basis. Justifiable costs (row 3) are either the benefits or the alternative costs of single-purpose projects providing the same benefits, whichever is the lesser. Justifiable costs can be interpreted as the maximum costs that an investor would be willing to pay to obtain a certain amount of benefits.

Separable costs (row 4) are the difference between the cost of the multiple-purpose project with the purpose included and the cost without, and they are subtracted from justifiable costs to arrive at remaining benefits. Separable costs include not only the specific costs of including the purpose, such as power turbines, transmission lines, irrigation ditches, and navigation locks, but also the added costs of a change in the size or design of the structure from inclusion of the purpose. For example, the separable cost of recreation would include

TABLE 3. SEPARABLE COSTS--REMAINING BENEFITS METHOD OF COST ALLOCATION (In 000s)

Item	Description	Purpose A	B	C	D	Total
1.	Benefits	140	100	150	100	490
2.	Alternative costs	100	120	100	130	450
3.	Justifiable costs (lesser of 1 or 2)	100	100	100	100	400
4.	Separable costs	80	50	20	0	150
5.	Remaining benefits (3 - 4)	20	50	80	100	250
6.	Allocated joint costs*	16	40	64	80	200
7.	Total allocated costs (4 + 6)	96	90	84	80	350
8.	Allocated savings (3 - 7)	4	10	16	20	50
9.	Percent allocated savings	8	20	32	40	100
10.	Cost of project combining all other purposes (project cost - 4)	270	300	330	350	---
11.	Justifiable costs combining all other purposes**	270	300	300	300	---
12.	Savings from purpose inclusion (3 + 11 - project cost)	20	50	50	50	170
13.	Percent savings from purpose inclusion	13%	29%	29%	29%	100%

*Total joint cost of $200 (project cost of $350 minus total separable cost of $150) is allocated to each purpose in the same ratio as that of the remaining benefits of each purpose to the total remaining benefits, i.e., for purpose A: $16 = ($20/250) x $200.

**The justifiable costs combining all other purposes are either the cost of a project combining all other purposes (row 10) or the sum of the justifiable single-purpose costs for all other purposes (row 3), whichever is the lesser.

the boat docks plus the cost of increasing the height of the dam to provide for adequate recreational water.

Joint costs (row 6) are the difference between total project costs and total separable costs and are distributed among each function in the same proportion as that of the remaining benefits of each function to the total remaining benefits. Total allocated costs for each purpose (row 7) are arrived at by adding separable costs and allocated joint costs. The benefit-cost ratio for the entire project is 1.4 (row 1 divided by row 7), indicating an economically feasible project.

The savings allocated to each purpose (row 8) from combining the purposes in a multiple-purpose development are the difference between the justifiable costs for each purpose and the total costs for each purpose. Total allocated savings from multiple purpose development amount to $50,000. These savings arise because the average cost of space in larger reservoirs is lower than that in smaller reservoirs and because the same storage space in multiple-purpose reservoirs may be used for two or more functions. The first savings arise from a more efficient use of a given site, while the second results from more efficient use of existing facilities.

Alternative Justifiable Expenditure Method (Specific Costs-Remaining Benefits Method)

This method differs from the Separable Costs-Remaining Benefits Method only to the extent that specific costs are used rather than separable costs. Specific costs are the costs directly attributed to the purpose and exclude the costs of a change in project design due to inclusion of the purpose. Joint costs are arrived at by subtracting all specific costs from total project costs, and they are distributed among the various purposes in proportion to remaining benefits. With this formula, remaining benefits are calculated by subtracting specific costs from justifiable costs. Total allocated costs are the sum of specific costs and allocated joint costs.

The alternative justifiable expenditure method is recommended in those instances where the data are not available for estimating separable cost or when the cost of obtaining such data would be prohibitive. A series of cost estimates showing the multi-purpose project with and without each purpose can be quite expensive. Since it relies on specific costs rather than separable costs, the alternative justifiable expenditure method is much easier to calculate than the SCRB method.

The Alternative Justifiable Expenditure Method is illustrated by the following example:

TABLE 4. AJE METHOD OF COST ALLOCATION (In 000s)

Item Description	Purpose A	B	C	Total
1. Benefits	50	70	30	150
2. Alternate Costs	35	55	45	135
3. Justifiable Costs (lesser of 1 or 2)	35	55	30	120
4. Specific Costs	10	5	5	20
5. Remaining Benefits (3 - 4)	25	50	25	100
6. Allocated Joint Costs*	15	30	15	60
7. Total Allocated Costs (4 + 6)	25	35	20	80

*Total joint costs of $60 (project cost of $80 minus total specific cost of $20) are allocated to each purpose in the same ratio as that of the remaining benefits of each purpose to the total remaining benefits.

Use of Facilities Method

This method of cost allocation attempts to allocate joint costs in proportion to the relative use of the common facilities by each purpose. It thus distributes joint costs in proportion to physical criteria rather than benefits as in the two previous methods. Such measures as reservoir storage space, water flow, and energy consumption have been suggested to estimate joint use. Joint costs are determined by either subtracting all separable costs or subtracting all specific costs from total project costs. Joint costs are then distributed among project purposes in proportion to a measure of physical capacity. For example, if reservoir storage space of 5,000, 3,000, and 2,000 acre feet is needed for purposes A, B, and C, respectively, purposes A, B, and C are allocated 50 percent, 30 percent, and 20 percent of joint costs, respectively. Allocated total costs equal the sum of allocated joint costs plus separable or specific costs.

The Use of Facilities method is considered acceptable in those instances where joint use is clearly determinable on a comparative basis. However, because of the problem of finding a common denominator for all purposes, it is usually recommended only for suballocating costs of a given function in a single or multi-purpose development.

The following is an example of this method:

TABLE 5. USE OF FACILITIES METHOD OF COST ALLOCATION (In 000s)

Item Description	Purpose A	B	C	Total
1. Benefits	300	250	150	700
2. Specific Costs	60	40	20	120
3. Total Storage, acre feet	5,000	3,000	2,000	10,000
4. Allocated Joint Costs*	200	120	80	400
5. Total Allocated Costs (2 + 4)	260	160	100	520

*Total joint costs of $400 (project cost of $520 minus total specific cost of $120) are allocated to each purpose in the same ratio as that of the storage assigned to each purpose to the total storage.

Criteria for Evaluation

The following criteria are proposed for evaluation of the cost allocation methodologies:

Efficiency and equity. Any cost allocation method employed should satisfy the objectives of economic efficiency and equity. The conditions for efficiency in cost allocation can be stated as follows:

1. The separable cost of adding each purpose as the last increment should not exceed the benefits derived therefrom.

2. The sum of the total costs allocated to each purpose should not exceed the sum of the total benefits allocated to each purpose.

3. The total costs allocated to each purpose should not exceed the cost of a single-purpose alternative providing equivalent benefits.

Equity as an objective of cost allocation and cost sharing has two meanings: redistribution and fairness. A redistribution occurs, for example, when beneficiaries in low per capita income areas receive benefits from a program that are proportionally greater than the local costs of the program. With regard to cost allocation, equity refers to

a policy governing the distribution of total project costs among all the purposes served by a multiple-purpose development. Specifically, an equitable cost allocation is one which permits all project purposes to share in the savings from multiple-purpose rather than single-purpose construction. Once costs are allocated, equity in cost sharing is then concerned with the distribution of benefits and local costs among users. Therefore project costs are distributed equitably among the purposes served by providing for sharing of the savings resulting from multiple-purpose development.

Credibility. An important aspect of cost allocation methodologies should be its credibility to knowledgeable professionals and to lay observers. The credibility factor should include avoidance of any methodological error.

Accuracy. The accuracy component of cost allocation methodology is to adopt a methodology that gives consistent results regardless of the person who uses it. This means procedural steps should be explained in sufficient detail, so the results obtained by one user can be replicated by a second user.

Simplicity. It should be relatively easy to gather data required for cost allocation. The methodology should be adaptable to computer calculation and the data for cost allocation should be capable of being updated without disturbing the basic methodology. Finally, the adopted method should keep the computation time and the level of effort required to a minimum consistent with accuracy and credibility of results.

Comprehensiveness. The cost allocation methodology should identify those costs that can be matched with each purpose and benefit.

Analysis of Meeting Criteria

The three methods for determination of cost allocation, briefly described earlier, have been compared against the six criteria proposed above. Table 6 reflects this comparison in matrix form.

Efficiency. All three efficiency conditions are satisfied by the SCRB method. However, the alternative justifiable expenditure method and use of facilities method employing specific costs do not necessarily satisfy condition (1) in those instances where separable costs are greater than specific costs. In these cases it is possible that the benefits of including a purpose may be equal to specific costs but less than separable costs. The purpose would be justified on the basis of specific costs but infeasible on the basis of separable costs. Since these methods cannot assure that the separable costs of adding a purpose will not exceed the benefits derived from its inclusion in the project, they fail condition 1 of the efficiency test.

TABLE 6. ANALYSIS OF METHODOLOGIES FOR DETERMINATION OF COST ALLOCATION IN MEETING EVALUATION CRITERIA

	Criteria					
Methodology	Efficiency	Equity	Credibility	Accuracy	Simplicity	Comprehensiveness
Separable Costs-Remaining Benefits Method	++ Satisfies all three conditions of efficiency	0 Procedural problems	++ Widely used	+ Not proportional share of savings	+/0 Detailed instructions given; however difficult to estimate separable costs	++ Will identify all benefits and costs
Alternative Justifiable Expenditure Method	+/0 Does not always satisfy Condition 1 of efficiency	0 Procedural problems	+ Not used often	+ Not proportional share of savings	+ Detailed instructions given	++ Will identify all benefits and costs
Use of Facilities Method	0 Does not always satisfy Condition 1 of efficiency	0 Procedural problems	+ Not used often	0 Conceptual problems in defining reservoir use; not proportional share of savings	+/0 Detailed instructions given; requires judgment	++ Will identify all benefits and costs

Legend: ++ High
+ Medium
0 Low

Moreover, the Use of Facilities method does not employ the concept of justifiable costs, which places an upper limit on the costs apportioned to a particular purpose. Since this method allocates joint costs on the basis of physical criteria, it is possible for a purpose to be assigned a share of multi-purpose costs in excess of the cost of obtaining the same benefit from a single-purpose alternative. For example, in Table 5, the total allocated costs for purpose A amount to $260,000, although the cost of a single-purpose might be $250,000. There is, therefore, no guarantee that condition 1 will be met by the Use of Facilities method. Since the Alternative Justifiable Expenditure and Use of Facilities methods do not always satisfy all three efficiency conditions, the SCRB method is judged superior on the basis of the efficiency criterion.

Equity. This criterion is not satisfied by any of the three cost allocation methods. At least two procedural problems exist which do not provide for proportional sharing of project savings among purposes. One source of inequity common to the SCRB and the Alternative Justifiable Expenditure methods arises because either separable or specific costs are subtracted from justifiable costs on a 1:1 basis. A further equity problem arises in attempting to define capacity when one is applying the Use of Facilities method.

Credibility. All three methods have been used enough to achieve credibility. The Federal Power Commission, the U.S. Army Corps of Engineers, and the Bureau of Reclamation have relied on the SCRB method almost exclusively. The Tennessee Valley Authority (TVA) and the Soil Conservation Service (SCS) have favored the Alternative Justifiable Expenditure and the Use of Facilities methods, respectively.

Accuracy. All three methods are suspect in terms of accuracy. The methods do not always give a proportional share of savings to the purposes of the project. Also, the Use of Facilities method involves conceptual problems in defining reservoir use and capacity.

Simplicity. Detailed instructions can be given for all three methods. The problem with the SCRB method lies in determining the separable costs, while the Use of Facilities method requires judgment in defining reservoir capacity and use.

Comprehensiveness. All three methods will identify and match benefits with costs, but obviously as mentioned earlier, not on an equitable basis.

Recommendation

The SCRB method is the recommended method for the State of Nebraska. The difficulties in computing separable costs should be resolvable for projects that are located entirely within Nebraska. All three methods described have problems in distributing costs equitably. For the most

part, these problems relate to qualitative, not quantitative, judgments. Therefore, equity in cost allocation becomes a policy decision of the State of Nebraska.

Cost Sharing

After costs have been allocated to purposes, by one of the previously described acceptable methods, it is then necesary to determine the costs to be borne by the local, state or federal governments, financing agencies and groups involved. The following tables (Tables 7-10) give insight into how different agencies and states share the cost of multiple-purpose water projects. Table 11 depicts the various ways in which state governments raise capital to help finance water resource developments.

