APPENDIX E

Civil Works Missions and Evaluation Procedures

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APPENDIX E

Civil Works Missions and Evaluation Procedures

SECTION I - Overview

E-1. Purpose. This chapter provides policy and planning guidance for project purposes of navigation, flood damage reduction, hurricane and storm damage reduction (shore protection), ecosystem restoration, hydroelectric power, recreation, water supply and multiple purpose projects. It covers Federal interest as defined by law and Army policies, types of improvements, specific policies, Federal and non-Federal participation and special considerations where applicable. (Note: Every effort has been made to eliminate all inconsistencies between the main body of the ER and the appendices. If any inconsistencies are found, the information in the main body of the ER will prevail over the one in the appendices. Please, notify CECW-PD immediately of any inconsistencies for correction.)

E-2. Project Purposes The term project purpose, as used above and elsewhere in this chapter, means a type or kind of project, the purpose for which it is undertaken. For example, flood damage reduction is a project purpose, as is navigation. Project purpose is also a convenient shorthand description; there may be a number of associated implications, such as a cost sharing formula, typically constructed features, a general notion of the type of outputs, and a legislative and institutional history. There also may be policies concerning individual project purposes. The term does not necessarily imply exclusive use of a particular kind or category of economic benefits however. Corps projects are formulated for specific project purposes, that is to produce specific outputs. This does not necessarily mean all project outputs will be exclusively those for which formulation occurs. Thus, a project formulated only for navigation (project purpose) could also have flood damage reduction benefits and recreation benefits.

E-3. General Policies.

a. The Planning Process. The Corps planning process follows the six-step process defined in the Principles and Guidelines (P&G) for Water and Related Land Resources adopted by the Water Resources Council. This process is a structured approach to problem solving which provides a rational framework for sound decision making. The six-step process shall be used for all planning studies conducted by the Corps of Engineers. The process is also applicable for many other types of studies and its wide use is encouraged. The six steps are:

Step 1 - Identifying problems and opportunities
Step 2 - Inventorying and forecasting conditions
Step 3 - Formulating alternative plans

Step 4 - Evaluating alternative plans
Step 5 - Comparing alternative plans
Step 6 - Selecting a plan

A description of each step is provided in the main body of this ER. Corps decision making is generally based on the accomplishment and documentation of all of these steps. It is important to stress the iterative nature of this process. As more information is acquired and developed, it may be necessary to reiterate some of the previous steps. The six steps, though presented and discussed in a sequential manner for ease of understanding, usually occur iteratively and sometimes concurrently. Iterations of steps are conducted as necessary to formulate efficient, effective, complete and acceptable plans. The following paragraphs provide additional guidance on selected steps.

(1) Step 1 - Identifying problems and opportunities. The first step in the planning process is the identification of (undesirable conditions to be solved) and opportunities (positive conditions to be improved) that the planning team seeks to address. Problems and opportunities should be defined in terms of their nature, cause, location, dimensions, origin, time frame, and importance. The planning team develops objectives and constraints based on those problems and opportunities. An objective is a statement of what an alternative plan should try to achieve, while a constraint is basically a restriction that the alternative plan should avoid. Objectives, as well as constraints, are written statements that should generally include the following four types of information: effect (the verb that expresses the intent to bring about an objective and not to violate a constraint); subject (what is to be changed for the better through meeting the objective or not changed through avoiding a constraint); location (often the study area, which defines where the objective is to be achieved); and timing and duration (often the study period of analysis, which define when and how long the objective is to be achieved or the constraint to be avoided). Developing specific, flexible, measurable, realistic, attainable, and acceptable objectives and constraints is critical to the success of the entire planning process. Objectives and constraints are used to guide information gathering, to help identify solutions and formulate alternative plans, to identify which plan effects will be evaluated, to compare the relative effectiveness of alternative plans, to assist in plan selection, and ultimately, in gauging the success of the plan implemented.

(2) Step 2 - Inventory of Existing Conditions and Forecast of Future Conditions. This entails quantifying and qualifying the planning area resources important to clearly define and characterize the problems and opportunities previously identified. Both existing conditions and future conditions expected to occur without a project must be characterized. The future without project condition forms the basis from which alternative plans are formulated and impacts are assessed. The information gathered at this step depends on the specific nature of the study.

However, at a minimum, information will be required to identify and adequately describe the problems and opportunities of the study area; to estimate life cycle project costs; and to describe important project effects. Gathering information about historic and existing resources requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic, social, environmental and other conditions are likely to impact problems and opportunities. Forecasting future conditions should be done in an iterative manner, seeking input from Federal and non-Federal entities and other stakeholders, in order to help build consensus about future without project conditions and what outputs the proposed project will and should produce. Forecasting may be especially critical in the case of a plan recommended for the protection of a given resource, where an argument must be made that there will be a decline or degradation of the resource unless protection is provided.

(3) Step 3 - Formulate Alternative Plans. Plan formulation is the process of developing management measures and plans that meet planning objectives and avoid planning constraints. A management measure is a feature (a structural element that requires construction or assembly on-site) or an activity (a nonstructural action) that can be implemented at a specific geographic site that is intended to cause a desirable change and results, preferably, in a positive output. Management measures are the building blocks of alternative plans. Alternative plans can be composed of a combination of various management measures or the same measures combined in significantly different ways. Plan formulation consists of three phases: 1) identifying management measures; 2) formulating alternatives by combining the management measures; and 3) iterative reformulation, during which alternative plans previously formulated are modified. Measures may be added, eliminated, re-scaled, or otherwise modified such that the reformulated plan will better achieve a planning objective or stay within the limits of a constraint.

(4) Step 4- Evaluate alternative plans. In this step, the significant contributions or effects of an individual plan are quantified and judged to determine which plans will continue to be considered during the planning process. All significant contributions and effects shall be quantified in order to succeed in evaluating the alternate plans. Significant contributions are identified on the basis of institutional, technical and public recognition. Institutional recognition of an effect means its importance is recognized and acknowledged in the laws, plans and policies of government, public agencies and private groups. Technical recognition of an effect is based upon scientific or other technical criteria that establish the significance of an effect. Public recognition means that some segment of the general public considers the effect important. The evaluation of alternative plans consists of four major tasks. The first task is to forecast the most likely with-project condition expected under each alternative plan. Each with-project condition will describe the same critical variables included in the without-project condition developed in step 2. Criteria to evaluate the alternative plans include all significant resources, outputs and plan effects, contributions to the Federal objective and the study planning objectives, compliance with environmental protection requirements, the P&G's four evaluation criteria (completeness,

effectiveness, efficiency and acceptability) and other criteria deemed significant by participating stakeholders. The second task is to compare each with-project condition to the without-project condition and document the differences between the two. The third task is to characterize the beneficial and adverse effects by magnitude, location, timing and duration. The fourth task is to identify the plans that will be further considered in the planning process, based on a comparison of the adverse and beneficial effects and the evaluation criteria.

(a) P&G Evaluation Criteria. The four evaluation criteria specified in the P&G are acceptability, completeness, effectiveness and efficiency.

(1) Acceptability is the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it can not be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a non-Federal sponsor does not make it infeasible or unacceptable *ipso facto*. The non-Federal partner's willingness or unwillingness to sign a Project Cooperation Agreement should not be the test of whether a plan is acceptable or not. The second dimension to acceptability is the satisfaction that a particular plan brings to government entities and the public. Obviously, the extent to which a plan is welcome or satisfactory is a qualitative judgement. Nevertheless, discussions as to the degree of support (or lack thereof) enjoyed by particular alternatives from a community, state Department of Natural Resources, Ducks Unlimited, or other national or regional organizations, for example, are additional pieces of information that can help planners evaluate whether to carry forward or screen out alternative plans.

(2) Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. To establish the completeness of a plan, it is helpful to list those factors beyond the control of the planning team that are required to make the plan's effects (benefits) a reality.

(3) Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. An effective plan is responsive to the identified needs and makes a significant contribution to the solution of some problem or to the realization of some opportunity. It also contributes to the attainment of planning objectives. The most effective alternatives make significant contributions to all the planning objectives. Alternatives that make little or no contribution to the planning objectives can be rejected because they are relatively ineffective. Another factor that can impact the effectiveness of an alternative is whether there is substantial risk and uncertainty associated with the alternative. If the

functioning or success of an alternative is uncertain, or less certain than another alternative, its effectiveness may be compromised and should be discussed.

(4) Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment (P&G Section VI.1.6.2(c)(3)).

(b) Four accounts are established in the P&G to facilitate the evaluation and display of effects of alternative plans. The national economic development account displays changes in the economic value of the national output of goods and services. The environmental quality account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The regional economic development account displays changes in the distribution of regional economic activity (e.g., income and employment). The other social effects account displays plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts (e.g., community impacts, health and safety, displacement, and energy conservation). Display of the national economic development and environmental quality accounts is required. Display of the regional economic development and other social effects accounts is discretionary.

(c) Procedures to evaluate national economic development benefits for each civil works mission (i.e., navigation, flood damage reduction, recreation, etc.) are provided in subsequent sections of this appendix. Procedures to evaluate environmental impacts are provided in Appendix C. Procedures to evaluate the impacts of ecosystem restoration projects are provided in Section V of this appendix. Steps in these procedures may be abbreviated by reducing the extent of the analysis and amount of data collected where greater accuracy or detail is clearly not justified by the cost of the plan components being analyzed. The steps abbreviated and the reason for abbreviation shall be documented in the planning reports. Planners can pursue the use of alternative procedures when these would provide a more accurate estimate of benefits. The use of alternative procedures and the consideration of new benefit categories, including the procedures to be used to estimate them, require advance approval from HQUSACE (CECW-P).

(d) General Considerations in NED Benefit Evaluation.