TABLE 7. CAPITAL COST-SHARING PERCENTAGES USED BY FOUR FEDERAL AGENCIES, BY PROJECT PURPOSE*

	U.S. Army Corps of Engineers			Bureau of Reclamation (USBR)		Soil Conservation Service (SCS) (Small watershed and flood prevention programs)			Tennessee Valley Authority (TVA)
		Federal (%)	Non-federal (%)	Federal (%)	Nonfederal (%)		Federal (%)	Non-federal (%)	
Urban flood control	a. Major reservoirs	100	0			a. Structural	100	0	There are no nominal cost-sharing requirements associated with TVA projects comparable to those of the other three federal water agencies because the TVA Act (amended) established repayment terms for federal outlays based on selling electric power rather than on the traditional procedure of allocating project costs and recovering portions of those costs according to specific nonfederal cost-sharing rates. However, an effective cost-sharing rate can be determined by comparing repayment and return contributions to Congressional appropriations. In these terms, the Water Resources Council calculated that the nonfederal cost share for all TVA capital costs was 79 percent (all project purposes).**
	b. Local protection--structural	100	0						
Rural flood control	c. Local protection--nonstructural	80	20			b. Nonstructural	80	20	
	d. Small reservoirs in lieu of local protection	100	0						
Drainage	Major drainage	50	50				50	50	
Irrigation		50	50		Varies according to ability to pay, but usually less than 20		50	50	
Hydroelectric power		100	Repay	0	100 as repaid				
Recreation	a. Separable--reservoir	50	50	50	50		50	50	
	b. Joint--reservoir	100	0						
	c. Nonreservoir	50	50						
Fish and wildlife		75	25	75	25		50	50	

(continues)

TABLE 7. CAPITAL COST-SHARING PERCENTAGES USED BY FOUR FEDERAL AGENCIES, BY PROJECT PURPOSE* (Continued)

	U.S. Army Corps of Engineers			Bureau of Reclamation (USBR)		Soil Conservation Service (SCS) (Small watershed and flood prevention programs)		Tennessee Valley Authority (TVA)
		Federal (%)	Non-federal (%)	Federal (%)	Nonfederal (%)	Federal (%)	Non-federal (%)	
Municipal and industrial water supply		100	Repay (within 50 years)	0	100 As repaid in 50 years	50	50	
Navigation--inland waterways	a. Commercial	100	0					
	b. Recreation	50	50					
Watershed protection								
Streambank erosion								
Aquatic plant control	a. Research, planning, evaluation	100	0					
	b. Control	70	30					
Water quality				75 To be repaid	25	Not established		

*Developed from the "Current Cost-Sharing and Financing Policies for Federal and State Water Resources Development," U.S. Congress, Congressional Budget Office, July 1983.

**U.S. Water Resources Council, Options for Cost Sharing, Part 5A (1975), a report submitted to the President, pursuant to Section 80 of the Water Resources Development Act of 1974 (P.L. 93-251).

TABLE 8. OPERATION AND MAINTENANCE COST-SHARING USED BY FOUR FEDERAL AGENCIES, BY PROJECT PURPOSE*

	U.S. Army Corps of Engineers	Bureau of Reclamation (USBR)	Soil Conservation Service (SCS)	Tennessee Valley Authority (TVA)
Urban flood control	a. Major reservoirs — Federal b. Local protection--structural — Nonfederal		a. Structural — Nonfederal	Same as for capital costs. Overall, the effective operation and maintenance costs shared are 46 percent by nonfederal sources.
Rural flood control	c. Local protection--nonstructural — Nonfederal d. Small reservoirs in lieu of local protection — Nonfederal		b. Nonstructural — Nonfederal	
Drainage	Nonfederal		Nonfederal	
Irrigation	Nonfederal	Nonfederal	Nonfederal	
Hydroelectric power	Nonfederal	Nonfederal		
Recreation	a. Separable costs--reservoir — Nonfederal b. Joint costs--reservoir — Federal c. Nonreservoir projects — Nonfederal	Nonfederal	Nonfederal	
Fish and wildlife	Nonfederal	Nonfederal	Nonfederal	
Municipal and industrial water supply	Nonfederal	Nonfederal	Nonfederal	

(continues)

TABLE 8. OPERATION AND MAINTENANCE COST-SHARING USED BY FOUR FEDERAL AGENCIES, BY PROJECT PURPOSE* (Continued)

	U.S. Army Corps of Engineers	Bureau of Reclamation (USBR)	Soil Conservation Service (SCS)	Tennessee Valley Authority (TVA)
Navigation--inland waterways	a. Commercial Federal b. Recreation Federal			
Watershed protection				
Streambank erosion				
Aquatic plant control	a. Research, planning, evaluation N/A b. Control 30% Non-federal			
Water quality		Nonfederal	Not established	

*Developed from the "Current Cost-Sharing and Financing Policies for Federal and State Water Resources Development," U.S. Congress, Congressional Budget Office, July 1983.

TABLE 9. EFFECTIVE NONFEDERAL COST SHARES FOR JOINT FEDERAL-STATE WATER RESOURCES DEVELOPMENT PROJECTS, BY FEDERAL AGENCY, BASED ON ANALYSIS OF NEARLY 4,800 PROJECTS

	U.S. Army Corps of Engineers (%)	Bureau of Reclamation (USBR) (%)	Soil Conservation Service (SCS) (%)	25 Federal Agencies (%)
Urban flood damage reduction	17	N/A	N/A	20
Rural flood damage reduction	7	10	27	11
Irrigation	19	18	54	19
Municipal and industrial water supply	54	71	100	64
Hydroelectric power	61	65	N/A	64
Water quality	3	82	N/A	60
Fish and wildlife	11	13	57	14
General recreation	17	18	63	19
Navigation--inland waterways	6	7	N/A	6
Agency mean	20	37	49	30

Source: U.S. Water Resources Council. Data assume a 6 percent discount rate and a project life of 50 years.

TABLE 10. U.S. ARMY CORPS OF ENGINEERS PROPOSED COST SHARING FOR NEW WATER PROJECTS AFTER 1983*

Project Purpose	Up-front Nonfederal Share of Costs (%)
Hydropower	100
Municipal and industrial water supply	100
Flood control	35
Recreation	50[a]
Commercial navigation	75[b]
Irrigation	35
Beach erosion	50

[a]Could be repayment instead of up-front.

[b]25 percent of federal financing is reimbursable.

*This proposed new cost-sharing program implies that the states or other nonfederal agencies will be asked to bear more of the cost of jointly developed water projects. They will also be asked to contribute a greater portion in up-front financing (cash or contributions in kind) than they now contribute. Finally, by requiring 100 percent up-front financing for hydropower and municipal and industrial water supply projects, the proposal is in effect urging states and local government to handle these projects without federal assistance.

TABLE 11. FINANCING POLICIES FOR STATE WATER RESOURCES DEVELOPMENT*

State	Use of Appropriations from General Revenues for State Water Resources Development 1981-1982 Amount	Use of General Obligation Bonds for State Water Resources Development 1981-1982 Amount	Use of Revenue Bonds for State Water Resources Development 1981-1982 Amount	Use of Special Taxes and User Fees for State Water Resources Development 1981-1982 Amount	Use of Special or Revolving Funds for State Water Resources Development 1981-1982 Amount	Use of Loans and Grants for State Water Resources Development 1981-1982 Amount
Nebraska**	$2.8 million to Resources Development Fund. $.5 million to Water Management Fund. This fund established April 10, 1984, to provide financial assistance to water development projects costing more than $10 million.	$0. Constitutionally prohibited at state level.	Established Nebraska Water Project Revenue Bonding Act, April 10, 1984.	$8 million. Local natural resources districts levy property tax which may be used for all natural resource purposes, including water resources development.	$2.8 million to Resources Development Fund for matching grants to political subdivisions for all types of water projects. Small Watersheds Fund (cash revolving fund for land rights acquisition) approximately $.5 million.	$2.8 million, up to 75% state grants or loans, any purpose.
**All Nebraska figures represent 1984-1985 amounts.						
Colorado	$10 million (1981) from excess revenue in general fund (tax surplus created by yearly expenditure limitations).	$0. Bond indebtedness constitutionally prohibited at state level.	$0. State constitutional prohibition against bonded indebtedness; separate bonding authority set up in 1982, but not active yet.	$10 million (1981), $5 million (1982) from sales and use taxes. $40 million (1980), tax surplus--$30 million allocated to bonding authority in enue bonding program. $25 million (1981) from Mineral Leasing Fund.	Colorado Water Conservation Board Construction Fund revolving loan fund for up to 50% of any water project. Loans at 5% interest for 40 years.	Loans for projects that will increase beneficial use of water and for municipal and water supply--up to 50% of project costs at 5% interest over 40 years.
Iowa	$0. Virtually no state-level water development.	$0. Only at local level.	$0. Only at local level.	$0. Not used.	$0. Not used.	$0. Not used.

(continues)

TABLE 11. FINANCING POLICIES FOR STATE WATER RESOURCES DEVELOPMENT* (Continued)

State	Use of Appropriations from General Revenues for State Water Resources Development 1981-1982 Amount	Use of General Obligation Bonds for State Water Resources Development 1981-1982 Amount	Use of Revenue Bonds for State Water Resources Development 1981-1982 Amount	Use of Special Taxes and User Fees for State Water Resources Development 1981-1982 Amount	Use of Special or Revolving Funds for State Water Resources Development 1981-1982 Amount	Use of Loans and Grants for State Water Resources Development 1981-1982 Amount
Kansas	$750,000 for grants to local jurisdictions for construction of flood control works.	$0. Legislature may not encumber future years' revenues.	$0. Legislature may not encumber future years' revenues.	Groundwater management districts collect tax on acreage to pay for administration of regulatory programs.	$0. Not used.	$0. Not used.
Missouri	$700,000. One-time program--not done annually. Missouri Water Development Fund--currently zero balance.	$75 million to be issued in 1982/1983; only partially for water resources; $600 million for all purposes over five years.	$0. Not used.	$0. Not used.	$0. Not used.	$11.8 million. Grants to local jurisdictions to match federal wastewater treatment plant grants.
Montana	$0. Not used.	$5 million in 1975. One time program--not done annually. Seed money for Renewable Resources Development Fund.	$250 million. Total authorized to date. Large projects only--not implemented yet; repaid with coal severance tax receipts. Not available for Water Conservation Revenue Bonds.	$600,000 biennial. .625% of state coal severance tax for water development projects. $1.3 million Water Development Program--from severance tax on extractable minerals.	$1.3 million biennial. Water Development Program Fund--all types of water projects.	$5 million total authorized from loans and grants for conservation management and development of water resources.

(continues)

TABLE 11. FINANCING POLICIES FOR STATE WATER RESOURCES DEVELOPMENT* (Continued)

State	Use of Appropriations from General Revenues for State Water Resources Development 1981-1982 Amount	Use of General Obligation Bonds for State Water Resources Development 1981-1982 Amount	Use of Revenue Bonds for State Water Resources Development 1981-1982 Amount	Use of Special Taxes and User Fees for State Water Resources Development 1981-1982 Amount	Use of Special or Revolving Funds for State Water Resources Development 1981-1982 Amount	Use of Loans and Grants for State Water Resources Development 1981-1982 Amount
North Dakota	$1.4 million (biennial). Appropriated to Contract Fund.	$0. Not done but under study to supplement new water supply projects out of Resources Trust Fund.	Only limited use for small irrigation projects. $3 million ceiling set by legislature.	$20 million biennial. .5% of oil extraction value into Resources Trust Fund for water supply development. Local water resource districts levy up to $4 million per $1 property value for water resources development.	$20 million biennial potential. Resources Trust Fund for water supply development.	$1.4 million from contract fund, 15-20% cost sharing with local units for all water development--all grants.
Oklahoma	$25 million. One-time program--not done annually. Seed money to start water development fund for project construction or guarantee revenue bond issue.	$0. Not at state level; local communities may issue bonds.	$11 million to fund community loan program for water and sewer projects; also done routinely at local level.	$0. Currently examining dedication of part of oil and gas severance tax.	$25 million. Water Development Revolving Fund--funds all aspects of water development.	$25 million from Water Development Revolving Fund--emergency grants or loans for all purposes.

(continues)

TABLE 11. FINANCING POLICIES FOR STATE WATER RESOURCES DEVELOPMENT* (Continued)

State	Use of Appropriations from General Revenues for State Water Resources Development 1981-1982 Amount	Use of General Obligation Bonds for State Water Resources Development 1981-1982 Amount	Use of Revenue Bonds for State Water Resources Development 1981-1982 Amount	Use of Special Taxes and User Fees for State Water Resources Development 1981-1982 Amount	Use of Special or Revolving Funds for State Water Resources Development 1981-1982 Amount	Use of Loans and Grants for State Water Resources Development 1981-1982 Amount
South Dakota	$200,000; $4 million expended through 1982. Grants to rural water system.	$0. Only at local level.	$5 million total authorized to date. Board of Water and Natural Resources authority for bonding up to $1 million per project. Substate district may bond for project such as irrigation or watershed.	$2 million in 1982; $9 million expected in future years. From payments of private pipeline company for coal slurry pipeline water. $1-3 million from six conservancy subdistricts having taxing authority to promote and finance water development.	Payments from private pipeline company placed in revolving fund for loans and grants for water projects.	$200,000 grants to rural water systems. $700,000 for loans for construction of any water resources project at 0-10% interest. $500,000 loans for water resources studies; interest free until borrower obtains a water right.
Wyoming	$114 million transfer to Water Development Account.	$0. Not used.	$0. Water Development Commission has authority for revenue bonding, but has not yet used it.	$34 million (1982), $150 million projected for 1986. From 1.5% of coal severance tax. Also a Permanent Mineral Trust Fund and a Permanent Land Fund.	$212 million. Permanent Mineral Trust Fund--from mineral and local severances taxes for all water development. Small Water Development Loan Fund--loans up to $60 million.	$212 million; $1 billion projected for 1986. Permanent Mineral Trust Fund makes loans for various water purposes.

*Developed from the "Current Cost-Sharing and Financing Policies for Federal and State Water Resources Development," U.S. Congress, Congressional Budget Office, July 1983, and Legislative Bill 1106 of the State of Nebraska, approved by the governor, April 10, 1984.

**All Nebraska figures represent 1984-1985 amounts.

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Documents	Benefit Evaluation Methods	Fish and Wildlife Benefits	Outdoor Recreation and Tourism Benefits	Irrigation Benefits	Municipal and Industrial Water Supply Benefits	Flood Control Benefits	Streambank Erosion Benefits	Other Benefits
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APPENDIX: COMMENTS BY PROFESSOR MAURICE BAKER, MR. GERALD R. CHAFFIN, PROFESSOR RONALD M. NORTH, AND PROFESSOR RICHARD G. WALSH, TOGETHER WITH DENVER RESEARCH INSTITUTE RESPONSES TO THESE COMMENTS

APPENDIX

The Nebraska Natural Resources Commission solicited comments on the May 1985 review draft of this report from several state agencies and members of the Executive Committee and Technical Work Group that advise the Commission on this study. Two written comments were received, from Professor Maurice Baker of the Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln, and from Mr. Gerald R. Chaffin, Water Resource Planner, Nebraska Game and Parks Commission. Their comments appear first in this appendix, each followed by responses from the Denver Research Institute authors.