(1) When an alternative procedure provides a more accurate estimate of a benefit, the alternative estimate may also be shown if the procedure is documented.

(2) Goods and Services: General Measurement Standard. The general measurement standard of the value of goods and services is defined as the willingness of users to pay for each increment of output from a plan. Such a value would be obtained if the "seller" of the output were able to apply a variable unit price and charge each user an individual price to capture the full value of the output to the user. Since it is not possible in most instances for the planner to measure the actual demand situation, four alternative techniques can be used to obtain an

estimate of the total value of the output of a plan: Willingness to pay based on actual or simulated market price; change in net income; cost of the most likely alternative; and administratively established values.

(a) Actual or Simulated Market Price. If the additional output from a plan is too small to have a significant effect on price, actual or simulated market price will closely approximate the total value of the output and may be used to estimate willingness to pay. If the additional output is expected to have a significant effect on market price and if the price cannot be estimated for each increment of the change in output, a price midway between the price expected with and without the plan may be used to estimate the total value.

(b) Change in Net Income. The value of the change in output of intermediate goods and services from a plan is measured by their total value as inputs to producers. The total value of intermediate goods or services to producers is properly measured as the net income received by producers with a plan compared to net income received without a plan. Net income is defined as the market value of producers' outputs less the market value of producers' inputs exclusive of the cost of the intermediate goods or services from a plan. Increased net income from reduced cost of maintaining a given level of output is considered a benefit since released resources will be available for production of other goods and services.

(c) Cost of the Most Likely Alternative. The cost of the most likely alternative may be used to estimate NED benefits for a particular output if non-Federal entities are likely to provide a similar output in the absence of any of the alternative plans under consideration and if NED benefits cannot be estimated from market price or change in net income. This assumes, of course, that society would in fact undertake the alternative means. Estimates of benefit should be based on the cost of the most likely alternative only if there is evidence that the alternative would be implemented. In determining the most likely alternative, the planner should give adequate consideration to nonstructural and demand management measures as well as structural measures.

(d) Administratively Established Values. Administratively established values are proxy values for specific goods and services cooperatively established by the water resources agencies. An example of administratively established values is the range of unit-day values for recreation.

(3) Goods and Services: Categories. The NED account includes goods and services in the following categories: municipal and industrial (M&I) water supply; agricultural floodwater, erosion and sedimentation reduction; agricultural drainage; agricultural irrigation; urban flood damage reduction; power (hydropower); transportation (inland navigation); transportation (deep draft navigation); recreation; and, commercial fishing.

(4) Other Direct Benefits. The other direct benefits in the NED benefit evaluation are the incidental direct effects of a project that increase economic efficiency and are not otherwise accounted for in the evaluation of the plan or project. They are incidental to the purposes for which the water resources plan is being formulated. They include incidental increases in output of goods and services and incidental reductions in production costs. For example, a project planned only for flood damage reduction and hydropower purposes might reduce downstream water treatment costs; this reduction in costs would be shown as another direct benefit in the NED account.

(5) Use of Otherwise Unemployed or Underemployed Labor Resources. The opportunity cost of employing otherwise unemployed and underemployed workers is equal to their earnings under the without plan conditions. Conceptually, the effects of the use of unemployed or underemployed labor resources should be treated as an adjustment to the adverse effects of a plan on national economic development. Since this approach leads to difficulties in cost allocation and cost sharing calculations, the effects from the use of such labor resources are to be treated as an addition to the benefits resulting from a plan.

(a) Beneficial effects from the use of unemployed or underemployed labor resources are limited to labor employed on site in the construction or installation of a plan. This limitation reflects identification and measurement problems and the requirement that national projections are to be based on a full employment economy.

(b) If the planning region has substantial and persistent unemployment and these labor resources will be employed or more effectively employed in installation of the plan, the net additional payments to the unemployed and underemployed labor resources are defined as a benefit.

b. Plan Recommendations.

(1) The National Economic Development (NED) Plan. Ordinarily the plan that reasonably maximizes net benefits, known as the NED plan, is recommended. Another plan may be recommended if it qualifies for a categorical exemption, or if a specific Secretarial exception from ASA(CW) is sought.

(2) The National Ecosystem Restoration (NER) Plan. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. The selected plan must be shown to be cost-effective and justified to achieve the desired level of output. This plan shall be identified as the National Ecosystem Restoration (NER) Plan.

(3) The Combined NED/NER Plan. Projects which produce both National Economic Development (NED) benefits and National Ecosystem Restoration (NER) benefits will result in a "best" recommended plan so that no alternative plan or scale has a higher excess of NED benefits plus NER benefits over total project costs. This plan shall attempt to maximize the sum of net NED and NER benefits, and to offer the best balance between two Federal objectives. Recommendations for multipurpose projects will be based on a combination of NED benefit-cost analysis, and NER benefits analysis, including cost effectiveness and incremental cost analysis.

(4) The Locally Preferred Plan. Projects may deviate from the National Economic Development Plan and/or the National Ecosystem Restoration Plan if requested by the non-Federal sponsor and approved by ASA(CW). In some instances, a non-Federal sponsor may not be able to afford or otherwise support the NED, NER or Combined NED/NER Plan. Plans requested by the non-Federal sponsor that deviate from these plans shall be identified as the Locally Preferred Plan (LPP). When the LPP is clearly of less scope and cost and meets the Administration's policies for high-priority outputs, an exception for deviation is usually granted by ASA(CW). In making a decision to recommend a LPP smaller in scope and costs than the NED, NER or Combined NED/NER plans, the district should assist the sponsor in identifying and assessing the financial capability of other potential non-Federal interests who may be willing and able to participate in plan development and implementation. In all cases, the LPP must have greater net benefits than smaller scale plans, and enough alternatives must be analyzed during the formulation and evaluation process to insure that net benefits do not maximize at a smaller scale than the sponsor's preferred plan. If the sponsor prefers a plan more costly than the NED plan, the NER Plan or the combined NED/NER Plan, and the increased scope of the plan is not sufficient to warrant full Federal participation, ASA(CW) may grant an exception as long as the sponsor pays the difference in cost between those plans and the locally preferred plan. The LPP, in this case, must have outputs similar in-kind, and equal to or greater than the outputs of the Federal plan. It may also have other outputs. The incremental benefits and costs of the locally preferred plan, beyond the Federal plan, must be analyzed and documented in feasibility reports.

(5) Categorical Exemption for Flood Control and Navigation Projects. If the non Federal sponsor identifies a constraint to maximum physical project size or a financial constraint due to limited resources, and if net benefits are increasing as the constraint is reached, the requirement to formulate larger scale plans in an effort to identify the NED plan is suspended. The constrained plan may be recommended. If the NED plan is identified at a physical size or cost which is less than the constraint, the NED plan requirement is satisfied and the NED plan should be recommended.

c. Cost Sharing.

(1) Applicability. Unless otherwise specified, the cost sharing provisions of Title I of the WRDA of 1986, as amended and as interpreted in subsequent guidance, applies to all projects and separable elements thereof. Specific Federal and non-Federal cost sharing requirements applicable to each civil works mission are discussed in subsequent sections of this appendix. Exhibit E-1, at the end of this appendix, summarizes these requirements.

(2) Separable Element. A separable element is any part of a project which has separately assigned benefits and costs, and which can be implemented as a separate action (at a later date or as a separate project). Separable elements so considered are similar to the planning concept of last added increments, with the added idea of separation or detachment of the increment from the whole. The Corps has used a separable element concept for many decades; the term itself was coined in the WRDA of 1986 to assist in the transition to new cost sharing formulas. The WRDA definition was more complex, yet more ambiguous than that above. There is little continuing need for that definition. For cases where the WRDA definition (see section 103(f)) appears necessary, consult HQUSACE; otherwise use the definition above. Separable elements usually must be incrementally justified.

(3) Waivers for Territories (Section 1156 of the WRDA of 1986). Local cost sharing requirements for all studies and projects in American Samoa, Guam, the Northern Mariana Islands and the Virgin Islands will be reduced by up to $200,000 for each study and project. Cost sharing for each study will first be established using the general cost sharing criteria; then the non-Federal share will be reduced by $200,000 or to zero if the non-Federal share is less than $200,000. A similar procedure will be followed for the non-Federal implementation cost share.

(4) Exceptions to the NED Plan. When the ASA(CW) grants an exception to selection of the NED plan, the costs for the granted exception will be shared on the same percentage basis as the NED plan.

(5) Locally Preferred Plans. Local interests may prefer a plan that is larger or smaller than the NED plan. A locally preferred plan may generally be recommended, except that in the geographic areas covered in (3) above, a larger than NED plan may not be recommended. The incremental cost between the Federally supportable plan (NED), and a larger locally preferred plan, is entirely a non-Federal responsibility. Recommended plans smaller or less costly than the NED plan will normally be granted an exception to NED plan selection, and cost shared on the same percentage basis as the NED plan.

d. Financing of Non-Federal Share of Project Costs. Guidance on the financing of the non-Federal share of project costs including payment options, deferral of payments, method of payments, source of non-Federal funds, and the rate of interest for deferred payments is contained in ER 1165-2-131.

e. Credit for LERRD. Specific guidance on crediting the value of LERRD toward the non-Federal share of project costs is contained in ER 1165-2-131.

f. Replacement Costs. Repair, replacement and rehabilitation costs must be identified and included in the estimated cost of operation and maintenance. The entity responsible for project operation and maintenance is responsible for all rehabilitation and replacement costs (except for some inland navigation projects, see Section II of this appendix).

g. Fish and Wildlife Mitigation.

(1) Allocating Costs. Fish and wildlife mitigation costs incurred after 17 November 1986 shall be allocated to the authorized purposes causing the need for mitigation in the same proportions as other allocable costs are allocated to those purposes.