The Commission also sought critical review of the draft report from two prominent natural resources economists, Professor Ronald M. North of the University of Georgia, and Professor Richard G. Walsh of Colorado State University. Dr. North was asked to critically assess the report and the methods and procedures presented from the viewpoint of economists who would generally be advocates for construction of large water development projects. Dr. Walsh was asked for an assessment from the viewpoint of those who would generally oppose such projects. Their comments appear later in this appendix, each followed by responses from the Denver Research Institute authors. In a number of cases, the report has subsequently been revised to reflect those comments. In addition to the comments included in this appendix, Dr. North and Dr. Walsh supplied the Commission with supplementary material which may be examined in the Commission offices.

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June 24, 1985

Mr. Steve Gaul
Natural Resources Commission
301 Centennial Mall South
P.O. Box 94876
Lincoln, NE 68509-4876

Dear Steve:

I believe you probably captured any basic comments I had on the Denver Research Institute draft report. As I indicated at our meeting, I feel they did an adequate job of reviewing alternative methods for valueing recreation and wildlife. I have some
NOTE 1 problems of using any method which relies upon the consumers' surplus as a value for benefits; however, that is a quarrel with the economics profession and not with DRI. My quarrel with the profession is that those items which are traded in the market are not valued on the basis of consumer surplus but on the basis of price times quantity.

If day users (those living within twenty-five miles of the site) are included in the benefits at the rate of $8.64 per recreation day, then this is probably a little too high. It is probably unrealistic to assume that five persons would take two
NOTE 2 cars to drive fifty miles. This is obviously 2.5 persons per car and there is not justification for this average figure. There is also another upward bias in this value in that instead of using an average distance of perhaps half of the twenty-five mile radius, the figure assumes everyone is located at the outer boundary of the twenty-five mile radius. If you do nothing more than take the mid point, this lowers the time and travel cost per recreation day to $7.29.

As we discussed at the meeting, it is not at all certain that any value is included for those persons living within twenty-five
NOTE 3 miles of the recreational site. If this is true, then the time and travel cost per recreation day is irrelevant since they apparently do not propose to use it any place in the evaluation process.

NOTE 3

The formula at the bottom of page 28 results in an over statement of tourist recreation days. There is an assumption that there will be the same rate of participation by members of the population regardless of the distance from the recreational site. All logic suggests that this assumption does not correspond with the real world.

NOTE 4

The report, as we noted, confuses benefits and impacts. The two concepts should never be used as interchangeable. We have economic impacts from tornado damage; however, I do not believe we have economic benefits associated with that activity.

The so called separable cost remaining benefits method of cost allocation is not truly a remaining benefits approach. The so called remaining benefits are really the difference between the separable cost and the lesser of the alternative cost or benefits. Because of this, there is confusion as to the basis for allocating joint cost. This procedure neither allocates the joint cost proportionate to the benefits nor proportinate to the separable cost. It allocates the joint cost largely on the basis of "the ability to pay". In spite of this, it is the method which has been used by the federal agencies for many years. Again my disagreement is not with DRI but with the developers of the method originally.

The separable cost remaining benefits method guarantees a purpose will remain in a project as long as that purpose can cover the separable cost. There is no reason to believe that the joint costs are incurred in proportion to the ability to pay.

The method of cost allocation is still a policy decision and there is no right or wrong answer.

I hope these comments will be useful to you.

Sincerely,

Maurice

Maurice Baker
Professor

MB:hw

DRI RESPONSES TO PROFESSOR MAURICE BAKER'S COMMENTS

Note 1: The authors agree that determining benefits by the use of actual market prices rather than hypothetical values based on consumers' surplus is both more defensible and more satisfactory.

Note 2: Without a site specific origin and destination study, it is not possible to say what the average automobile occupancy is. The U.S. Water Resources Council Principles and Guidelines (p. 78) uses a "hypothetical" average of 2.7 persons per vehicle. The authors proposed a 2.5 average to make calculations slightly easier, although they have no empirical basis for determining the precise average occupancy for Nebraska.

Professor Baker's other point is a persuasive one: that basing travel time and cost calculations on travel from the edge of the market area rather than from somewhere within the area introduces an upward bias. Theoretically, the travel time and cost calculations should be based on the centroid of the area of origin of recreation site users, i.e., the point at which the passenger miles driven are equal for the group living closer to the site and the group living farther away. It is not possible to determine this directly without an origin and destination study. However, the use of the edge of the market area as the average travel point implies that as many passenger miles are driven by users from outside the market area (20% of all users) as from within the market area, and that most of the latter gain a consumers' surplus. Upon reflection, the authors have revised the formula to use the midpoint of the market area radius to calculate travel time and cost. This appears to be a more conservative and credible basis of calculation.

Note 3: The wording of the discussion of the formula was confusing. Travel time and cost are calculated for perons living within 25 miles of the recreation site, but their spending (as day users) is not used in calculating tourist expenditures.

Note 4: It is recognized that persons living closer to the recreation site will make greater use of it than persons living farther away. In calculating tourist recreation days, however, all persons living within 25 miles of the site were omitted. This was an empirical attempt to compensate for lack of data on origins of site users.

Note 5: Agreed. The authors hope they have corrected places in the report where benefits and impacts are confused.

Nebraska Game and Parks Commission

2200 North 33rd Street / P.O. Box 30370 / Lincoln, Nebraska 68503

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JUN 26 1985

NEBRASKA NATURAL
RESOURCES COMMISSION

June 24, 1985

Mr. Steve Gaul
Planning Process Coordinator
Natural Resources Commission
P.O. Box 94876
Lincoln, Nebraska 68509-4876

Dear Steve:

Following are my comments on the DRI report on methods for evaluation of outdoor recreation projects dated May, 1985.

NOTE 1 1. Page 8, 5th paragraph - Discussion of the factors affecting the accuracy of methods for estimating the value of recreational use of water projects appears incomplete. Of at least equal concern in addressing feasibility is the accuracy of projections of future levels of use and future costs.

NOTE 2 2. Page 9, last paragraph, continuing on page 10 - indicates that guidelines fail to provide for estimating future benefits for fishing, hunting and tourism. Fishing benefits have been included, when appropriate, for NRDF projects. Hunting and tourism benefits of project applications submitted to date have probably not been significant. In the event projects are proposed with significant potential for these uses, the guidelines do not preclude their inclusion.

NOTE 3 3. Page 11, 3rd paragraph, starting with "The use of . . . " - suggests that fixed value of $2.90 per recreation day assigned to NRDF projects is questionable. The application of monetary value proposed by DRI for several completed NRDF projects based upon estimates of future use as stated in project applications indicate recreation benefits that could also be termed questionable.

NOTE 4 4. Page 16, 1st paragraph - Discussion of the "consumer surplus" principle should be expanded. Is it applied in determining benefits for other purposes such as flood control and irrigation? If not, how would the benefits based upon consumer surplus for these purposes compared with benefit estimates under present methods?

NOTE 5 5. Page 27, 2nd paragraph - a fixed distance applicable to entire state would understate the distance people in some areas of state would travel for day use while overstating distance in other areas. For example, the 25- mile distance suggested would relegate virtually all of the users of Merritt Reservoir State Recreation Area to the tourist status.

NOTE 6 A final concern not addressed by the report is the potential consequences if future recreation benefits in multiple-purpose water projects are overstated. This assessment should reflect impacts upon demographic and geographic disparities in outdoor recreation opportunity. It should also relate implications, if any, to future financial capability for satisfactory operation and maintenance when funds for these purposes are largely derived from sale of park entry permits and other fees.

Sincerely,

Gerald

Gerald R. Chaffin
Water Resource Planner

GRC:bsm

DRI RESPONSES TO GERALD R. CHAFFIN'S COMMENTS

Note 1: The text has been modified to reflect the point that the methodology should include means for estimating future levels of use. It is less easy to project future costs because there are numerous forces in the economy that will affect relative costs of construction, operation and maintenance, etc. This is why costs customarily are shown as "(1985 dollars)," for example, leaving to others the task of indexing these into the future.

Note 2: Evidently the authors' original statement was misunderstood, so an effort has been made to clarify it. The Guidelines do, of course, include means for measuring the recreational value of fishing. DRI meant that the Guidelines do not accept estimates of the benefits of the existence of fish and wildlife, which are based on enhancements of habitat, in contrast to the recreational benefits that the fish and wildlife provide.

Note 3: Mr. Chaffin's point is valid; the values proposed by the authors, even though based on an average of 60 studies, may also be termed questionable. Two parenthetical sentences have been added to clarify this.

Note 4: The authors are unfamiliar with cases where the consumer surplus principle has been applied in determining benefits from flood control or irrigation. It is obvious that some persons benefit more than others from receiving a quantity of irrigation water, depending on whether it is a supplemental or a total supply, yet the cost to each from the same project would be the same. The same would be true for flood control, if the costs were paid by the direct beneficiaries, some on the river bank and others on the sides of hills well above the river. The point the authors intended to make is that a simulated market value, established as the price that will maximize revenue to a discriminating monopolist, is by definition set at the value received by the least satisfied user. It follows, then, that it underrates the value received by all other users. This point has been clarified in the text.

Note 5: The review draft of the report, subsequently clarified, led to some confusion over the intent of the 25-mile radius from the recreation site that distinguishes day users from tourists. This was not intended to eliminate users living within 25 miles of the site from the calculation of travel time and travel cost benefit; indeed, nearby users do obtain a recreation benefit which should be counted. The 25-mile radius distinguishing day users from tourists was intended to eliminate day-user spending (considered a transfer) from the economic benefits of tourist spending in the locality.

Note 6: It is true that problems can arise from overstating future recreation benefits as well as from understating them. Either can generate distortions in the allocation of costs or in the justification of multiple purpose water resources projects. The authors addressed this topic briefly in the "Criteria for Evaluation" section on the first page of Chapter III.

Critique

of

A STUDY OF METHODS FOR ASSESSING ECONOMIC BENEFITS AND ALLOCATING COSTS OF LARGE WATER DEVELOPMENT PROJECTS

for the

State of Nebraska

Natural Resources Commission

Offered by

Ronald M. North

Institute of Natural Resources

The University of Georgia

Athens, Georgia 30602

General Comments

This report, as written, is somewhat confusing to the reader in terms of its purpose and goal. It is apparent that the work was divided into several parts for expediency in management. However, the particular arrangement of the study seems to contribute to a great deal of overlap when the dual jobs of evaluating methods of benefit cost analysis and cost allocation were further subdivided by conventional project services (purposes) such as fish and wildlife and irrigation. I was also quite disappointed by the very minor attention given to assessing the economic benefits of municipal and industrial water supplies (M&I) and the complete absence of attention to power generation (either direct or supporting). These two multiple purpose project services will be a major factor in financing and operating successfully any multiple purpose water project by a state or sub-state entity. I also believe that the omission of water quality improvement and ground water management as benefit potentials is ill-advised. Granted, the U.S. Water Resources Councils' "principles and guidelines," as well as provisions of the clean water act (especially public law 92-500) allow the inclusion of benefits from water quality improvement only as they relate to aesthetic values or in-stream improvements. However, the state of Nebraska need not be confined necessarily to these guidelines in evaluating its own projects and estimating its own values for improved water quality. This could be especially critical in highly-irrigated areas in which salinity control is very valuable or very expensive or both.

NOTE 1

Another oversight in the benefit category that is related to outdoor recreation and tourism is that of land enhancement. Land enhancement benefits have been claimed by the Tennessee Valley Authority in its projects and identified in a few Corps of Engineers' projects over the years.

However, in recent years land enhancement benefits have been overlooked or excluded for political reasons, apparently, in that they represent a major regressive redistribution of income. However, there is no reason for a state not to include this category of benefits. Also, land enhancement is an additional criterion for measuring the benefits generated by investments in water resources projects. Some of our work on small watershed projects in the mid-1970's showed conclusively that the standard income increasing/cost saving measurement criteria used in the economic justification of such projects were not fulfilled. In these cases, the estimates of benefits generated from income increasing and other more intensive land use practices did not occur because both the with project and without project projections of future land uses were completely in error. However, the added values accruing to lands adjacent to small watershed projects were of such magnitude to more than justify the investments on the basis of net enhancement of wealth in the communities with projects.

NOTE 2

On the basis of the descriptive material provided in this report the literature search seems to be extremely weak. I conclude this on the basis that most of the classic, often cited, books, articles and monographs addressing the issues of benefit cost analysis were not cited in this report. Also, those that were cited were not annotated in a manner that would be useful to an analyst trying to develop a benefit cost estimating (project evaluation) system. Many cases of data bases are cited in the "unnumbered" document tables but they provide very little help to someone structuring a system of project evaluation. Most of the newer methods such as the surrogate worth trade-off and goal programming applications to recognize multiple objective project evaluation were completely omitted or unrecognized. Throughout the publication there were few citations and no critical reviews of the literature available. Also, some of the cited

literature, such as the cost sharing tables, was not appropriately cited for purposes of any follow-up. If one were not already familiar with the literature it would be very difficult to use any of it as given in this review draft of May 1985.

Specific Comments on Benefit Estimation

A few other general points should be considered in future work as suggested in the introduction. The authors labor strenuously to differentiate outdoor recreation and tourism with regard to measurement of benefits. I would agree that tourism should be separated from residents for analytical purposes. However, the real key to measuring benefits from outdoor recreation is the participation rate of the two groups and their willingness to pay for specific water-based services. To use a different measurement criteria for tourist participation and local participation seems to beg the question. I personally believe it is more important to divide local participants into "day users" and long term users. These may be classified or described as capital extensive and capital intensive users. The capital extensive users visit public access areas on a periodic basis, making little or no investment except in personal property. The capital intensive users buy lots, build homes and invest in other real property or capital intensive facilities--all of which enhance the private and public wealth of the area or project. These investor-type users also contribute to the tax base of the local community and contribute to the local economy in the same or greater proportion as the capital extensive users on a user day basis.

NOTE 3

Regarding the authors' criteria for evaluation of benefit measurement methods, I find the criteria of credibility, accuracy, simplicity, comprehensiveness and consistency of viewpoint to be valid criteria for judging

the effectiveness of a benefit measurement method. As later detailed, we disagree on how these criteria are applied. Basically, when structuring an evaluation system, one should state a goal, i.e., an objective function, then define the measurement system and the criteria for success. I find the goals elusive in this report. An example may help. Let's say the objective is to maximize yield on investment. Then the measurement system would include use of payback period, net present value or internal rate of return. The success criterion would be to minimize payback period, maximize revenues less costs or maximize internal rate of return.

NOTE 4

I would delete the "ability to distinguish private and public benefits" (p. 9) as completely irrelevant to the measurement of benefits. I believe the authors recognize this in the inability to resolve the issue consistently in Table 1. A benefit is a benefit as it was so well stated in the 1936 Flood Control Act when the Congress said that " . . . benefits should exceed costs to whomsoever they may accrue . . . . " The real dividing line between public and private benefits should be handled in the cost allocation and pricing/cost-recovery/reimbursement considerations in project design and financing.

NOTE 5

If another evaluation criterion is desired it would be better to subsitute for this one the ideas of project efficiency and project equity to see how these considerations affect the measurement system. There are many aspects of project efficiency but the basic idea is to maximize the net social benefits from the project. This means that in the design stage a project should be scaled or sized to the point that marginal benefits just equal marginal costs. At this point, net (private and/or social) benefits are maximum. Likewise, in a multiple purpose project each identifiable function or purpose or service provided should be scaled so that marginal benefits equal marginal costs for each purpose when marginal

benefits are declining and marginal costs are rising. However, one must be careful to always scale the project on the basis of marginal benefits and costs and calculate the benefit-cost ratio or net present value of benefits on the basis of total benefits minus total cost to determine project feasibility or to rank alternative projects for the maximum benefit cost ratio or net present value.

The concept of equity in economics is also manageable without regard to ownership. The concept behind economic equity is that any policy change will have the potential of changing the distribution of income. The direction of these changes can be easily indicated but the estimates of magnitudes will be more difficult. A few examples will suffice to clear this point and explain economic equity in positive--not normative--terms. This can be done for individuals or groups. For example, a policy that reserves all lands adjacent to a water resources project for the public sector will redistribute income from private individuals to the public sector or from land owners to non-land owners. A rise in interest rates will redistribute benefits to owners of capital and away from other sectors of the economy. These considerations when clearly stated can be very beneficial in overcoming adverse political or public reaction to a project. Bear in mind the equity considerations can and should be treated separately from the efficiency considerations in a hard-nosed analysis. However, as the analyst allows normative judgements to enter the process it becomes more and more difficult to differentiate or justify in anyone's mind the relative or absolute efficiency of a project.

NOTE 6

On page 9 of the report, under "Consistency of Viewpoint," I find this a bit confusing. As an economic developer I went through the decades of applying multipliers to all kinds of investments. However, I now believe multipliers are irrelevant to the decision process that justifies a project

on the basis of its efficiency, i. e., on the basis of benefits exceeding cost by the maximum possible. I suppose multipliers are all right for Chambers of Commerce to use since they do little damage in that context. However, it is only the direct benefits produced by an investment that can and should be measured or tallied as an indicator of the efficiency of that investment. Just as we have given up secondary benefits we have given up multipliers in all creditable measures of economic efficiency. It is more important to spend this time on refining such things as the true economic life of the project, selection of appropriate discount rates and estimates of participation rates as opposed to toying with multipliers.

I also find it perfectly reasonable and publically beneficial to have a state or local (that is a sponsor) viewpoint when evaluating a proposed project. However, in terms of measuring benefits and costs for either efficiency or equity reasons I see no point in belaboring the differentiation between state and national viewpoints. If such considerations should be given it would be with respect to considerations of financing, pricing, cost recovery and other aspects of project distribution. There could also be some impact due to differences in interest rates that might be available to state/local versus federal funding sources. Just as in the case of private versus public benefits, a benefit is a benefit is a benefit. One that contributes to the economy of Nebraska is, of course, to be preferred to one that might benefit Missouri. However, a dollar of net benefits in either Nebraska or Missouri would make about the same contribution to gross national product. The special distribution would be relevant only to Nebraska when it is deciding about the special distribution of projects of equal economic merit within one county or district of the state versus another. The "efficiency" aspect should then be considered on the

basis of realistic appraisals of unemployed resources in one district versus another that may be utilized in the project.

I find the document somewhat behind the times with respect to evaluating fish and wildlife benefits (pp. 9 and 10). In this case it refers to the current Nebraska guidelines but throughout the document no particular suggestions are made about available ways to measure fish and wildlife benefits. Of course, federal agencies have been doing a reasonably good job of estimating fish and wildlife benefits in straightforward terms of fishing and hunting days provided by the resource. If one wishes to lump this into outdoor recreation (which is not done by the federal agencies) and consider the fish and wildlife habitat independently of the economic value of the resource itself, it can be done, but at the risk of double counting. If one does not wish to measure fish and wildlife in terms of fishing and hunting days (modified for quality of the fish or hunt) then the habitat value can be measured in terms of its foregone or alternative uses. It is conceivable that a wetland providing wildlife breeding grounds could be drained and used for agricultural production. In this case there is an alternative use that produces net value and this net value is a legitimate measure of a value assigned to fish and wildlife habitat. Whether or not the acre of wetland so designated actually produces the foregone value is yet another question as far as economic analysis is concerned (it is most likely one of risk analysis). Similar types of risks would apply to agricultural uses as well as to wildlife uses. Flood damages would reduce the agricultural productivity and it may either reduce or enhance wildlife productivity. But, this is a separate question from using the foregone value as a surrogate measure of benefit expected. There is also the prospect that equity considerations would be mismatched -- a

waterfowl breeding area does not necessarily benefit the locals as much as those on the flyway.

At this time, I wish to lift up a few statements that are arguable with respect to benefit evaluation methods. On page 14 two statements on the last paragraph of the page are particularly disturbing. In the second sentence it is stated that the market for outdoor recreation " . . . is normally not a commercial one." I argue that any activity involving a user fee is a commercial activity. With this definition, nearly all outdoor recreation, tourism, fishing and hunting is of a commercial nature. We lease hunting rights, we buy fishing licenses, we pay to tour historic sites, we pay to launch at a public reservoir. The authors themselves contradict their statement in the following sentence when they except user fees. In the same paragraph about midway, I find it incredible that anyone in this age could find it inappropriate to use a private recreation fee as a surrogate for the value of a public recreation experience of equal or similar quality. A policy decision to charge or not to charge has absolutely nothing to do with the value of that recreational experience and it is much more creditable and accurate to use a surrogate market value than any other conceivable estimate. These surrogate market values will, in my opinion, contribute more to the sum of benefits claimed than any other method that might meet the criteria specified on pages 8 and 9. We have found that, for thirty years, both the inflation adjusted willingness to pay and the participation rates in both privately and publically provided water based recreation exceed our wildest estimates. We have substantial evidence of this in our studies of water based recreation for Disney World and for most Corps of Engineer projects in the eastern states. I have not investigated this personally but my impression is that recreation on

NOTE 7

western states reservoirs also exceed design expectations. Consider Lake Mead and Lake Powell if you have any doubts about this.

On page 19 the authors suggest that the monopoly revenue method proposed by Marion Clawson has received wide acclaim. This may be true but it is not a creditable method of estimating benefits as it is explained by the authors of this study. The monopoly revenue method is simply defined as all that area under the demand curve (that is, price times quantity perfectly discriminated). All this method requires is an estimate of the demand curve, however it may be arrived at. Once a demand curve is established, by any method, it is then a simple and straightforward process of estimating the value thereof. However, this provides a gross value, not a net value as proposed elsewhere in this document. The monopoly methods described on page 19 actually are applicable only when one considers discriminatory pricing schemes available to a non-regulated monopolist to enhance his revenue. There are very specific economic conditions that must apply for these pricing schemes to work. For example, a non-discriminatory monopolist facing an estimated demand curve will produce x quantity of output. For this output there is only one clearing price available to the monopolist. Of course, if he overestimated demand he will have a sale or offer other incentives. If he underestimated, demand charges will occur, surcharges will be added or service will deteriorate. There are two kinds of discriminatory monopolists: (1) between markets when no transfers can take place and (2) among units of the product when the flow can be controlled to the consumer, that is, a consumer must buy and pay for the first unit before he can have the second unit and no transfers are permitted. This occurs in all public utilities that are flow control such as domestic water supply and electricity. The perfectly discriminating monopolist can price each unit so as to gain all the revenue, (including consumer's

surplus) if he is unregulated. However, as in any other enterprise public or private, net revenues are determined by cost relationships.

Since much of the authors' recommendations and evaluation is contained in Table 1., I must address several issues summarized therein. For example, under methodology, market value is assessed. Even though any rating or ranking system is subject to substantial judgment I feel that the assessment of "market value" is entirely off base. In the first place, with respect to credibility, market values are by definition empirical. Market values are based on good estimates of demand schedules and these are not based on "judgment." In fact, market value is the only legitimate measure of an economic value that is not based upon judgment. Therefore, its credibility depends entirely on the analyst's credibility in collecting and analyzing data. Also, with respect to accuracy, the market value method would involve the minimum amount of judgment from the estimator. Using this method, the estimator is simply a collector and reporter of data. Also, the market value method is simple and straightforward. It would involve making surveys only for those situations in which market data are not regularly reported or widely known. Also, market values are applicable to the broadest range of purposes. Market values are available for all water project based services with a little imagination. Take an often abused case, flood control. Is it not true that frequently flooded land will be discounted vis-a-vis unflooded land, ceteris paribus?

NOTE 8

Again, the market value method of estimating benefits is least subject to problems of estimator judgment or estimator manipulation. The only assessment criteria I agree with regarding the market value as an estimator of benefits is the one on distinguishing between private and public benefits--and this one is irrelevant to the issue.

Although Table 1 is a great idea to be used as an executive summary of the methodologies, many of the statements in the individual cells are inaccurate in my opinion. Let me mention a few examples--take gross expenditures method. I believe it can be used to measure recreation activity but this method certainly will not provide much specific information about the net value of recreation participation. However, there is nothing wrong with gross values -- it is a good measure of market success widely used in business. With regard to accuracy it would be very difficult to substantiate whether or not this undervalues inexpensive activities. I don't understand this statement at all. Also, gross expenditures method says as much about consumer's surplus as any other method suggested except willingness to pay and market value which are about equal in estimating consumer's surplus.

NOTE 9

I also have difficulty with judging the current Nebraska method as inadequate on the basis of accuracy. Unless the authors have substantial unrevealed data about the value of a recreation day in Nebraska it would be difficult to judge that $2.90 is "inaccurate." I also have difficulty understanding how the "interview" (p. 23) is an established methodology. Most of the other methods described include the technique of the interview to establish a benefit value. The interview is a technique of accumulating data or information rather than a method of estimating benefits. For example, the willingness to pay as well as some of the other methods require "interviews." However, the authors amend this by describing the interview method as one of iterative bidding on page 24--I can accept that. Also, as a matter of clarification, we often refer to what the authors call the "market value of fish method" as the meat value method. It applies comprehensively to any service with an economic or market-based value or a surrogate therefor. These values are usually well-established and are the

least "arbitrary" of all benefit estimates except the market value of participation itself. However, the meat value method usually understates a "true" value or at least will provide the lowest possible value for a recreational experience. I would not recommend this particular method as an estimator of recreation benefits since it excludes substantial consumer's surplus as well as all leisure related values that may be imputed from the activity.

In summary, the most creditable values to be used for all water resources outputs (recreation, fish and wildlife, navigation, power generation, flood control, etc.) is a direct market estimate. In the absence of a market estimate one may use a surrogate method utilizing various techniques such as interviews, travel costs, participation estimates, interative bidding techniques, etc., all of which are intended to measure the willingness to spend for a particular water resource project service or output. These estimates should then be converted into a demand curve (as is frequently done in the travel costs method) from which various values can be accurately estimated. For example, from a demand schedule one can estimate the value that would accrue from a competitive market position, the value that would accrue from a nondiscriminatory monopolist or a value that would result from several methods of discriminatory monopoly pricing. Bear in mind that all these estimates provide gross values of the benefit. This is an acceptable approach and technology that is ecnomically sound and widely practiced. However, any estimate of net benefits must be adjusted by subtracting costs. This is another subject, but briefly such costs can be handled as marginal (roughly equivalent to OM&R) and/or as capital (roughly equivalent to fixed) costs. In typical water project evaluation the acceptable approach is to deal in gross benefits and gross costs to

calculate the benefit cost ratio or benefits minus cost after consideration of appropriate discount rates and project life expectancies.

Alternative Approaches

If one wants to maximize gross benefits expected from a project this can usually be done by one of the surrogate methods related to willingness to spend. The method that is most likely to maximize gross benefits is that of the opportunities foregone. In this method participants are interviewed to determine how much value they would give up in order to participate in a recreation event. At the extreme, participants would be giving up a day's wage, as well as all direct expenditures associated with the event, which could be spent on other things. We can handle this by assuming that a recreation day is a result of a holiday and thus no salary is given up. However, many self-employed and other professional people do in fact give up a day's labor in order to participate in a recreation event. The next highest estimate of expected benefits from a water resources based recreation event usually occurs or stems from interview or bidding techniques that estimate willingness to spend in a hypothetical market situation. In my opinion, market estimates are the very best as measured by all the criteria suggested by the authors such as credibility, accuracy, simplicity, comprehensiveness and consistency.