(2) Mitigation LERRD. When lands, easements, rights-of-way, relocations or disposal areas (LERRDs) are a non-Federal responsibility for a project purpose, any LERRDs associated with mitigation for that purpose is likewise a non-Federal responsibility.

h. OMRR&R Mitigation. Non-Federal sponsors will be responsible for all costs of the operation and maintenance, repair, rehabilitation, and replacement of mitigation measures except for: (1) inland navigation projects and harbor projects with depths up to 45 feet, which have no requirement for non-Federal sharing of these costs, and (2) harbors with depths over 45 feet which require a 50 percent non-Federal share for those costs assigned to increments in excess of a 45-foot project.

i. Hazardous, Toxic and Radioactive Waste (HTRW). Policy is to avoid expenditure of Civil Works funds for HTRW remediation by avoiding contaminated areas where practicable. For water resource studies, emphasis should be placed on early problem identification. Reconnaissance and feasibility studies will include a phased and documented review to provide for early identification of HTRW potential. Efforts to determine the existence and extent of HTRW problems will be treated as study cost and shared accordingly. Consistent with the guidance in ER 1165-2-132, the Corps will not participate in clean up of materials regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or by the Resource Conservation and Recovery Act (RCRA). The cost of clean up of materials not covered by CERCLA and RCRA will be considered when determining if the proposed project is justified. While measures to improve water quality parameters may be included in projects with an ecosystem restoration component, the ecosystem restoration portion of these projects should not principally result in treating or otherwise abating pollution other compliance responsibility.

j. Brownfields. Brownfields are abandoned or under-utilized properties that are perceived to be or, at worst, are lightly contaminated. Brownfields may be included in the preliminary planning phase of projects where they are integral to solving water resources problems related to Corps mission areas and authorities. If the assessment determines that there are non-CERCLA types of materials or small, easily and cost effectively managed amounts of CERCLA controlled materials, then these sites may be included in project formulation and any remediation costs would be shared as project costs. If the assessment determines a CERCLA level clean-up is required, then the site will be removed from plan formulation for processing under CERCLA procedures. It is important that no unnecessary Federal liability be incurred when working within a Brownfield site.

E-4. Risk and Uncertainty-Sensitivity Analysis. Uncertainty and variability are inherent in water resources planning. For example, there is uncertainty in projecting such factors as stream flows, population growth, and the demand for water. Therefore, the consideration of risk and uncertainty is important in water resources planning. This paragraph provides guidance for the evaluation of risk and uncertainty in the formulation of water resources management and development plans.

a. Concepts.

(1) Risk. Situations of risk are conventionally defined as those in which the potential outcomes can be described in reasonably well known probability distributions. For example, if it is known that a river will flood to a specific level on the average of once in 20 years, a situation of risk, rather than uncertainty, exists.

(2) Uncertainty. In situations of uncertainty, potential outcomes cannot be described in objectively known probability distributions. Uncertainty is characteristic of many aspects of water resources planning. Because there are no known probability distributions to describe uncertain outcomes, uncertainty is substantially more difficult to analyze than risk.

(3) Sources of Risk and Uncertainty.

(a) Risk and uncertainty arise from measurement errors and from the underlying variability of complex natural, social, and economic situations. If the analyst is uncertain because the data are imperfect or the analytical tools crude, the plan is subject to measurement errors. Improved data and refined analytic techniques will obviously help minimize measurement errors.

(b) Some future demographic, economic, hydrologic, and meteorological events are essentially unpredictable because they are subject to random influences. The question for the

analyst is whether the randomness can be described by some probability distribution. If there is a historical data base that is applicable to the future, distributions can be described or approximated by objective techniques.

(c) If there is no such historical data base, the probability distribution of random future events can be described subjectively, based upon the best available insight and judgment.

(4) Degrees of Risk and Uncertainty. The degree of risk and uncertainty generally differs among various aspects of a project. It also differs over time, because benefits from a particular purpose or costs in a particular category may be relatively certain during one time period and uncertain during another. Finally, the degree of uncertainty differs at different stages of the analysis, for example, between initial screening and final detailed design, when more precise analytic methods can be applied.

(5) Attitudes. The attitudes of decision makers toward risk and uncertainty will govern the final selection of projects and of adjustments in design to accommodate risk and uncertainty. In principle, the government can be neutral toward risk and uncertainty, but the private sector may not be. These differences in attitudes should be taken into account in estimating the potential success of projects.

b. Application.

(1) The role of the planner.

(a) The planner's primary role in dealing with risk and uncertainty is to characterize to the extent possible the different degrees of risk and uncertainty and to describe them clearly so that decisions can be based on the best available information. The planner should also suggest adjustments in design to reflect various attitudes of decision makers toward risk and uncertainty. If the planner can identify in qualitative terms the uncertainty inherent in important design, economic, and environmental variables, these judgments can be transformed into or assigned subjective probability distributions. A formal model characterizing the relationship of these and other relevant variables may be used to transform such distributions to exhibit the uncertainty in the final outcome, which again is represented by a probability distribution.

(b) At all stages of the planning process, the planning can incorporate any changes in project features that, as a result of information gained at that stage, could lead to a reduction in risk and uncertainty at a cost consistent with improvement in project performance.

(2) Some risk and uncertainty are assumed in nearly every aspect of a water resources project. Some types of risk and uncertainty are dealt with in terms of national planning parameters; for example, ranges of population projections and other principal economic and demographic variables. Other types of risk and uncertainty are dealt with in terms of project or regional estimates and forecasts. When projects are related to other projects and programs in their risk and uncertainty aspects (e.g., interrelated hydrologic systems), reasonable attempts should be made to see that the same analyses and presumed probability distributions are used for all of them.

(3) The risk and uncertainty aspects of projects are likely to be seen and analyzed differently as planning proceeds from rough screening to detailed project proposals. An effort should be made, therefore, to relate the techniques used in characterizing and dealing with risk and uncertainty to the stage of the planning process.

(4) The resources available for analyzing aspects of risk and uncertainty should be allocated to those assessments that appear to be the most important in their effects on project and program design. Rather than assuming in advance that one or another variable is a more important source of risk and uncertainty, the planner should make a thorough effort to determine which variables will be most useful in dealing with measurement errors and natural sources of risk and uncertainty.

(5) The aspects of project evaluation that can be characterized by a probability distribution based on reasonably firm data, such as hydrologic risk, can be treated by standard methods of risk evaluation developed by Federal agencies and others.

(6) Most risk and uncertainty aspects of projects cannot be characterized by probability distributions based on well established empirical data. A first step in dealing with this problem is to describe why the project or specific aspects of it are uncertain, as well as the time periods in which different degrees of uncertainty are likely. A range of reasonably likely outcomes can then be described by using sensitivity analysis, the technique of varying assumptions as to alternative economic, demographic, environmental, and other factors, and examining the effects of these varying assumptions on outcomes of benefits and costs. In some cases and in some stages of planning, this approach, when accompanied by a careful description of the dimensions of uncertainty, will be sufficient. It can be accompanied by descriptions of design adjustments representing various attitudes toward uncertainty.

(7) It may be appropriate in some cases to characterize the range of outcomes with a set of subjective probability estimates, but the project report should make clear that the numerical estimates are subjective. Moreover, subjective probability distributions should be chosen and justified case by case, and some description of the impact on design of other subjective

distributions should be given. Design alternatives reflecting various attitudes toward uncertainty may be suggested.

(8) Utility functions may be used in conjunction with assessments of uncertainty to explore design adaptations reflecting specific preferences. Public preferences, if well known, may be used to illustrate to decision makers what the best design would be, given the uncertainties and preferences in a particular case. If public preferences are not well known, justification could be given for the selection of various utility functions, which can be used only to illustrate the effects on design of various preferences.

(9) At each level of analysis, the planner should take into account the differences in risk and uncertainty among project purposes and costs, among various time periods, and among different stages of planning.

(10) Adjustments to risk and uncertainty in project evaluation can be characterized as general or specific. General adjustments include the addition of a premium rate to the interest, overestimation of costs, underestimation of benefits, and limitations on the period of analysis. Such general adjustments are usually inappropriate for public investment decisions because they tend to obscure the different degrees of uncertainty in different aspects of projects and programs. Specific adjustments, including explicit assessments of different degrees of risk and uncertainty in specific aspects of a project or program and specific adjustments to them, are preferable.

(11) One guide to the use of the techniques discussed here is displayed in Table E-1. In general, more complex techniques are appropriate as planning proceeds from the initial development and the screening of alternatives to the analysis and presentation of the final set of alternative plans. For example, sensitivity analysis, testing the sensitivity of the outcome of project evaluation to variation in the magnitude of key parameters, may be most useful and applicable in the early stages of planning, when the concern is to understand single factors or relatively general multiple-factor relationships. Multiple-factor sensitivity analysis, in which the joint effects or correlation among underlying parameters are studied in greater depth, may be more appropriate in the detailed analytic stage than in the screening stage.

Table E- 1 Planning Task and Approaches to Risk and Uncertainty

<----------Planning Tasks---------->

Approaches to Risk and Uncertainty	Screening Alternatives	Detailed Analysis of Projects	Final Presentation of Alternatives
Sensitivity analysis	X	X	X
Use of objective and subjective probability distributions		X	X
Illustrative applications of public preference and decision makers attitudes		X	X

(12) Similarly, analysis of risk and uncertainty based on objective or subjective probability distributions would be more appropriate in the detailed analytic stage than in the early screening stage. Although hydrologic and economic probabilities may be used in the screening stage, the full use of independent and joint probability distributions, possibly developed from computer simulation methods, to describe expected values and variances, is more appropriately reserved for the detailed stage.