Some traditional water resource project benefits are also measured by market surrogate methods that have wide acceptability. For example, flood control benefits are usually measured in two dimensions: (1) cost savings from flood damage reduction and (2) income increases from flood damage reduction. Similarly, irrigation benefits are measured not in terms of willingness to pay but in terms of expected increases in income. Navigation benefits are always measured as net values of"cost savings" over the

least cost alternative method of transportation. Hydropower benefits are measured directly in terms of the least cost alternative of producing hydropower. In this case two components are involved, capacity and energy alternative costs.

These and other measurement methods are summarized in what I consider the order of preference based on reliability and credibility criteria in attachment 1, extracted from my textbook. I hope this will clarify and better organize the many suggestions made by the authors of this document. Their general identification and approach was good, but it is not well-organized for the purpose of establishing or developing a benefit estimation system. If one followed the general ranking of benefit estimating preferences provided in attachment 1, an outstanding benefit estimation system for all project services could be developed. The details, as far as they go are laid out in the WRC "Principles and Guidelines." Of course, modifications for expediency and state or local conditions and objectives would be in order.

Cost Allocation

Regarding the short section IV on "Methods for the Allocation of Project Costs," I am including my own version of cost allocation and cost sharing as attachment 2. I believe this will help clear up several points regarding the frequent confusion between project evaluation to determine the socially efficient benefits and costs and the more important financial feasibility that is the heart of cost allocation and cost sharing as it is traditionally practiced. Also, the 1983 version of the "Principles and Guidelines" is very specific about cost allocation being based on "financial" estimates, not economic estimates. I recommend this section of the 1983 "Principles and Guidelines" on cost allocation, especially if the historical methods of cost allocation are understood.

Personally, I find the material submitted in the review draft somewhat skimpy and secondhand. It certainly does not address the kinds of problems the State of Nebraska will face should it decide to enter the water resource project financing or construction business. Unless the state decides to subsidize the water business through general tax revenues it must decide on a cost allocation policy and a concurrent/equivalent cost recovery or pricing system (now called user charges) that will amortize any revenue bonds or revolving funds that must be amortized or maintained.

I have only a few specific comments about this aspect of the paper that might be included in a revision or final copy to improve its accuracy.

NOTE 10 There are some statements on page 54 about equity and cost allocation. Equity in the economic sense is defined very carefully as a change in the distribution of income or wealth resulting from a policy or market change. For example, a lowering of freight rates on corn from Nebraska to Georgia would redistribute incomes from Iowans (present market) to Nebraskans and Georgians in some proportion relative to bargaining strength. When one

suggests that this is, in a generic sense, a favorable or unfavorable redistribution is to inject a normative judgment that reduces the credibility of the economic analysis. We simply document the change in distribution and leave the normative judgments to politicians and philosophers. Also, fairness is a very delicate philosophical or legal argument best left to philosophers and lawyers or politicians. I also find no particular justification for arguing that a proportional sharing of savings from a multiple purpose project is of any consequence. It certainly cannot be justified by economic theory.

I believe one must decide whether or not to use the separable cost remaining benefits method of cost allocation or adopt the proportional savings approach. I do not believe they give the same result or the same distribution of cost. As a matter of fact, if one adopts the more market oriented approach of selling all vendible outputs from a multiple purpose project at market prices then the whole issue of cost allocation becomes irrelevant except as an accounting exercise. However, I do recognize and support the concept that a water resources project provides monopoly type services in which utility pricing (discriminatory) schemes are appropriate and should be used to provide financial feasibility for the multiple purpose project.

The biggest problem in dealing with cost allocation and cost sharing is that it always results in normative statements of good or bad to the detriment of creditable economic analysis. However you treat this problem please try to avoid that quagmire. I have found over the years that it is best to approach the problem of cost allocation and cost sharing from the financial point of view as a banker or investment underwriter so that one can maintain a clear view of the project's financial feasibility. Then,

any policy to subsidize one sector or a group of beneficiaries can be clearly stated along with the source of funds to provide that subsidy.

I also believe that you should seriously consider making maximum use of your potential water resources for power generation and municiple water supply uses. These purposes have market values (alternative costs) sufficiently high to provide consumers of power and M&I water supply with utility values equal to their willingness to pay and still provide net revenues that can be made available for subsidizing the "public goods" aspects from project services such as fish and wildlife and recreation if one chooses to do that.

Regarding the unnumbered table evaluating the cost allocation methodologies (p. 56), I do not see how the credibility of the separable cost remaining benefits method is in any way affected by its being widely used. The credibility of this method is found in economic theory because it is the only method that attempts to match marginal (read separable) costs to marginal benefits. Then, in a normative sense, it makes sense to allocate any residual costs in proportion to the remaining benefits. It is a benefits based method that comes closest to duplicating what would happen in a private competitive market where economic efficiency is a maximum and where economic distribution is by definition acceptable--though it may not be judged fair by all. I believe also that this table would be better served by defining accuracy in terms of matching marginal benefits to marginal costs, not in sharing the savings proportionately.

I am particularly sensitive to treatment of cost sharing in this document for two reasons. First, this Federal version has little to recommend it to the State of Nebraska because it completely ignores the financial aspects which will be most important to Nebraska citizens, water project service users and government officials. The data presented on

pages 58 through 63 were partially duplicated from a very complicated Federal cost sharing study based on a specific model with many, many assumptions. The presentation here indicate the authors have very little understanding of the numbers presented nor the context in which they were generated nor in the uses that can be made of such numbers by either the Federal Government or a state government in negotiating cost sharing arrangements that are now being proposed by both Democrats and Republicans in what they call "upfront non-federal sharing of costs." In my opinion, this is a sharing of financing which should also result in a sharing of revenues from such a joint Federal-state project. The normal procedure in the business world is to share in revenues in proportion to capital contributions. The federal government is particularly unwilling to face this issue since they now collect all of the cash from power generation and water supply sales and make very little effort to share any net revenues with local beneficiaries or governments.

I believe we will be seeing substantial and fundamental changes in the way we approach the financing of water resources projects. I can summarize all of my positions as I see them developing by saying that the good programs will be evaluated, invested in and priced in the future on the basis of financial analyses rather than the 1936 version of economic anaylyses (i.e., welfare economics) in vogue at that time. The sooner we work to this goal the better water resource projects and services we will be able to provide. This should not be interpreted as flaunting the environmental and welfare values associated with water projects. They can and should be provided for as a public good with the best engineering and ecological design considerations that we are capable of producing with the cost and benefits appropriately allocated.

The unnumbered table (pp. 64-67) on financing policies for state water resource development is very interesting and indicative of the move toward financial responsiblity as indicated above. I have no information or background to comment on the credibility or accuracy of these data. You should also be aware that many eastern states, Georgia included, are also establishing general obligation and revenue bond systems to finance water supply and waste treatment facilities through either loans and/or grants to their political subdivisions.

I hope you will be able to consider these comments and suggestions in the context in which they are offered, that is, to improve the study you're undertaking to determine your role in water resource project development and management. In some cases I have been pointedly blunt in order to correct either inaccurate or misused data, especially where it has been ingrained as a part of the contemporary wisdom without the benefit of contemporary analytical discussion. Frankly, it is hard to get a good discussion of these issues on benefit estimation and cost allocation that has much promise of improving our understanding. So, I wish to congratulate you in the Natural Resources Commission of Nebraska on undertaking this study whether you use it directly in your own program or in negotiating better deals for your users with the Federal Government or other financial interests. Overall, it is a good study that needs a little more critical review and polish. I enjoyed the project and best wishes.

DRI RESPONSES TO PROFESSOR RONALD M. NORTH'S COMMENTS

Note 1: The Nebraska Natural Resources Commission, which determined the scope of the study, had intended to have methods for evaluating public water supply, i.e., M&I, benefits analyzed during the second year of the study, and it is not clear yet if a second year of study will be authorized. The Commission did not seek to extend the study to power generation, water quality improvement or ground water management. However, the Commission may wish to consider Professor North's comments on these subjects and on the subject of land enhancement benefits as well.

Note 2: The technique used by the Denver Research Institute in conducting the literature search is described in Chapter II. The emphasis of the search, as specified by the Commission, was on "methods for determining fish, wildlife, outdoor recreation and tourism benefits of water development projects" and "methods for allocating project costs." While there is a close relationship with literature on cost-benefit analysis issues, the intention of the search was not to emphasize the latter. It was not the intention of the authors, nor in their opinion the intention of the Commission, to expend resources in preparing annotations of the literature. In conducting the search, reviewing documents, categorizing them, and evaluating methods for valuing benefits of fish, wildlife, recreation and tourism, Denver Research Institute did what it proposed to do in its September 1984 proposal to the Commission. It is understandable, since Professor North presumably did not see the RFP or the proposal, that he judged the work according to other criteria.

Note 3: The authors agree that it would be conceptually useful for economic impact analysis to distinguish between capital extensive and capital intensive users. However, it appears quite difficult to predict, at the time a project is proposed, how many of each there will be some years in the future. Distinguishing day users from tourists on the basis of distance of residence is an easier task.

Note 4: As Professor North comments, a benefit is a benefit. However, if private and public benefits cannot be distinguished, how can cost allocation be determined equitably?

Note 5: The authors favor maximization of project efficiency and project equity, as does Professor North. They are, however, unclear as to how to use these as criteria in evaluating methods for determination of benefits, which was the Commission's charge to them. Project planning and benefit cost methodologies are more suited to those criteria.

Note 6: The authors have expressed some reservations on their recommended use of economic multipliers (pages 33-34), and have discussed the rationale behind their recommendation. Professor Walsh also commented on the use of multipliers. It is not a matter of dispute that injections of new spending from tourism do lead to secondary rounds of spending that support economic growth. The problems are in distinguishing new spending from transfers, and in establishing a value for the multiplier in the absence of a recent, carefully done, economic base study of the

locality. These are sources of concern to the authors, as they should be to the Commission. Omitting multipliers is the most conservative way of estimating benefits, but it is not the most accurate way. Neither is overstating the multiplier and counting transfers as new spending from outside the region.

Note 7: As Professor North states, these points are arguable. Purchasing an annual pass to state parks or purchasing an annual fishing license are, to a degree, market choices. However, because the charges are unrelated to volume or frequency of use, they are not commercial in the sense that Disney World is. Professor North makes a significant shift of the authors' meaning when he derides their unwillingness to use a private recreation fee as a surrogate for the value of a public recreation of equal or similar quality. (Emphasized words added by Professor North.) The authors had argued that, because private recreation areas normally have controls on overcrowding, they are not fully comparable with public areas and thus not equal in quality. If of unequal quality, it is inappropriate to use their fees as a surrogate; if equal or similar in quality, then of course it is appropriate to do so. As to the point that willingess to pay for water-based recreation is high and that participation rates also are high, this certainly is true in the western states reservoirs. These are, incidentally, all or nearly all public--no private ones offering water-based recreation come to mind--although concessions are granted to private marina operators. Some years ago, the Bureau of Reclamation overlooked the importance of recreation on reservoirs it constructed. In 1947, for example, after completion of scenic Shadow Mountain Reservoir near the headwaters of the Colorado River, the USBR sold nearly all the shoreline land to private parties. Luckily, some public access is possible. Now, the USBR plans multipurpose use reservoirs with a public agency managing the recreation.

Note 8: Several of Professor North's points are well taken. "Judgment" was used, somewhat inaccurately, to describe the estimator's ability to gather data, analyze its applicability, and use it to develop a demand schedule. In cases where the market is imperfect or nonexistent, surrogate data must be found, and this requires something more of the estimator than merely gathering data on actual transactions.

Note 9: The statement, "undervalues inexpensive activities," reflects the bias of one of the authors concerning the ability of the marketplace to set values on outdoor recreation, admittedly a form of heresy which he hopes his economics professors will not discover. Leaving aside transportation cost and travel time for the moment, anyone can enter Rocky Mountain National park for camping, fishing, hiking, even a wilderness experience for a fee of $2.00 (in summer; $1.00 for most of the year). An annual pass to this and other national parks is $10.00. A visit to Disney World will cost several times as much. Is Disney World several times more valuable than Rocky Mountain National Park? The market says so, the gross expenditures method says so, but adults who have visited both parks may not agree.

Note 10: Agreed. The text has been revised to reflect Professor North's comments on economic equity.

EVALUATION OF METHODS OF DETERMINING FISH, WILDLIFE, OUTDOOR RECREATION, AND TOURISM BENEFITS OF WATER DEVELOPMENT

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June 30, 1985

INTRODUCTION

Water is of increasing concern to the citizens of Nebraska -- how to conserve available supply, plan for the needs of an expanding population and industrial base, provide for irrigated agriculture, and achieve a balance between environmental quality and water development. As the economy grows, increasing demands will be made on rivers. In the past, most Nebraska communities welcomed new dams and water diversions as a source of income and economic growth. The supply of water was increased within the constrains of available water for storage, suitable construction sites, and the large amount of initial capital investment required. More recently, citizens of the state have begun to question whether some rivers should be protected from further water development. As natural rivers become increasingly scarce, they are expected to have more value to the general public than potential reservoirs which would inundate them. In a balanced approach, some rivers or sections of rivers would be best suited for development and others for protection (Walsh, et al., 1985). Suitable techniques for estimating the benefits of environmental quality will be discussed in the third section of this paper. Benefits include recreation use and preservation values of the general public.

Economists distinguish between the primary benefits and secondary impacts of recreation economic decisions. In the first section of this paper, I consider the primary benefits to individual consumers of outdoor recreation programs. Procedures for estimating values of nonmarketed commodities such as water-based outdoor recreation can be interpreted as efforts to simulate market outcomes. The principal concept underlying such estimation is that value, or net benefit, is defined as the amount a rational and informed user of a publicly

supplied good would be willing to pay for it, net of associated costs (U.S. Water Resources Council, 1983). Willingness to pay, which reflects the user's willingness to forego other consumption is formally represented by a demand curve relating the quantities of a good taken to a series of prices. The value of additional units decreases as quantity consumed increases. The negative slope of the demand curve follows from the principle of diminishing marginal utility for consumers. The area under the demand curve above cost is an approximation of the consumer surplus of individual users. The net benefits of individual consumers represent the social benefits of public recreation programs. The consumer surplus of individual users is not spent in the region of the recreation site, but this does not make it any less real to individual consumers.

In the second section of this paper, I consider another closely related concept, the secondary effects of the actual expenditures by individual consumers and managers of recreation resources. These are the regional economic impacts on business output or sales, employment, net income, tax revenues, etc. The essential idea is that primary costs to individual consumers and managers become secondary gains, in part, to the regional economy supplying recreation goods and services. Studies of regional economic impact do not measure the value of the project to the primary users of the recreation site but rather the value of the project to those who are involved in supplying the primary users with goods and services. Regional economic impacts of water development should be placed in a separate account from the benefit cost analysis of water projection.

BENEFITS OF OUTDOOR RECREATION, FISH, AND WILDLIFE

The Denver Research Institute recommends a curious method of estimating benefits per recreation user day. Their benefit estimate is simply the sum of a uniform transportation cost (9 cents/mile) for recreation users who live 25 miles from the water-based recreation site plus travel time (50 MPH) valued at the gross state product per capita. Round trip travel costs are equal to 9 cents times 50 miles divided by 2.5 persons per vehicle equals $1.80 per trip. Travel time cost at 1.25 of per capita income is assumed to be $6.84 for 1 hour travel. Summing these two values provides their benefit estimate of $8.64 per recreation day. They propose that this procedure is superior to the current Nebraska unit day value of $2.90 per recreation day. Their estimate is proposed to represent the consumer surplus of all persons using the site. Recreation user benefits are simply given by the travel cost for persons living on the perimeter of an assumed 25 mile market area.

This method represents a serious reversal of the meaning of costs and benefits. Certain expenditures for travel and travel time have
NOTE 1 been transformed as if by magic from costs into benefits. For example, direct auto expenses become, rather than a cost of access, a benefit of water based recreation. But, for the travelers visiting the site these costs must be paid for and a further surplus be available for the recreation trips to be viable. The net willingness to pay of a typical user of a site may be more or less than the visitor who lives 25 miles away. Their approach is not even an acceptable measure of the costs of transportation or of travel time, as will be discussed below.

NOTE 2 The sum of recreation travel expenditures and travel time cost is not appropriate for valuation of recreation nor for valuation of other

resources. Travel expenditures are only useful for measuring the impact on local economies of some resource management action. Travel expenditures only indicate the amount of money going into recreation support sectors of the economy resulting from availability of this site. If the site were closed, the same expenditure might be shifted to a different site or leisure activity. Thus, the flows of money might not be lost to the economy, just shifted from one area or sector to another.

NOTE 3

Use of travel expenditures as a measure of value leads to maximizing inefficiency instead of efficiency. That is, if travel expenditures and travel time are a measure of value, new recreation sites should be located as far away from population centers as possible, so that people have to incur large expenditures to get there. This is unwise, because the travel costs saved by locating a site closer to major population centers could be spent to purchase other goods that also provide enjoyment.

Management decisions should be based on the net value in excess of the costs of taking advantage of the recreation opportunity, because this measures the real monetary value that would be lost if the opportunity were not available. What is needed is the net contribution to user benefits provided by the recreation opportunity. For example, in determining whether it is economically feasible to do some site improvement, such as planting trees in a picnic area, the management costs of planting must be compared to the benefits. Travel expenditures and time do not provide information on net benefits. In my judgment, their recommended procedure would not provide recreation

values comparable to the value of irrigation and other water uses because it is not a correct measure of net willingness to pay.

Net willingness to pay is the standard measure of value in benefit cost analysis performed by the U.S. Army Corps of Engineers, Bureau of Reclamation, and the Soil Conservation Service (U.S. Water Resources Council, 1979, 1983). Net willingness to pay is the basis of the Resources Planning Act values used by the U.S. Forest Service in FORPLAN. The Rangeland Investment Policy of the Bureau of Land Management stipulates willingness to pay as the measure of value of all outputs in SAGERAM analysis (Bureau of Land Management, 1982). For the purpose of benefit cost analysis, Forest Planning Optimization Models (Forest Service's FORPLAN) and Range-wildlife Investments (BLM's SAGERAM), economic values for all outputs are defined in terms of net willingness to pay by users. This is the value of forage to ranchers, the value of irrigation water to farmers, and the value of wildlife to hunters and fishermen. The approach applied to water calculates how much receipts and costs will change in a given area as the result of additional water supplies. The excess of receipts over costs is the economic measure of benefit. These water values are commensurate with the values for other resources because they represent net benefit to the user per unit of output (i.e., the user's maximum net willingness to pay for the resource).

NOTE 4

Contrary to the Denver Research Report, there is no difference in principle between benefit cost appraisals conducted for a state and that for the nation. Beneficial and adverse effects must be identified and measured. The conventional benefit cost approach to project appraisal shows the change in gross regional benefits (GRB) net of costs to the state as a result of the project in question. The

appraisal answers the question: "Will GRB increase sufficiently to pay the project's cost and still leave the state (region) better off as a result of the project?"

In symbols, this is stated as:

$$\sum_{t=0}^{T} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{T} \frac{C_t}{(1+r)^t} > 0$$

where B_t and C_t represent, respectively, benefits (increase in GRB due to the project) and costs (decrements in GRB due to the project) in year t; T represents the project life and r is the rate of discount.

Knetsch and Davis (1966), the U.S. Water Resources Council (1979, 1983), Dwyer, Kelly and Bowes (1977), and Walsh (1984) all recommend the Travel Cost Method (TCM) and the Contingent Value Method (CVM) as conceptually correct techniques for empirically estimating users net willingness to pay. The TCM relies on variations in travel costs of recreationists to trace out the demand curve. The area under this demand curve but above travel costs is a measure of consumer surplus or net willingness to pay. For readers unfamiliar with TCM see Clawson and Knetsch (1966), Dwyer, Kelly and Bowes (1977), or Rosenthal, Loomis, and Peterson (1984). The CVM asks users directly to indicate their net willingness to pay for current or proposed conditions.

NOTE 5

Advances in the theoretical foundation and empirical applications have provided the basis for a general non-market valuation framework within the context of microeconomic theory that provides "rules" for generating comparability between various applications of TCM and CVM. Surveys of the literature are not substitutes for region-specific estimates of the value of recreation. These can be done using campground fee receipts, boating permits, and state game information as

data sources for TCM. A few water projects are already conducting TCM studies. A systematic effort to harness the existing data and skills within each state would provide more region-specific values. For example, a recent study could be applied to water-based recreation benefit estimation in Nebraska. Rosenthal (1985) conducted an outstanding regional travel cost demand study of 11 reservoirs operated by the U.S. Army Corps of Engineers in Kansas and Missouri. The data were obtained from on-site interviews during the summer of 1982.

The basic travel cost model is an equation that predicts visits from particular origins to the site. As such, it includes those variables that are expected to influence site use including distance to site, site characteristics, and the availability and characteristics of substitute sites. In evaluating the benefits of a proposed new site, the first decision is whether or not to employ an existing model. If an existing model is employed it is important that the model (i.e., the equation that predicts visits from particular origins to the site), be applied to the proposed water-based recreation site, and not the values per visit derived from its application to another site. The values derived from application of a travel cost model to a particular site depend on the characteristics of that site, the alternatives that are available, the population of the market area, and the location of the market population with respect to the site and alternative sites. Because all of these factors vary from site to site, the dollar value derived from application of the model at one site is not appropriate at another site, unless the two sites are very similar in all of these respects.

Assume that the construction of a new site is being considered and the benefits include the value of the recreation experience that will be provided at the site, as well as the value of enhancements to experience provided at other sites where reductions in congestion may have resulted from use being shifted to the new site. If these other sites are heavily used and congestion is reduced by the creation of the new site, the increase in the willingness of users of those sites to pay resulting from that reduction in congestion should be considered as a benefit of the newly constructed site.

To estimate the change in benefits associated with the modification of a site, it is necessary to estimate the benefits with and without the modification. For example, assume that a wildlife biologist estimates that fish populations would double if grazing were eliminated along riparian areas. This doubling of fish population increases fish available for harvest. Once the increase in fish available for harvest is known, the correct way to calculate the additional long run benefits of the change is to use this new level of harvest as a demand curve shifter. When fish harvest goes up, the demand increases or shifts to the right. The improvement in quality will be translated into existing anglers taking more trips and non-anglers beginning fishing. The correct benefits of these additional trips from the increase in quality of fishing is equal to the area between the with and without demand curves. If the anglers net willingness to pay for the additional fishing trips is greater than the ranchers net willingness to pay for the AUM's, economic efficiency is improved by restricting cattle from riparian areas.

These added values can be very useful in evaluating changes in fishing regulations or resource actions that will change the number of

fish harvested or the size of fish caught. Decisions made by integrating these economic values into project analyses of water development, timber sales, grazing allotment management, right of way design and fish restoration investments are likely to result in increases in net public benefits as compared to current undervaluation of fisheries values.

In many states, the land or habitat of large water development projects is managed at the Federal level, and the wildlife is property of the state. Coordination of economic value is necessary if Federal plans affecting habitat are to be compatible with the state plans for management of individual species. Nebraska should consider the experience of other states. For example, to promote a concensus on the economic value of fisheries in the state of Idaho, several Federal agencies (notably the U.S. Forest Service, Bureau of Land Management, and the U.S. Fish and Wildlife Service) joined with the Idaho Department of Fish and Game to empirically estimate the value of fisheries based on recreation in Idaho (Donnelly, et al., 1985; Sorg, et al., 1985).

The underlying premise of this study was that using data from a survey reviewed by all parties, using methodologies acceptable to all parties, and applying standard statistical techniques, all parties would agree the resulting dollar values were reasonable and useful. The study produced theoretically correct values and values acceptable to several agencies. In addition, the study served as a test of the cost effectiveness of using the travel cost method and the contingent value method.

One of the assumptions of the travel cost method is that, at each travel cost, any user who wishes to visit the site is not excluded. If users living over 25 miles away from a site or out-of-state users are excluded from the study, the visitation rate is not correct. Omission of distant users tends to result in an underestimation of visits at relatively high travel costs. The effect on the demand curve and benefit estimates is that benefits will tend to be underestimated to the degree that these users travel further distances than other users. The highest observed travel cost is used as the upper limit in deriving the second stage demand curve. Omission of distant users is likely to produce the most serious underestimate of benefits for activities such as big game hunting, waterfowl hunting, fishing, and boating.

NOTE 6

Contrary to the Denver Research Institute report, there is no reason to believe that the disutility of driving is related to gross state product valued at 125 percent of per capita income. The practice of expressing travel time cost as a proportion of the traveler's wage rate is a convenience adopted by the transportation literature. In the early 1970s, Cessario and Knetsch reviewed the literature on disutility of commuting to work and concluded that the disutility of driving ranged from 25 to 50 percent of the wage rate. Subsequently, the U.S. Water Resources Council (1979, 1983) recommended this identical amount for applications of the zonal travel cost method in recreation benefit studies. This was a reasonable standard which would allow comparability among studies of alternative water development projects until better information becomes available.

There has been very little empirical work on the value of recreation travel time. In the early 1980s, Winston (1985) found that the disutility of recreation travel time by auto in the U.S. was

equivalent to only 6 percent of the wage rate. Our own investigations in Colorado show that travel time has positive sightseeing benefits on short trips, and that as distance traveled rises, driving time eventually becomes a disutility which increaess with distance. It seems clear that the DRI estimate is of questionable validity. I would be surprised if the disutility of recreation travel time in Nebraska is a uniform 125 percent of per capita personal income on trips of 25 miles or less.

Morrison and Winston (1985) used a multinomial logit mode choice model to estimate the demand for vacation trips in the U.S. They estimated the marginal rate of substitution of money for travel time, i.e., the amount of money vacation travelers are willing to sacrifice for a reduction in the amount of time that they spend in travel. The authors estimated that the value of auto vacation travel time was 6 percent of the wage rate, which suggests that vacation travelers do not perceive the time spent driving to recreation sites as particularly onerous nor do they attach a high opportunity cost to their travel time in terms of the time foregone from recreation activities at these destinations. Recreation travel usually involves distinctly different circumstances from work travel. Commuters are required to travel to a destination not of their own choosing, often during peak, rush-hour traffic. Recreation travel, on the other hand, is a discretionary leisure time activity. The route, time of departure and destination may be chosen to provide a positive value of travel time.

REGIONAL ECONOMIC IMPACT OF TOURISM

The DRI report incorrectly defines the economic benefits of tourism as the regional economic impacts. The authors recommend that

the economic benefit of tourism be measured as the gross expenditures of tourists ($20.51) from outside the 25 mile radius of the site times a 2.3 multiplier. Thus, tourist benefits would be $20.51 x 2.3 = $47.17 per recreation day. The multiplier of 2.3 represents the value added of tourism and is derived from input-output models for the economy of the region or state. See Supalla, et al. (1982) for a recent study in the Nebraska High Plains. Value-added generally refers to net payments for wages, salaries, rents to primary natural resources, and government services utilized by the relevant accounting entity -- a reservoir, region or state.