(13) Although decision makers' attitudes and decision rules can be used to give perspective on alternative designs through out the planning process, they are more appropriate at the stage of displaying alternative designs.

(14) The differences among the underlying degrees of risk and uncertainty, the design adaptations to them, and the preferences of decision makers should be kept clear throughout the analysis. The first two depend primarily on technical expertise; the last is the set of preferences based on various attitudes toward risk and uncertainty.

c. Report and Display. The assessment of risk and uncertainty in project evaluation should be reported and displayed in a manner that makes clear to the decision maker the types and degrees of risk and uncertainty believed to characterize the benefits and costs of the alternative plans considered.

E-5. Project Cost Estimating and Scheduling.

a. Accuracy and Completeness. Accuracy and completeness of project cost estimates must be emphasized throughout the project development process, including the reconnaissance

and feasibility phases. Even in these early phases cost estimates should represent as complete and as accurate a picture as is practicable. This is necessary for Federal and non-Federal sponsor planning and budgeting processes.

(1) Elements. The project cost estimate is the total cost (Federal and non-Federal) of implementing the project and includes the construction costs, lands, easements, rights-of-way, relocations, disposal areas (if needed), mitigation, add-ons such as engineering and design, and supervision and administration. The project cost estimate will be developed on a constant dollar basis.

(2) Presentation. Project cost estimates during study phases are often perceived to be more accurate than they are, and therefore, project documents must include a discussion of the elements that make up the project cost estimate and of their variability. The presentation of the project cost estimate is of particular importance in the feasibility study as it forms the basis for local decisions on project commitment and financing. It is also the basis for developing budget requests for implementation (inflation allowances are added separately). The project estimate prepared during the feasibility phase is generally the one presented to the Congress for authorization, although it may be revised during the early stages of preconstruction, engineering and design depending on the authorization cycle. Section 902 of WRDA '86 limits the authorization of projects in the Act to a 20% increase in the cost of that project (with increases due to inflation and increased requirements of law allowed). Without firm cost estimates and schedules, neither the Federal government nor the non-Federal sponsors can make prudent financial and budgetary decisions.

b. Study Management of Cost Estimates. During the feasibility study phase, the team must ensure that plans are formulated in such a way that constructability and operability are assured, that major cost items are adequately assessed or appraised as in the case of real estate, and that the uncertainty associated with the estimate is properly presented. The team should also develop plans, with appropriate consideration for Corps plan formulation criteria under the Principles and Guidelines , with an awareness of the ultimate cost. With increased non-Federal financial responsibility for project planning and implementation and Federal emphasis on budgetary restraint, commanders must be sensitive to real financial constraints on project scale. Accurate estimates of the costs of alternative plans play a vital role in plan formulation and project scoping. In any case, financial considerations must not be the sole criteria on which plan development rests, as the NED plan must still be identified. The goal of this approach is to reduce significant design changes after the feasibility phase.

c. Uncertainty in Cost Estimates. Project cost estimates should be supported by a discussion of the scope of the estimate and the uncertainties associated with each major cost item in the estimate. Special attention will be given to large cost items and items that are sensitive to change. Such increased effort on these high risk components will increase the reliability of the overall project cost estimate. The goal is a final project cost that will be within 20 percent of the

estimated project cost in the feasibility report after appropriate adjustments for inflation. Based on such an approach, appropriate contingencies may be applied for each element to account for information that is lacking to more accurately establish its cost. General percentage contingencies applied to the entire project will not be used.

d. Life Cycle Costs. Life cycle costs will also be explicitly considered in the development of project cost estimates. These life cycle costs, including operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs as well as any necessary environmental monitoring and compliance inspection costs, play an important role in the trade-offs between high capital cost projects and those that have high operation and maintenance (O&M) costs. The sponsor's financial situation may accommodate one type of project better than another. The study management team should draw upon the O&M resources in the district to assist in developing accurate estimates for these costs. These costs should be presented on a constant dollar basis.

e. Full Funded Cost Estimates. Project cost estimates will also be developed on an inflated dollar basis.

f. Review of Cost Estimates. Project cost estimates will be prepared by or reviewed by the cost engineering element in the district and the chief of that unit will sign the estimate. Real estate estimates included in the project cost are reviewed, approved and signed by chief or designee of the Real Estate Office.

SECTION II - Navigation

E-6. Federal Interest. The Federal interest in navigation derives from the Commerce Clause of the Constitution, and is limited to the navigable waters of the United States. Federal navigation improvements must be in the public interest and thus must be open to the use of all on equal terms. As a matter of law and policy, a distinction is made between general navigation features, and other features or facilities serving navigation. The Corps participates financially in general navigation features and Special Navigation Programs only (see below); all other features and facilities (e.g., piers) are non-Federal responsibilities.

E-7. Types of Improvements. General navigation features include channels, jetties or breakwaters; locks and dams; basins or water areas for vessel maneuvering, turning, passing, mooring or anchoring incidental to transit of the channels and locks. The also include dredged material disposal areas (except those for the inland navigation system, the Atlantic Intracoastal Waterway and the Gulf Intracoastal Waterway), and sediment basins. These are eligible for development as general navigation features of harbor or waterway projects. Special Navigation Programs include removal of wrecks and obstructions; snagging and clearing for navigation; drift and debris removal; bridge replacement or modification; and mitigation of project-induced damage.

a. Harbor and Waterway Projects. These projects are specifically authorized by Congress, except for Continuing Authorities Projects. Financial responsibility for project components is specified in Public Law 99-662. Harbors and waterways have separate cost sharing formulas.

(1) Harbors. Harbors are places that offer vessels shelter from weather. They are primarily places for vessels to put in as needed, although they may serve incidentally as connecting waterways. They are ports if they also offer port facilities. Provision of harbors offering only shelter (Harbors of Refuge) was historically an active Corps program; no new projects have been authorized in many years. Many of the existing harbors of refuge continue to be maintained however. While the terms “inland harbor” and “deep draft harbor” may be used in legislation, it is harbor depth and use which determine cost sharing, not location.

(2) Waterways. Waterways are routes used by vessels. They are rights-of-way enabling and aiding vessel movement; vessels also may stop and stay at facilities along waterways. Waterways may simply connect bodies of deep or shallow water, or they may be parts of riverine or coastal waterway systems.

(a) The waterways described in Public Law 95-502 as amended, and such other waterways that subsequently may be determined to be parts of the inland waterway system referred to in Public Law 99-662, are exempt from non-Federal cost sharing of studies.

(b) By action of Congress, construction (including PED) for PL 95-502 defined waterways or other waterways may be 100 percent Federal, the Inland Waterway Trust Fund may be used to fund all or part of the construction, and the waterway may be made subject to waterway fuel taxes. All other waterways are treated as harbors for cost sharing purposes.

b. Special Navigation Programs.
These navigation improvements are for specific purposes, and may be projects, elements of projects, or simply Corps activities. They are initiated and/or implemented on Congressional authority (specific or continuing). They are usually subject to program or project expenditure limits, with cost sharing as specified in the original authority or as amended. The following program expenditure limits and cost sharing are as amended by Public Law 99-662 unless otherwise stated.

(1) Removal of Wrecks and Obstructions (Section 19, River & Harbor Act of 3 March 1899). The Corps may remove sunken vessels and similar objects if they are determined to be obstructions to navigation. The cost is 100 percent Federal; it is recoverable from the vessel or object owner. Abandonment by the owner is not a bar to cost recovery. Sunken vessels and objects that are not obstructions to navigation but may be nuisances or otherwise undesirable, are treated as drift and debris removal.

(2) Snagging and Clearing for Navigation (Section 3, River & Harbor Act of 1945). Cost-sharing for this continuing authority is according to whether it is a harbor or inland waterway. There is no project limit, but the current program limit is $1,000,000 annually.

(3) Drift and Debris Removal (Section 202, Water Resources Development Act of 1976). The Corps has continuing authority to study and undertake projects to remove and dispose of derelict objects such as sunken vessels, waterfront debris and derelict structures, and other sources of drift that may damage vessels or threaten public health, recreation, or the environment at publicly maintained commercial boat harbors. The harbor need not be, but usually is a Corps project. Congressional authorization is required for projects with Federal costs of $400,000 or more. Cost sharing for the cleanup is one third non-Federal. Non-Federal sponsors are required to recover cleanup costs if there is an identifiable owner of the source. The recovery costs do not become part of the local share but can be applied to reduce total project cost. All costs of any disposal facility or area and its operation are cost shared according to project depth.

(4) Navigation Projects Under the Continuing Authorities Program. Refer to Appendix F for additional guidance concerning policies, procedures and authorities pertaining to navigation projects conducted under the CAP.

(a) Small Harbor and Waterway Projects, Section 107, River & Harbor Act of 1960. Small harbor or waterway projects constructed under this authority must be complete and capable of producing benefits as separate projects. They cannot be constructed in lieu of authorized elements of another navigation project. The requirements for study cost sharing, construction, and operation and maintenance are generally the same as those for specifically authorized studies and projects. Project and annual program Federal expenditure limits are $4,000,000 and $35,000,000.

(b) Mitigation of Shore Damage Due to Federal Navigation Projects (Section 101 of the WRDA of 1986 and Section 111, River and Harbor Act of 1968). The Corps can recommend measures for the prevention or mitigation of erosion or shoaling damages attributable to Federal navigation works. Costs are shared in the same proportion as is applicable to the project, which causes, or is projected to cause, the erosion or shoaling. The non-Federal interests shall agree to be responsible for O&M. Guidance for Section 111 projects is presented in Appendix F.