This approach differs sharply from benefit measures employed in conventional benefit cost analysis. The Denver Research Institute report which recommends an input-output approach for regional water program evaluation has not given sufficient attention to the linkage between welfare economics principles and the nature of input-output analysis. As a result, evaluations based on regional inter-industry models would overstate the net direct benefits of water developments. Young and Gray (1984) demonstrate that the social opportunity cost of labor and other primary resources would have to be zero for the maximum net social product derived from water-based recreation expenditures to be properly measured by value added. Even though water is very scarce in the arid western United States, that fact does not appear to warrant the further leap to an assumption of zero opportunity cost of labor and other primary resources. Such a position is tantamount to assuming that a significant portion of the "associated recreation user costs" of a water resource project have no alternative uses during the life of the project. This implicit assumption would be realistic for a state

NOTE 7

or regional planning agency only in the most unusual of cases, i.e., in a developing economy with permanent unemployment.

The Water Resources Council guidelines recommend that regional economic impacts should be treated as income transfers in a separate account to distinguish them from benefits which contribute to general welfare or state economic development. Conceptually, employment anywhere in the state of otherwise unemployed or underemployed resources that results from a project represents a valid benefit. However, they should not be counted because of problems of identification and measurement and because unemployment is temporary. The federal guidelines allow one major exception to the rule. If the regional economy of a proposed project has substantial and persistent unemployment of labor, then the benefits of the project may include the income (salaries and wages) of otherwise unemployed labor working onsite in the construction or installation of a water project or a nonstructural improvement.

NOTE 8

These benefits would be determined at the time a water project is submitted for authorization and for appropriation of funds to begin construction. Substantial and persistent unemployment would exist in an area when: unemployment in the previous year was 6 percent or more; and was at least 50 percent above the national average for three of the previous four years; or 75 percent above the national average for two of the previous three years; or 100 percent above the national average for one of the previous two years. The guidelines provide that the percentage of project construction labor estimated to come from the local unemployed labor pool will be: skilled, 30-43 percent; unskilled, 47-58 percent; and other, 35 percent, depending upon whether there is a local hire rule.

In the 1960s and 1970s the areas of the United States where these conditions prevailed were the Appalachian Mountains, the Northern Lake states, and the Four Corners area of the Southwest. In these cases, secondary economic benefits measured by direct and indirect gains in net income from the construction of water-based recreation facilities would be counted as benefits representing real economic gains to the national economy. But these cases are infrequently encountered in recreation economic decisions. This is not to downplay the economic importance of regional economic impacts to the economic and political considerations in the region of a water-based recreation site. Much of the political motivation for the development of water projects represents an attempt to capture regional gains, which in many cases are reflected in large increases in property values. From the viewpoint of the region where a proposed water recreation project will be located, the residents affected are concerned about the gains and losses to themselves, not to other regions or the state as a whole.

Most secondary gains to a particular region will be offset by actual or potential losses elsewhere. This means that outdoor recreation programs redistribute income to the regional economy of water-based recreation sites from other regions in the state and the nation. Whether such redistribution is desirable is a political decision beyond the scope of economics. The essential point is that these changes in the distribution of income represent transfers of income and not social benefits, i.e., not real welfare gains to the state or nation. For example, recreation spending by western Nebraska tourists may result in a net economic loss to the eastern region of Nebraska and to other areas where the money would have been spent had

they not taken a western Nebraska vacation. We should be cautious when interpreting the regional economic gains from a new water-based recreation development. What is a gain to the local region may be a loss to another region, and the economic welfare of the state may not change. Economists refer to such transfers of income as pecuniary impacts to distinguish them from technological impacts where real secondary benefits occur in regions with long run unemployment, immobility of resources, and economies of large scale.

The multiplier of 2.3 recommended by the Denver Research Institute report is somewhat higher than the national average but is within the acceptable range. Regional output or sales multipliers for expenditures on recreation goods and services have averaged approximately 2.0 and ranged from 1.5 to 2.6 in the United States. Several studies provide clues as to the reasons regional multipliers vary in amount. Size of the region has an important effect; the value added within the region rises as its geographic area is increased and a smaller proportion of the expenditures on recreation goods and services are purchased outside of the region. Also regional multipliers represent a weighted average of the multipliers for each type of business where tourists purchase goods and services. If a large proportion of expenditures by recreation visitors are for services, lodging, and food and beverages, with much higher output or sales multipliers, then the regional multiplier will be higher because it represents a weighted average for all recreation expenditures. Day users of a park who bring a picnic lunch from home have very low regional output or sales multipliers. Recreation visitors who stay overnight in campgrounds typically spend little or no money for services, lodging, or restaurant meals, and as a result have low

regional multipliers. The recreation industry tends to have somewhat lower regional multipliers than agriculture, forestry, or light manufacturing industry. However, in many rural counties with substantial recreation industries, the somewhat lower regional multiplier effect of tourist spending is more than offset by the large absolute level of tourist expenditures.

Every local community is concerned about regional economic development to create job opportunities, raise incomes, and contribute to the community's social viability and general economic prosperity. The hundreds of local economic development organizations in Nebraska are testimony to the importance communities place on regional economic impacts. These organizations cooperate with the state and federal government in programs aimed at attracting new employers and retaining current ones. Examples of economic development activities in resort areas include: acquiring parks and other recreation areas, open space, upgrading sewer-water systems, roads, labor training, small business assistance, theme zoning, and store front renovation. It is not surprising that nearly all communities welcome additional job opportunities. Community members worry that young people finishing school and other unemployed residents will be forced to commute elsewhere or move away to find work. This concern is not only for the individuals unable to find work locally, but also regards a broader issue -- a significant loss of residents would threaten the community's social and economic viability. The ghost towns from an earlier era are stark reminders that not all local economies survive.

In this section, we discussed the proper role of empirical studies of the regional economic impact of outdoor recreation, in particular,

the policy implications for recreation economic decisions. The important conclusion is that the regional economic impact of water development should be placed in a separate account from benefit cost analysis of water projects because they usually represent transfers in welfare within the state or nation.

VALUE OF WILDLIFE AND ENVIRONMENTAL QUALITY

The Denver Research Institute report bemoans the deficiencies of attempts to value wildlife and environmental damages of water development projects. Unfortunately, their survey of the nonmarket valuation literature is several years out of date. Most of the problems in valuing wildlife and environmental damages the report discusses have been overcome in more recent years. In this section, we will review studies of the recreation use and preservation benefits to the general public of the: grizzly bear, bighorn sheep, golden eagle, and other endangered species, wilderness areas, wild and scenic rivers, water quality, air quality, and forest quality. These resources have been valued using standardized procedures so that their values are on an equivalent basis. The contingent valuation method is recommended by an interagency committee of the federal government (U.S. Water Resources Council, 1979, 1983) as a suitable measure of net willingness to pay. It provides values which are commensurate to values of alternative resource uses. The method has also been used by the U.S. Fish and Wildlife Service as part of its National Survey of Fishing, Hunting and Wildlife Associated Recreation, since 1975. Along with the travel cost method for estimating recreation demand, the contingent value method serves as a standardized tool for use in valuing environmental consequences of many land and water management projects.

NOTE 9

The travel cost method of estimating the demand for wildlife recreation has been widely applied. Dozens of studies exist on the value of hunting and fishing. Recent improvements in the travel cost method have allowed analysts to evaluate how the benefits of recreaional fishing changes when fish catch is increased (Donnelly, et al.; 1985; Sorg, et al., 1985; Mendelsohn and Brown, 1983), and how the type of angler influences the benefits of fishing (King and Hof, in press). Desvousges, et al. (1983) and Vaughan and Russell (1982) have utilized the travel cost method to quantify the increased benefits due to improved water quality.

Economists have made considerable progress in developing a concept of total economic value. As early as the 1960s, economists recognized that onsite recreation values did not capture the full social benefits of preserving a natural area from irreversible loss. Weisbrod (1964) first discussed the notion that most people would be willing to pay something to maintain the option of possibly visiting a natural area in the future. Arrow and Fisher (1974) demonstrated there exists a quasi option value for maintaining future options when considering an irreversible investment that would forever foreclose preservation of an area or species. Krutilla (1967) and Krutilla and Fisher (1975) discussed the possibility that many persons who may never visit a unique natural area or see a particular species might still gain satisfaction from knowing that the area exists and is protected. Krutilla (1967) also suggested the current generation would be willing to pay something to bequest a unique natural resource or species to future generations. Much of this literature has been summarized in Randall and Stoll (1983). As these concepts have evolved in the

economics literature, they are now commonly, though not universally, referred to as "option, existence, and bequest values."

Protection of water quality was the first resource for which empirical estimates of option and existence values were estimated along with recreational use values. In the Walsh, et al. (1978) study of the South Platte river basin, the viability of fish populations was one for the key characteristics described to the respondent. They report values of $56 per household for recreation use, $22 per household for option value, $22 per nonuser household and $47 per user household for existence value (defined as clean water exists for natural habitat for plants, fish and wildlife, even if you knew for certain you would not use the river for water-based recreation), and $18 per nonuser household and $45 per user household as bequest value. This study sparked other studies of these benefits of water quality. The Environmental Protection Agency provided funding to Research Triangle Institute for a study of the recreation, option and existence values of improving water quality in the Monongahela River, Pennsylvania. In this study Desvousges, et al. (1983), reported household option values ranging from $10 to $38 a year in terms of higher prices and taxes for better water quality. Desvousges, et al. calculated existence values of improved water quality ranging from $42 for nonusers to $66 for users.

Brookshire, et al. (1978) presented their first attempt to measure option values for bighorn sheep and grizzly bears. This experiment led to refinement in both theory and application. Brookshire, et al. (1983) published refined estimates of option price (option value plus expected recreational use benefits) of viewing bighorn sheep and

grizzly bears and the existence values for these species using the CVM approach. The option prices were $21 and $23 annually for grizzly bears and bighorn sheep, respectively. The existence values were $24 annually for grizzly bears and $7 annually for bighorn sheep.

More recently, Stoll and Johnson (1984) conducted a CVM survey to estimate the value of whooping cranes. Their survey included visitors to the Aransas National Wildlife Refuge in Texas to measure recreation use value and a mail survey of the residents of Texas, Chicago, New York, Atlanta and Los Angeles. The authors reported an annual option price of about $17 for Aransas Refuge visitors, $10 for Texas residents and $13 for out-of-state residents. The existence values for refuge visitors average $9 a year, and $1 per household for Texas and out-of-state residents. Since protection of an endangered species such as the whooping crane is a public good households in the U.S. and throughout the world can simultaneously enjoy existence and option values. Stoll and Johnson estimated the national option and existence value for whooping cranes at $573 million annually.

Boyle and Bishop (1985) studied the willingness to pay for protection of the bald eagle and striped shiner endangered species in Wisconsin. The willingness to pay for the protection of the bald eagle ranged from about $12.50 to $44 per person depending upon whether the respondent viewed bald eagles on recreation trips and whether they were active in environmental organizations. The willingness to pay for the protection of the striped shiner fish ranged from about $5 to $13 per person with the upper level representing active environmentalists.

A recent study by Walsh, et al. (1985) demonstrates how much a household is willing to pay to protect all kinds of threatened and endangered species of wildlife when their protection is one of seven

environmental resources individuals are asked to value. The average household in Colorado was willing to pay $58 in higher taxes and prices to improve the current management programs to remove all fish and wildlife from the list of threatened and endangered species. Of this $58, 29 percent was for recreation use, 20 percent for option values, 23 percent for existence values and 28 percent for bequest values.

NOTE 10

Other empirical estimates of option, existence and bequest values include air quality at Grand Canyon National Park (Schulze, et al., 1983), protecting wilderness areas in Colorado (Walsh, et al., 1982, 1984) and protecting potential wild and scenic rivers in Colorado (Walsh, et al., 1985). In both the Grand Canyon and Wild Rivers study, 80 percent or more of the total social benefits of environmental improvements were associated with off-site benefits such as option and existence values.

Of course, these types of survey's are subject to several possible types of error including what has become known as hypothetical, strategic and information influence or bias. It is generally acknowledged that careful survey design can minimize these biases and empirically they are not very common (Schulze, et al., 1981). Comparison of the hypothetical market approach used in CVM with property value markets for air quality (Brookshire, et al., 1982) and simulated markets with real cash for deer permits (Bishop, et al., 1984) show that CVM values tend to be conservative. Since then, additional refinement in CVM have occurred to improve the accuracy with considerable success.

Bishop and Heberlein (1979) compared contingent valuation estimates of willingness to pay for goose hunting at Horicon Marsh in

Wisconsin with values obtained from the travel cost method. They suggested that contingent valuation estimates of willingness to pay were rather low by comparison, depending on their assumption about the value of travel time. With no disutility of travel time, the values obtained by the two approaches were not significantly different. In a more recent study, Bishop, et al. (1984) compared contingent valuation estimates of willingness to pay ($28) with actual cash payments ($31) and found no significant difference in the hypothetical and actual payments for deer hunting in the Sand Hills of Wisconsin. We also have found that the rank order of contingent valuation estimates of willingness to pay were not significantly different from rank order of values derived from psychological scores. Thus, in terms of travel behavior, actual cash payment, and rank order psychological comparisons, the contingent valuation method has performed reasonably well.

Perhaps of more importance, willingness to pay equations have been developed from CVM information that allow decision makers to determine how social benefits change with a small increase or decrease in society's stock of some resource. For example, what is an additional 1,000 acres of wilderness worth in Colorado (Walsh, et al., 1982, 1984) or seeing 10 elk per day instead of 5 elk per day in Wyoming (Brookshire, et al., 1978, 1983) or seeing 10 more trees per acre in Colorado (Walsh and Olienyk, 1981). These incremental and site specific issues are the ones that are management relevant. While society as a whole values wilderness, the U.S. Congress is not deciding whether to have wilderness or not but rather how many areas and where. The same is true with of State Game and Fish managers. The issue is not whether to have any deer or not but what are the benefits of more

deer for viewing and hunting. To make resource allocation decisions, managers need to know how social benefits change when the level of a resource is increased or decreased from the current amount.