(5) Modification of Bridges that Obstruct Navigation (Public Law 67-647, the Bridge Alteration Act). The Bridge Alteration Act (1941), commonly called the Truman-Hobbs Act, applies only to existing highway and rail bridges. It provides authority to require bridge modification or replacement if a bridge causes an unreasonable obstruction to navigation, and it sets the apportionment of costs among the bridge owner, the Federal government, and non-Federal sponsor (if any). In 1966, responsibility for administration of the act was transferred from the Army to the Department of Transportation; the Secretary of the Army retains authority to determine whether a bridge causes unreasonable navigation obstruction.

(a) The bridge owner must bear the part of the cost attributable to direct and special benefits accruing to the owner; the remainder is apportioned between the U.S. and non-Federal sponsor (if any) according to the cost sharing that would apply at the harbor or waterway involved. (For details of cost sharing see the Act.) The bridge owner is required to absorb the cost of betterments and an apportionment of costs representing the expired service life of the obstructing bridge.

(b) Truman-Hobbs cost sharing applies as well when a new project or project improvement would cause an existing bridge to become an obstruction to navigation. The cost of constructing new bridges or replacing existing bridges over non-obstructed channels is 100 percent non-Federal. New bridges required because of land cuts for new or realigned channels are treated as general navigation features of those projects and cost shared accordingly.

(6) Beneficial Use of Dredged Material. When determining an acceptable method of disposal of dredged material, districts are encouraged to consider options that provide opportunities for aquatic ecosystem restoration. Where environmentally beneficial use of dredged material is the least cost, environmentally acceptable method of disposal, it is cost shared as a

navigation cost. Section 204 of the WRDA of 1992, as amended, provides programmatic authority for selection of a disposal method for authorized projects, that provides aquatic restoration or environmental shoreline erosion benefits when that is not the least costly method of disposal. The incremental cost of the disposal for ecosystem restoration purposes over the least cost method of disposal is cost shared, with a non-Federal sponsor responsible for 25 percent of the costs. Smaller projects typically will be pursued within the programmatic limits of Section 204, as amended. Section 207 of the WRDA of 1996 amended this authority. Section 207 will primarily be used with new navigation projects or in conjunction with maintenance dredging when the incremental cost is large. Projects pursued under Section 207 authority are separately budgeted and will not count towards the Section 204 programmatic limit. (See Section E-14 and Appendix F for additional information regarding Beneficial Use of Dredged Material).

(7) Environmental Dredging. Section 312 of the WRDA of 1990 as modified by Section 205 of the WRDA of 1996 provides programmatic authority for environmental dredging of sediments not classified as HTRW where the material lies outside and adjacent to Federal navigation channels, contributes to contamination of materials in the Federal navigation channel and it can be demonstrated the removal and remediation, if necessary, are economically justified based on savings in future operation and maintenance costs. Section 224 of the WRDA of 1999 amended this authority. Implementation guidance is under development.

E-8. Specific Policies. There are many components necessary to make a navigation project work, but there is Federal financial responsibility for only some of them. The components that are a Federal responsibility are cost-shared according to the project benefits and type of project (harbor, waterway) as shown in a subsequent paragraph. All other components are wholly non-Federal responsibilities.

a. General Application. For most project components, the responsibility and cost sharing has been determined by legislation, precedent, or practice. These components are described below.

(1) General Navigation Features. This category of structural components of harbors and waterways contains most of those components in which the U.S. will financially participate. The components may be constructed by the project sponsor with reimbursement for the Federal cost share if authorized by Congress under Section 204 of the WRDA of 1986.

(a) Locks and dams and river training works on coastal and inland waterways.

(b) Offshore, approach, and harbor entrance channels, which may have associated protective works such as breakwaters or jetties.

(c) Mainstem, or main and branch channels that are either waterways, or that connect harbor entrances with local facilities areas.

(d) Basins, areas, or widened channels for vessel maneuvering, turning, passing, or anchoring or mooring incidental to transit of locks or channels, and sediment basins.

(e) Bridges that are required by new or realigned channels that cut fast land. It is Corps policy to not recommend new navigation channels cutting fast land however.

(f) Ice control structures.

(2) Aids to Navigation. These are buoys, lights, ranges, markers, and other devices and systems required for safe navigation or to achieve the project benefits. Aids to navigation are provided by the Coast Guard, and are a Federal cost included in economic justification, but are not subject to project cost sharing. Absent sufficient Coast Guard funding, or adequate justification for the navigation aids, non-Federal interests may be required to provide them.

(3) Local Service Facilities. These are the responsibility of non-Federal interests, and they may be required as part of project cooperation agreements if they are necessary for project benefits to accrue. Examples are:

(a) Piers, wharves, floats, and other structures or devices at or near the shoreline, where vessels can moor or be held for the purpose of loading and unloading cargo and passengers, fueling, repairs and other servicing, or to await orders or use.

(b) Berthing, mooring, and anchorage areas where vessels can stay whatever time is required without obstructing the channels or other water areas provided for the movement of vessels.

(c) Port facilities or open areas, structures, or equipment on the shore for receiving, storing, and transferring cargo and passengers. Harbor facilities are for providing fuel, water, ice, provisions, repairs, and other services to vessels. Recreation facilities are for launching boats via ramps or equipment, storing boats on land, parking vehicles, and public access areas and restrooms.

(d) Utility services, such as telephone, water and power, and public services, such as police and fire protection.

(e) Land access via roadways or railroads.

(f) Access channels or, main or branch channel extensions providing access to facilities usable only by exclusive private interests, i.e., not open to the general public on equal terms.

(4) LERR. Non-Federal sponsors are required to provide all lands, easements, rights-of-way, and relocations for a navigation project or a harbor of any kind, and for waterways that are treated as harbors for cost sharing purposes. LERRD for "inland waterways" (includes disposal areas in this case) are 100 percent Federal, and may be funded up to 50 percent from the Inland Waterways Trust Fund for construction when so authorized by Congress.

b. Special Cases. Special cases that require a determination of policy, Federal responsibility, or cost sharing are described below.

(1) Access Channels. Subsidiary channels may be needed to connect main harbor channels or inland waterways with anchorages, mooring, or berthing areas not located adjacent to the primary channel. An access or connecting channel can be a Federal responsibility only if it provides access to two or more areas; or if access is provided to a single area it, must contain two or more facilities with separate owners, or a facility owned by a public entity. For a harbor project, the cost shares are determined by the depth of the access, or interior the channel. If an access channel serves an inland port or port facility it is cost shared based on its own depth, unless the channel is in an area included in the inland waterway system as described in Public Law 95-502, as amended, or as determined by Congress.

(2) Deeper Depths in Entrance Channels. Where an entrance channel is deeper than interior channels because of the more adverse navigation conditions of the entrance channel, cost sharing is the same as the deepest reach of the more protected interior channels.

(3) Barge Fleeting Areas. Barge fleeting areas are defined as mooring areas or temporary anchorages used for assembling tows, making barge transfers between tows, transferring supplies, awaiting arrival of additional barges or serving as a barge holding area. Barge fleeting areas should generally not be recommended for Federal participation. Moorages or temporary anchorage areas may be recommended if necessary to implement a non structural efficiency improvement, for example if reconstitution of tows is necessary to implement a ready to serve lockage policy. These areas should not be considered as fleeting areas in the traditional sense.

(4) Single Owner Situations and General Versus Special Interest Considerations. Section 2 of the River and Harbor Act of 5 June 1920 provides that the Chief of Engineers shall make a determination of the general versus the special interest in an improvement, and recommend an appropriate sharing of costs between Federal and non-Federal interests. When there is a general interest the cost sharing prescribed by Public Law 99-662 will be the basis for recommendations. If there is no general interest there is no Federal financial participation. The determination of general interest requires consideration of the number and type of properties served by a proposed project.

(a) Single Owner Situations. The Corps will not recommend Federal cost participation, establishment, or expansion of a Federal navigation project where the improvement would serve only property owned by a single firm, corporation or individual, or club or association with restrictive membership requirements. A single-owner situation exists when restrictive conditions of any sort permit the single property owner exclusive present and future enjoyment of project benefits. An example of exclusive benefits would be a privately owned port, even though used by several shippers. However, the Corps may recommend Federal cost participation where the improvement would serve only property owned publicly by a single state county, municipality or other duly appointed public entity. Table 1 in ER 1165-2-123 summarizes single-owner situation policy for a variety of Federal project purposes and types of improvement.

(b) Initial Single Non-Public-Owner, Later Multiple-Owner Situations. Federal participation may be recommended in a significant increment of improvement when the improvement would initially serve property by a single non-public-owner when reasonable prospect exists for the improvement to later serve multiple properties with different owners. A significant increment is defined as one involving major increases in project length, depth, or width.

(1) The test for reasonable prospect is controlled by factors such as availability, ownership, and suitability of adjacent waterfront land for development. Another test is location by other industries and users, availability of land transport and other essential services. Also, the area's economic potential; the intent of the land owner or the potential developer; and the determination that no restrictive conditions exist that would prohibit the improvement from serving or benefiting two or more single-owner properties (and property owners) in the foreseeable future.

(2) In these situations, non-Federal sponsors shall contribute annually, until such time as multiple properties/owners are served by the general navigation facility, 50 percent of the annual charges for interest and amortization of the Federal first cost of the improvement, exclusive of aids to navigation. For new channels or extensions to existing channels, the required annual contribution shall also include 50 percent of the operation and maintenance costs of the improvement until such time as multiple properties/owners are served. The requirement for annual contributions may end when the Secretary of the Army determines that the improvement is actually serving/benefiting at least two properties that are owned by at least two different owners. These cash contribution requirements are in addition to the other regular established requirements of non-Federal cooperation for commercial navigation projects.

(c) Progressive Development. The Federal interest is satisfied and the regular cost sharing requirements apply where the improvement serves/benefits two or more properties having different owners or one publicly-owned property at the outset, or if new properties/owners would be served immediately after project completion. A principle of progressive development also applies. Progressive development includes situations where the last small increment of a channel serves a non-public owner. The last property owner served may be "at the end" in terms

of length, depth, or width, necessitating some project investment in his service alone. This is treated as a multiple-owner situation unless a disproportionate incremental investment is required.

(5) Project Purpose and Benefits. Navigation projects may produce both recreational navigation outputs including sport fishing, and commercial navigation outputs including commercial fishing. Current Army policy precludes budgeting Army Civil Works resources for new recreation orientated projects. Civil Works funds may normally be used to support recreational development where the level of commercial navigation benefits is equal to or exceeds 50 percent of the average annual project cost.

(6) Entrance Channels Cost Sharing. Increased depths provided in entrance channels for transit of vessels between protected interior channels and the wave action zone, e.g., across an outer bar, will be cost shared the same as the deepest protected interior channel. Breakwaters, jetties and channel width increases are cost shared in the same manner.

(7) Navigation Versus Hurricane and Storm Damage Reduction. Some measures serving navigation may also reduce hurricane and storm damage and vice versa. The following policies apply to cost sharing of measures affecting one or both of the navigation, and hurricane and storm damage reduction purposes.

(a) Measures resulting in increases in net income of commercial navigation activities or in decreases in commercial transportation costs will be evaluated and cost shared as navigation measures (harbor). This includes measures to prevent wave induced damages to berthed commercial vessels and to docks, piers and slips used in commercial navigation activities. Measures to prevent wave induced damages to berthed non-commercial (recreational) vessels, and measures to prevent wave damages to docks, piers, slips and other shoreline facilities not used for commercial navigation, are to be evaluated and cost shared under the hurricane and storm damage reduction provisions of sections 103(c)(5) and 103(j) of Public Law 99-662. Measures to provide for safe and efficient movement of commercial and recreational vessels into and within a harbor, and measures to prevent loss or damage to vessels in transit (harbors of refuge) will continue to be evaluated and cost shared as navigation measures (harbor). The Corps does not financially participate in provision of docks, terminal or transfer facilities, or berthing areas (see paragraph E-8a.(3)).

(b) Above policy applies to existing berthed vessels and shoreline facilities and to vessels and facilities that would exist in the future without project condition at the project or an alternative location. For vessels that would not be present at any location in the without project condition, but would be present in the future as a result of the project, benefits are evaluated as commercial or recreational navigation benefits, as appropriate.

(c) Where measures serve both hurricane and storm damage reduction and navigation, an allocation of multiple purpose joint costs must be made and the joint costs shared in accordance with the purpose to which they are allocated, along with any specific costs for features which serve only one purpose. This cost allocation must include operation, maintenance, repair and replacement and rehabilitation responsibility under the hurricane and storm damage reduction purpose. No cost allocation is required where a measure is formulated to serve a single purpose but results in incidental benefits.

(8) Federal Assumption of Maintenance. Section 204(f) of the WRDA of 1986, as amended, and implemented by ER 1165-2-124, provides the basis for the Federal assumption of maintenance of navigation projects constructed by non-Federal interest. (Section 204(f) was previously Section 204(e). It was redesignated by Section 303(b)(1) of the WRDA of 1990.) Section 204(f) provides that a non-Federal project must be approved by the Secretary of the Army prior to construction for Federal assumption of maintenance. In view of the provisions of Section 204(f) and in recognition of budgetary constraints, the Corps will not seek study funding or authorization for Federal maintenance of existing non-Federal navigation projects. Only assumption of maintenance under provisions of Section 204(f) will be considered. This policy does not apply to traditional study, authorization and construction of improvements to non-Federal harbors, which may include subsequent Federal maintenance.

E-9. NED Benefit Evaluation Procedures: Transportation Inland Navigation

a. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the inland navigation features of water resource projects and plans.

(1) Major Rehabilitation Projects. Construction of infrequent, costly structural rehabilitation or major works that will improve reliability or efficiency of a inland navigation project or a principal feature thereof are implemented under the Major Rehabilitation Program. Major rehabilitation projects are budgeted under the Construction General account. Rehabilitation is a major project feature restoration consisting of structural work on a Corps operated and maintained facility intended to improve reliability of an existing structure, the result of which will be deferral of capital expenditures to replace the structure. Rehabilitation is considered when it can significantly extend the physical life of a feature and can be economically justified by benefit-cost analysis.

(2) Major Rehabilitation Projects Evaluation Procedures. ER 1130-2-500 and EP 1130-2-500 document the requirements and procedures for major rehabilitation studies and projects.

b. Conceptual Basis. The basic economic benefit of a navigation project is the reduction in the value of resources required to transport commodities. Navigation benefits can be categorized as follows:

(1) Cost Reduction Benefit (same origin-destination; same mode). For traffic that uses a waterway both with and without a project, the benefit is the reduction in the economic cost of using the waterway. This reduction represents an economic efficiency or NED gain because resources will be released for productive use elsewhere in the economy; for example:

(a) Reductions in costs incurred from trip delays (e.g., reduced congestion by expanding lock sizes at congested facilities or by imposition of congestion fees).

(b) Reduction in costs because larger or longer tows can use the waterway (e.g., by channel straightening or widening).

(c) Reduction in costs by permitting barges to be more fully loaded (e.g., by channel deepening).

(2) Shift of Mode Benefit (same origin-destination; different mode). For traffic that would use a waterway with the project but uses a different mode, including a different waterway, without the project, the benefit is the difference between the costs of using the alternative mode without the project and the costs of using the waterway with the alternatives under consideration. The economic benefit of the waterway to the national economy is the savings in resources from not having to use a more costly mode.

(3) Shift of Origin-destination Benefit. If a project would result in a shift in the origin of a commodity, the benefit is the difference in total costs of getting the commodity to its place of use with and without the project. If a project would result in a shift in the destination of a commodity, the benefit is the difference in net revenue to the producer with and without the project. The shift of origin-destination benefit cannot exceed the reduction in transportation charges achieved by the project.

(4) New Movement Benefit. This benefit applies if a commodity or additional quantities of a commodity would be transported only because of lowered transportation charge with the project. The quantities are limited to increases in production and consumption resulting from lower transportation costs. An increase in waterway shipments resulting from a shift in origin or destination is not included. The new movement benefit is defined as the increase in producer and consumer surplus; practically, it can be measured as the delivered price of the commodity less all associated economic costs, including all of the costs of barge transportation other than those of the navigation project. This benefit, like the preceding one, cannot exceed the reduction in transportation costs achieved by the project.

(5) Use of Rates For Benefit Measurement. It is currently more difficult to accurately compute the long-run marginal costs of particular rail movements on the basis of cost estimation studies than to determine the rates at which railroad traffic actually moves. In competitive markets, rates (prices) correspond to marginal cost, and, given market stability, prices will settle at long-run marginal costs. Moreover, the rates actually charged determine the distribution of traffic among modes. For these reasons, rates will be used to measure shift of mode benefits. Section 7a of the Department of Transportation (DOT) Act of 1966 (Public Law 89-670) requires the use of prevailing rates, as described in paragraph E-9d(5). In the case of new waterways, this rate may or may not represent the best estimate of long-run marginal costs. In the case of existing waterways, prevailing competitive similar rates are the best available approximation of long-run marginal costs.

(6) Risk-based Analysis Procedure. Institute of Water Resources and HQUSACE staff are currently in the process of developing risk-based analysis procedures for inland navigation studies. Although these efforts are ongoing, preliminary indications are the following variables should be explicitly incorporated in risk-based analysis; 1) commodity forecasts, 2) alternative mode costs, 3) reliability of existing and proposed structures, and, 4) system delays associated with capacity constraints. Additional variables can be incorporated if appropriate for individual study areas. Districts are expected to incorporate risk-based analysis procedures in all inland navigation studies. Until risk-based procedures are fully developed, districts are expected to, at a minimum, perform sensitivity analysis of key variables.

c. Planning Setting.

(1) Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of the navigation project or any change in law or public policy. The without project condition includes any practice likely to be adopted in the private sector under existing law and policy, as well as actions that are part of broader private and public planning to alleviate transportation problems. The following specific assumptions are part of the projected without project condition:

(a) Assume that all reasonably expected nonstructural practices within the discretion of the operating agency, including helper boats and lock operating policies, are implemented at the appropriate time. Substantial analysis is required to determine the best combination of nonstructural measures to ensure the most effective use of an existing waterway system over time. This analysis should be documented in project reports to assure the reviewer that the best use of existing facilities will be made in the without-project condition and that the benefits of alternative with project conditions are correctly stated. The criteria for the best utilization of the system are overall public interest concerns, including economic efficiency, safety and environmental impact.

(b) User charges and/or taxes required by law are part of the without project condition. Proposed or possible fees, charges, or taxes are not part of the without project condition but should be considered as part of any nonstructural alternatives in the with project condition.

(c) The without project condition assumes that normal operation and maintenance will be performed on the waterway system over the period of analysis.

(d) In projecting traffic movements on other modes (railroad, highway, pipeline, or other), the without project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary.

(e) Alternative modes should be analyzed as a basis for identifying the most likely route by which commodities will be transported in the future in the absence of waterway improvement.

(f) The without project condition normally assumes that only waterway investments currently in place or under construction are in place over the period of analysis.

(2) With Project Condition. The with project condition is the most likely condition expected to exist in the future if a project is undertaken. The same assumptions as for without project condition underlie the with project condition. The following discussion relates to the alternatives considered under the with project condition.

(a) Management of demand by the use of congestion or lockage fees is a nonstructural alternative, which alone or in combination with structural devices may produce an economic optimum in a congested waterway. Influencing marginal waterway users through a congestion fee can increase the net benefits of a waterway. Evaluate alternatives that influence demand on the same basis as supply-increasing (structural) alternatives. Because lockage time is a scarce commodity, the imposition of a congestion fee will work to allocate this commodity in an efficient manner. HQUSACE (CECW-PD) should be consulted for assistance in analyzing congestion fees.