CONCLUSIONS

My main disagreement with the Denver Research Institute report is its conclusion that the state lacks the expertise and resources to measure net willingness to pay for fishing, hunting, other outdoor recreation and tourism. There is no reason why Nebraska should remain a backward state, outside the mainstream of economics, with regard to the application of economics in water resource planning. States with less population and resources have adopted the procedures recommended by the U.S. Water Resources Council to conduct studies of recreation demand and benefits. States where the travel cost method and contingent valuation method have been successfully applied include: Idaho, Montana, Kansas, Wyoming, Arizona, New Mexico, Colorado, Missouri, Texas, etc. The University of Nebraska has natural resource economists who are capable of applying these methods in a rigorous scientific basis. There is no need for the state to go outside for experts on water-based recreation. You would be better advised to spend your limited recreation economic budget for careful scientific studies applying the standard Water Resources Council techniques than to fund limited reviews of the literature, much of which is of only historic interest and not applicable to current empirical research and planning. For example, the Trice and Wood approach and the Ripley methods are not acceptable for benefit estimation, contrary to the view of DRI.

NOTE 11

NOTE 12

Donnelly, et al. (1985) concluded that the travel cost method and contingent valuation method yield consistent results. Which method is preferable depends on the circumstances, application of results, data availability, personnel, and time. The authors encountered little difficulty in getting people to participate in the survey or in answering the value questions in a study of the benefits of steelhead fishing in Idaho. Once the questionnaires were obtained, it took 10 to 14 man days to construct a regional travel cost model. The work involved use of several specialized computer programs designed to shorten the time necessary to aggregate individual data into zones, calculate substitute indices, calculate second stage demand curves, and benefits. Such programs are available from the U.S. Forest Service for application in other states. The contingent valuation method was faster in terms of data compilation and statistical analysis. The contingent valuation method took 1.5 person days to analyze mean willingness to pay. However, if origin-destination data already exist in the form of permits or license plate numbers, etc., then the travel cost method would become a more cost-effective way to value recreational activities.

With respect to joint cost allocation, I agree with the Denver Research Institute recommendation that the most acceptable approach is separable costs remaining benefits. Most water economists support the method including the leading natural resource economist in the U.S., John Krutilla, Resources for the Future, Washington, D.C. Moreover, it is the recommended procedure of the U.S. Water Resources Council. However, application of the method requires that all benefits of a proposed project be measured on a commensurate basis, i.e., net

willingness to pay. This refers to Item 1, benefits, in Table III on page 50 of the Denver Research Institute report. Item 2, alternative costs, and Item 3, justifiable costs (or is it benefits?), would not be an acceptable basis for estimating the benefits of outdoor recreation.

DRI RESPONSES TO PROFESSOR RICHARD G. WALSH'S COMMENTS

Note 1: The authors take sharp issue with Professor Walsh's allegation that travel cost and travel time expenditures are not appropriate means of valuing recreation benefits, and that costs and benefits have been confused. They have not been confused. Certainly, these expenditures are costs to the traveler and not benefits to anyone, ignoring the negligible benefit to those selling automobile fuel. That is not the point. The real point is that the travel cost method is a well-known, accepted means of measuring benefits of a recreation experience, i.e., a surrogate for determining willingness to pay. The U.S. Water Resources Council's Principles and Guidelines (p. 68) state "TCM [travel cost method] consists of deriving a demand curve by using the variable cost of travel and the value of time as proxies for price."

Note 2: The authors recognize a difference of opinion with Professor Walsh, and also some confusion in his terminology. He appears to use "travel expenditures" to mean both travel costs, i.e., direct costs of driving an automobile, and recreation expenditures, i.e., purchases of goods and services such as food, lodging, rental of sporting equipment, etc., but not including transportation cost or the value of time spent in travel. It is important to distinguish these expenditures. The authors use estimates of travel cost (automobile operation) and the value of time spent in travel as measures of willingness to pay, i.e., the simulated market value of a commodity--recreation--not traded in the market. This is, in other words, a measure of the benefit received from the recreation opportunity. It is entirely unrelated to any amount of money spent on goods and services in the area of the recreation site. Professor Walsh would have Nebraska continue to ignore the very tangible benefits of tourist spending on the local economy because if the site were closed that expenditure might be shifted to another site or to another recreation activity, e.g., bowling. The authors recommend that local spending on goods and services (other than transportation cost) be recognized as a benefit of tourism. Judgmentally, the authors reduce that spending by not counting any expenditures from users living within 25 miles, as a means of compensating for transfers. In the absence of a site-specific survey, which would establish amounts of new spending by tourists and residents of other states, the authors have proposed a method that, admittedly crudely, attempts to estimate the amount of tourist spending. To omit it entirely because it cannot be measured precisely is the rationalization of a theoretical economist, contrasted with an applied economist.

Note 3: Here, Professor Walsh sets up and demolishes a "straw person." It is obvious that the more remote sites would attract relatively fewer users so the aggregate amount of "willingness to pay" would be less, not more. The present Nebraska method, as well as the method recommended by DRI, base numbers of visits on the population density of the market area surrounding the site.

Note 4: Professor Walsh makes a statement that either is inaccurate or (if narrowly construed as accurate) is misleading: "there is no difference in principle between benefit cost appraisals conducted for a state and that for a nation." If in principle is emphasized, the statement can be defended. More to the point, however, is that benefit/cost analysis is very different in practice, if done for a

single state instead of for the nation. The state of Nebraska is contemplating spending state funds on water resource development and is interested in benefits to the residents of Nebraska. A benefit received by a Coloradan, vicariously enjoying the knolwedge that a stretch of the Niobrara remains wild and scenic, is not an appropriate benefit for Nebraska to count. However, a $500 expenditure by a Kansas fisherman, spent on goods and services at Lake McConaughy, is a benefit to the Nebraska economy. Such benefit/cost analysis may lead to a much different allocation of Nebraska state funds than if the Bureau of Reclamation were conducting a benefit/cost analysis for a 100 percent federal project.

Note 5: The authors hasten to agree that surveys of the literature are not substitutes for region-specific estimates of the value of recreation and indeed stated (on pp. 25-26 of the review draft of the report) that site-specific studies and state-specific surveys were preferable, if only they existed. The state of Nebraska, in the statement of work for this research study, specified that the initial component will be to compile a report on research of available literature, not to conduct site-specific studies. The authors, and presumably the Nebraska Natural Resources Commission also, are pleased to learn of the 1985 dissertation by Donald Rosenthal, who appears to be one of Professor Walsh's students. It did not appear in DRI's literature search which was done prior to the dissertation's appearance.

Note 6: Professor Walsh quibbles with the authors' use of gross state product per hour as the cost of travel time by such semantic devices as "there is no reason to believe" and "I would be surprised if." He mistakenly infers that DRI puts this forward as the definitive value rather than as an empirical value of a cost for which no definitive work exists. Upon analysis, it can be shown that an hour of gross state product ($6.84 for Nebraska in 1983) is not sharply divergent from 50 percent of the average wage rate, considering the proportion of residents who are not in the work force. The U.S. Water Resources Council's Principles and Standards (p. 78) recommends a value for travel time ranging between 0 and the full wage rate. The authors chose to use gross state product per capita for Nebraska, upon the recommendation of a professor of economics, University of Colorado, because it better reflects income in a state with many self-employed farmers than would data on employees' wages.

Note 7: The authors had noted (on pp. 33-34 of the review draft) some discomfort with the use of multipliers based on input-output studies of the Nebraska economy in 1958 and 1968. However, the rationale for using multipliers based on Nebraska studies rather than using studies from other states, or arbitrarily reducing the size of the multipliers, has been given.

Note 8: Once again, Professor Walsh disagrees with the authors' use of a Nebraska state viewpoint rather than a national viewpoint. The federal Principles and Guidelines consider regional economic impacts as income transfers because, from a federal perspective, they are. From a federal perspective, or from the viewpoint of a theoretical economist, to lure a factory from Illinois to Nebraska merely shifts employment (and unemployment) from one area to another and does not benefit the economy as a whole. This is a frequent argument against water resource development projects, as Professor Walsh discusses at length on pp. 13-

15 of his comments. To the extent that economic impacts are transfers from one part of Nebraska to another, and to the extent that recreational spending would occur in the same way elsewhere in the state, he is correct. But it is not correct to impose a federal viewpoint on the state of Nebraska, implying that a benefit to Nebraska accompanied by a loss to Illinois is a wash. It may be that a state viewpoint will lead to investments or expenditures that a federal official may consider suboptimizing. Yet the authors are satisfied that they properly interpret the viewpoint of the State of Nebraska which sponsored this research with specific goals in mind.

Note 9: The limited coverage given in the DRI report to valuations of the preservation of endangered species, wilderness areas, wild and scenic rivers, and water quality is not, as Professor Walsh implies, a function of the authors' lack of awareness of this literature. Indeed, the authors' search for literature on the topics germane to the research study they contracted to complete was made substantially more difficult by the need to scan and screen out literature on the above topics. It is clearly inaccurate to criticize the authors for bemoaning the deficiencies of attempts to value environmental damages of water development projects; the report included no such comment.

Perhaps Professor Walsh does not understand the purpose and scope of DRI's research project. As stated on page 3 of the report, the study involved:

- o Research of available literature concerning methods, procedures, and criteria for determining economic benefits of water projects and for allocating costs among beneficiaries; and

- o Analysis and evaluation of methods of determining fish, wildlife, outdoor recreation, and tourism benefits of water development projects. This analysis includes an examination of current Nebraska procedures for evaluating those benefits to determine in what cases benefits currently are not fully counted.

Nothing else. The Nebraska Natural Resources Commission carefully specified the purpose and scope of the study and did not choose to expand it into other areas. The limited time and resources available for the study would not have permitted DRI to expand the scope into areas mentioned by Professor Walsh on pages 17-23 of his comments even if the Nebraska Natural Resources Commission had asked DRI to do so. This is not to say that such topics are unimportant. They are, however, out of scope for this research.

Note 10: The authors knew of Professor Walsh's latest book, Wild and Scenic River Economics: Recreation Use and Preservation Values (American Wilderness Alliance, 1985) and its use of contingent valuation methods to measure the value of protecting 11 wild and scenic rivers, i.e., the willingness of Colorado households to pay for such protection. It is noted that values of $5,000 per household and $2,000 per household were rejected by the researchers, perhaps on grounds of credibility, but that three values in the range of $1,000 to $1,250 per

household were retained. The mean value per Coloardo household for such protection is found to be $95. No market place exists in which these values can be tested. The authors were not, however, familiar with Professor Walsh's other 1985 symposium paper, "Public Benefits of Programs to Protect Endangered Wildlife in Colorado," which reported that the average household in Colorado was willing to pay $58 in higher taxes and prices to improve current management programs to protect threatened and endangered species of wildlife. Interestingly, particularly for applied economists, a form of market does exist in which these values can be tested. The State of Colorado gives its residents filing individual income tax returns an opportunity to donate, by check-off, to a fund to protect nongame wildlife. Curiously, the actual behavior of Colorado households does not match in generosity their responses to Professor Walsh and his colleagues. The 1980 U.S. census showed Colorado having 1,062,879 households. During that year, $664,005 was donated to the nongame wildlife fund, or 62 cents per household.* During 1984, when Professor Walsh and colleagues presumably were gathering their data on endangered wildlife values, there were approximately 1,168,800 households in Colorado. Only $447,963 was donated to the nongame wildlife fund, or 38 cents per household.** This was the lowest collection since 1979.

Note 11: The authors cannot understand Professor Walsh's imputation to them of comments that they did not make and with which they disagree. Nowhere did the authors comment that the State of Nebraska lacks expertise or resources to measure net willingness to pay, or worse, that the state is backward in applying economics to water resources planning. The authors assume that this statement reflects carelessness in Professor Walsh's reading of the report, rather than petulance or envy.

The authors stated that, "Ideally, given sufficient time and financial resources, it would be possible to develop a group of travel cost studies . . ., a group of gross expenditure studies . . . and finally, a statewide interview survey using contingent valuation methods . . ." (p. 25) but concluded, "Denver Research Institute assumes that the resources for such studies and surveys are not now available and may not become available" (p. 26). The authors went on to say, "Even if they were, it is questionable whether funding applicants would have the expertise and objectivity to develop estimates of these benefits." In case other readers also distorted the intended meaning of this sentence, it can be restated: Denver Research Institute believes that typical funding applicants should be able to complete applications based on Resources Development Fund Guidelines; that typical applicants lack the expertise and objectivity to conduct travel cost and gross expenditure studies and contingent valuation surveys, unless they retain economic consultants to do so, at considerable expense; and that it is undesirable to shift the burden of developing estimates onto state agency (e.g., NRC) personnel who, while they have expertise and objectivity, probably do not have the time and resources to do so.

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*Sources: U.S. Department of Commerce, Bureau of the Census, Census of Population, 1980, Detailed Population Characteristics, Colorado, Table 206; Colorado Department of Revenue, 1984 Annual Report, p. 77.

**Ibid., and unpublished data from the Colorado State Demographer, September 24, 1985.

Note 12: Was Professor Walsh reading the authors' report hurriedly? The authors were asked to identify, describe, and evaluate methods for valuing recreation benefits. This was done, but identifying and describing are not the same as evaluating them as acceptable. On pages 25-26, the authors severely criticized the Trice-Wood method. Although the Ripley method was mentioned tangentially in passing, on page 28, the authors did not think enough of it to give it a full description and evaluation earlier in Chapter III.