(b) Additional nonstructural measures not within the current purview of the operating agency may be considered “supply management” measures. One example is traffic management. These supply-increasing (nonstructural) measures can be used alone or in combination with other structural or nonstructural measures.

(c) Project alternatives can differ in their timing as well as in their physical characteristics. Consider the optimal timing of projects and of individual project features in project formulation, so as to maximize net benefits over time.

(d) Consider improvements in alternative transportation modes as part of the without project condition only, as specified in paragraph E-9c.(1).

d. Evaluation Procedure: General. Use the following 10 steps to estimate navigation benefits. (See Figure E-1.) The level of effort expended on each step depends upon the nature of the proposed improvement, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to further refinement, especially as applied to steps 6, 7, and 8.

(1) Step 1--Identify the Commodity Types. Identify the types of commodities susceptible to movement on the waterway segment under consideration. The level of detail for each commodity is not pre-specified; for example, in some cases “grains” is detailed enough, while others, “corn,” “wheat” or “soybeans” is needed.

(a) New Waterways. Identify commodity types primarily by interviews of shippers and by resource studies. Interviews will identify primarily the benefit potentials of a shift of mode; resource studies will identify primarily the benefit potentials of shifts in origin-destination and in new movements.

(b) Existing Waterways. Identify commodity types primarily by analysis of data on existing use of the waterway segment under study; e.g., data from the Performance Monitoring System (PMS) and the Waterborne Commerce Statistical Center (WCSC).

(2) Step 2--Identify the Study Area. The study area is the area within which significant project impacts are incurred. The origins and destinations of products likely to use the waterway are normally included in the study area, broken out by river segments.

(3) Step 3--Determine Current Commodity Flow. Gather current data for commodity movements between origin-destination pairs susceptible to waterway movement as well as for commodities currently transported by waterway.

(a) New Waterways. Identify the total tonnage that could benefit from using the waterway. Obtain this information primarily by interviews of shippers. For benefits from shifts in origin and destination and from new movements, care must be taken to identify whether such movement would be likely to occur if waterway transportation were available; base this primarily on interviews. Give particular attention to delivered price from substitute sources in the case of benefits from shifts in origin and destination, and to resource and market analysis in the case of benefits from new movements. Assess current transportation costs in the area.

(b) Existing Waterways. Identify uses beyond the existing use of the waterway to identify commodities that might use the waterway in response to a reduced transportation charge.

(4) Step 4--Determine Current Costs of Waterway Use. Determine current costs of waterway use for all the tonnage identified in step 3. Include in the waterway transportation cost

the full origin-to-destination costs, including handling, transfer, demurrage, and prior and subsequent hauls for the tonnages identified in step 3. Consider the effect of seasonality on costs. In calculating the cost of prior and subsequent hauls, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which there is a wide geographic dispersion in ultimate origins and/or destinations, as in the case of grain traffic.

(a) New Waterways. The current cost of the proposed waterway use represents the with project condition; there are no without project costs for waterway transportation.

(b) Existing Waterways. Construct two arrays, one representing the without project and one the with project condition. The difference between the two arrays reflects the reduction in current delays and any gains in efficiencies resulting from the alternative under consideration.

(5) Step 5--Determine Current Cost of Alternative Movement. Determine the current cost of alternative movement for all the tonnages identified in step 3. The cost includes the full origin-to-destination costs, including costs of handling, transfer, demurrage, and prior and subsequent hauls. Consider the effect of seasonality on costs. In calculating the costs of gathering or distribution prior or subsequent to the primary line haul, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which the ultimate origins and/or destinations are widely dispersed, as the case of grain traffic. This procedure uses price data when available as a proxy for the long-run costs of movement by other modes. This step, combined with steps 3 and 4, generates a first approximation of the demand schedule for waterway transportation given (1) the costs of transportation by alternative modes, (2) current levels of production, and (3) the distribution of economic activity.

(a) New Waterways. In the case of rail movements, use the prevailing rate actually charged for moving the traffic to be diverted to waterways. For traffic induced by the waterway construct the rail rate as in step 5b.

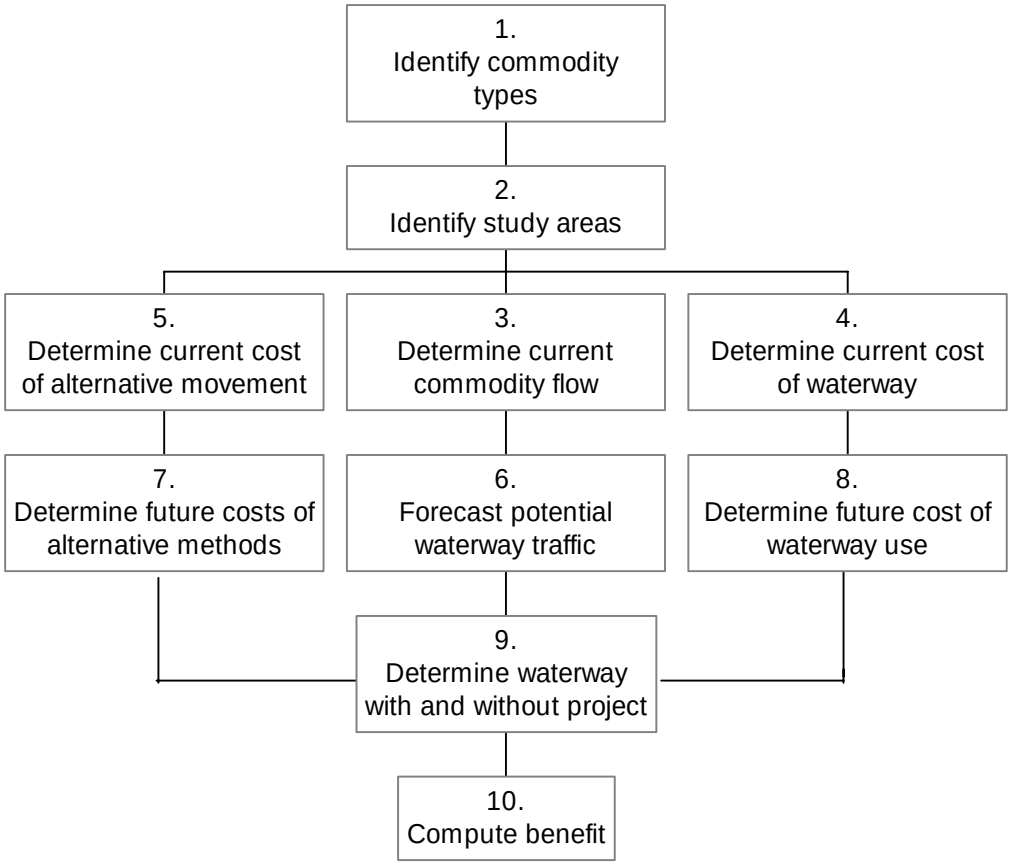


Figure E- 1 Inland Navigation Benefit Evaluation Procedure

(b) Existing Waterways. Use rate and other price data when available to estimate the cost of movement by alternative modes. In the case of rail movements, if the rate for that movement is not now used, use prevailing rates that are (1) competitive, and (2) for movements similar to the individual move that would occur without the project. Avoid the use of paper rates, i.e., rates at which no significant amount of traffic is actually moved. A rate is "competitive" to the extent that it is for traffic for which there is intra modal or intermodal competition within the relevant markets. In identifying a "similar" movement, the factors considered may include geographic location, degree of use, characteristics of terrain, backhaul, contract division, seasonality, ownership of rolling stock, and physical rail connection to the shipper. It is the responsibility of the analyst to select rates that, in his or her view, best represent the long-run marginal costs of the movement. Cost estimates for particular movements may be useful in selecting the rate or rates that best meet the criteria of competitiveness and similarity. If more than one competitive and similar rate is identified, an average may be used. Assume that all water-compelled or water-competitive rates are competitive and similar.

(6) Step 6--Forecast Potential Waterway Traffic by Commodity. Develop projects of the potential use of the waterway under study for selected years from the time of the study until the end of the project life, over time intervals not to exceed 10 years. Document commodity projects for the commodity groups identified in step 3.

(a) The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and the availability of data and previous studies.

(b) Generally, OBERS (now BEA) projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of OBERS-derived indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by OBERS. Even when total commodity flows can be adequately described through the use of indices derived from OBERS projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by OBERS.

(c) If problems of the type described in paragraph b. above are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data with (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts; and (3) historical flow patterns. Commodity projections can then be constructed on the basis of the results of the independent studies.

(d) Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life through the use of general indices on a regional and industry basis. Such indices can be constructed from the OBERS projections or other generally accepted multi-industry and regional models.

(7) Step 7--Determine Future Cost of Alternative Modes.

(a) Future cost per unit of each commodity will normally be the same as current cost. As stated previously, the without-project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary. This step combined with step 6 provides a time series of demand schedules specific to

a particular commodity origin-destination pattern. Address the projection of any change in future prices as indicated below.

(b) A future rate is a prevailing rate as defined in step 5. It reflects exclusively a shift in rates because of projected changes in the volume of shipments on a given mode or a shift from one mode to another (e.g., from rail to pipeline). To support such a shift, show that the increase in volume is likely to lead to a change in rate; do not assume, for example, that an increase in volume of traffic of a commodity from one area to another will automatically ensure a more favorable high-volume rate.

(8) Step 8--Determine Future Cost of Waterway Use. Two separate analyses make up this step. First, analyze the possibility of changes in the costs of the waterway mode for future years for individual origin-destination commodity combinations. Second, analyze the relationship between waterway traffic volume and system delay. Do this second analysis in the context of the total volume of traffic on the waterway segments being studied for with and without project conditions. This analysis will generate data on the relationship between total traffic volume and delay patterns as functions of the mix of traffic on the waterway; it may be undertaken iteratively with step 9 to produce a “best estimate.”

(9) Step 9--Determine Waterway Use, With and Without Project. At this point the analyst will have a list of commodities that potentially might use the waterway segment under study, the tonnages associated with each commodity, and the costs of using alternate modes and the waterway, including system delay functions with and without the project over time. Use this information to determine waterway use over time with and without the project based upon:

(a) A comparison of costs for movements by the waterway and by the alternative mode, as modified by paragraph E-9d(7).

(b) Any changes in the cost functions and demand schedules comparing (1) the current and future without project conditions and (2) the current and future with project condition. Conceptually, this step should include all factors that might influence a demand schedule; e.g., impact of uncertainty in the use of the waterway; ownership of barges and special equipment; level of service; inventory and production processes; and the like. As a practical matter, the actual use of a waterway without a cost savings or nonuse of a waterway with a cost savings depends on the knowledgeable judgment of navigation economists and industry experts.

(c) Account for the “phasing in” or “phasing out” of shifts from one mode to another in the analysis. Base diversion of traffic from other modes to the waterway, and from the waterway to other modes as the waterway becomes congested, on expected rate savings as adjusted by any other factors affecting the willingness of users to pay or the speed of the response mechanism to changes in the relative attractiveness of alternative modes. Specifically, determine diversions

from congested waterways in the order of the willingness of users to pay for waterway transportation. Divert users with the lowest willingness to pay first.

(d) Consideration must also be given to potential shifts in origin and destination pair due to increased costs of future without project waterway use. Potentially, increased waterway costs less than alternate mode costs may cause some traffic to divert to different origin – destination pairs. This would be the case for commodities with relatively elastic demand for waterway transportation. In these cases the analysis must be expanded to address this shift in origin-destination pair.

(10) Step 10--Compute NED Benefits. Once the tonnage moving with and without a plan is know and the alternative costs and waterway costs are known, total NED navigation benefits can be computed at the applicable discount rate:

(a) For cost reduction benefits, the benefit is the reduction in cost of using or operating the waterway; the cost of the alternative mode is a factor in determining whether the tonnage would move both with and without the project but is not a factor in computing benefits. Cost reduction benefits are generally limited to evaluation of existing waterways. The benefits for current and future cost reductions are reflected by the difference in waterway costs (steps 4 and 8) with and without the project. Compare waterway cost data (steps 4 and 8) with the alternative mode costs (steps 5 and 7) in order to determine the traffic flow by mode over time (steps 3 and 6).

(b) For shift of mode benefits, the benefit is the reduction in costs when the alternative movement is compared with the waterway. These benefits apply to new or existing waterways. Cost differences between the alternative mode and the waterway mode (step 5 - step 4 x step 3 and step 7 - step 8 x step 6) will identify the shift of mode benefits over time.

(c) For shift or origin-destination benefits and new movement benefits, the benefit is the value of the delivered product less the transportation and production costs with the project. The transportation cost without the project (assuming the with project movement would have occurred) is a factor in categorizing these benefits but is not a factor in computing them. The upper limit of these benefits can normally be determined by computing reduction in transportation charges achieved by the project. These can be a reduction in waterway costs (steps 4 and 8) with and without the project or changes in mode (steps 5, 4, 7 and 8).

e. Evaluation Procedure: Problems in Application.

(1) Changes in System Delays. Differences in system delays resulting from project alternatives are difficult to compute. An assessment of system delays within the state of the analytic art is necessary for a comprehensive benefit analysis. Delays at all points in the system should be analyzed only to the extent that project formulation and evaluation are sensitive to such

refinements, and to the extent that the state of the art permits accurate refinement of the estimate. Appropriate proxy measures may be used in lieu of individual assessments at each element in the system when evaluating system delays.

(2) Interaction of Supply and Demand Schedules. The entire evaluation procedure (paragraph E-9d.) is based on an assumption that the supply and demand schedules are independent; but in fact, they are not. This problem is most acute when considering the variance in delays at high levels of lock utilization. Essentially, shippers will face not an expected delay value but rather a highly uncertain delay value. Shippers' response to uncertainty (as reflected in the demand schedule) may be quite different from their response to an expected shipping cost (as reflected by the intersect of the supply and demand schedules).

(3) User Fee Collection. The incremental collection of user charges, fees, or taxes is not a NED benefit. It is a transfer or resources between the private and public sectors of the economy, manifesting itself as resources committed to the proposed navigation system. The increased collection of these charges, fees, or taxes is therefore considered a decrease in the public sector's contribution to the proposed system.

(4) Sensitivity Analysis. Project benefits are calculated on the basis of "the most probable" with project and without project conditions. However, risk and uncertainty should be addressed in the analysis of NED benefits and costs. In particular, major uncertainty exists in the proper measure of savings to shippers, namely the difference in long-run marginal costs. To the extent that rates or other prices vary from long-run marginal costs, savings to shippers will contain a component of transfers varying from real resource savings. This element of uncertainty should always be identified or acknowledged in estimates of benefits. In dealing with uncertainty, three techniques may be used: establishing consistent sources of data, expanding the data-gathering, and estimating the range of benefits. Use the following two specific approaches to implement the third technique, and display the results in terms of their effects on project benefits in tabular form in the project report.

(a) Pre-specified sensitivity analysis. Compute the following and include it in the report:

(1) Current tonnage, new waterway. For new waterways, compute benefits for the recommended alternative on the basis of current phased-in tonnage (steps 3 and 9c), current rates, and current fleet characteristics.

(2) Current rates, fleet. For both new and existing waterways, compute benefits for the recommended alternative on the basis of tonnage over time, current rates (step 3), and current fleet characteristics.

(3) Growth beyond 20-year period. Compute the benefits for alternatives carried forward for final display assuming no growth in tonnage or changes in fleet characteristics beyond 20 years in the future.

(4) Interest rate. For projects whose authorized discount rate is different from the current discount rate, compute annualized benefits using the current rate.

(5) User charges. Estimate the effect on benefits of full recovery through user charges.

(b) Other. In addition, the report should contain such other sensitivity analyses as are necessary to meet the objective of a clear, concise report presenting a range of benefit levels that represent data and assumptions about which reasonable persons might differ. The following discussion summarizes key data sources, including problems in their use.

(1) Interviews. Interview data may be used in steps 1 through 8. (Use only forms approved by the Office of Management and Budget.) Collect data not available from secondary sources by personal interviews. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in such a way as to prevent the disclosure of individual sources. Describe the errors and uncertainty inherent in the sampling methods and responses.

(2) Other. The basic organizational source for systematically collected waterway data is the Office of the Chief of Engineers.

f. Report and Display Procedures. Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Tables E-2 through E-5 are suggested presentations for all reports that include navigational objectives. In addition to detailed data on the NED benefits of a project, summary tables may present useful information on other aspects of the project such as its impact on commodity flows, on other modes of transportation, and on the location of economic activity. (See tables E-2 to E-5).

E-10. NED Benefit Evaluation Procedures: Transportation, Deep-Draft Navigation

a. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the deep-draft navigation features of water resources plans and projects. Deep-draft navigation features include construction of new harbors and channels and improvements to existing or natural harbors on the seacoasts to meet the requirements of ocean going and Great Lakes shipping. Harbor improvements include such structural projects as the construction of breakwaters and jetties to protect exposed harbors and the provision of entrance channels, interior channels, turning basins, and anchorage areas. Nonstructural deep-draft measures include improved traffic management and pilotage

regulations. The Institute of Water Resources is currently developing risk-based analysis procedures for deep-draft navigation studies. Unlike the current risk-based flood damage model, the navigation model will integrate both benefit uncertainty, related to fleet and commodity forecasts and vessel operating costs, with cost uncertainty related to dredging and disposal costs. Districts are expected to continue to use risk and uncertainty techniques in all navigation studies, at least in the form of sensitivity analyses, before field release of the risk-based navigation models.

b. Conceptual Basis. The basic economic benefits from navigation management and development plans are the reduction in transportation costs for commodities and the increase in the value of output for goods and services. Specific transportation savings may result from the use of larger vessels, more efficient use of large vessels, more efficient use of existing vessels, reductions in transit time, lower cargo handling and tug assistance costs, reduced interest and storage costs such as from an extended navigation season, and the use of water transportation rather than an alternative land mode. Principal direct benefits are categorized as follows:

(1) Cost Reduction Benefits. If there is no change in either the origin or destination of a commodity, the benefit is the reduction in transportation costs of quantities of the commodity that would move with and without the plan resulting from the proposed improvement. Cost reduction benefits apply in the following situations:

Table E- 2 Summary of Annualized NED Benefits For Alternative Projects

(Applicable discount rate: ____)

	Alternatives			
	1	2	3	X
Navigation benefits:				
Cost reduction benefits	.....	.....	.....	.....
Shift of mode benefits	.....	.....	.....	.....
Shift in origin-destination benefits	.....	.....	.....	.....
New movement benefits	.....	.....	.....	.....
Total navigation benefits	.....	.....	.....	.....
Other purpose benefits	.....	.....	.....	.....
Total project benefits	.....	.....	.....	.....
Project costs	.....	.....	.....	.....
Net benefits	.....	.....	.....	.....

Table E- 3 Time Phasing of NED Benefits For Recommended Project[1]
(Applicable discount rate: ____)

	Time Period[1]						
	Base Years Specify	Decade[2]					
		1	2	3	4	5	AAE[3]
Navigation benefits:							
Cost reduction benefits:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....	.....	.....	.....
Benefits	.....	.....	.....	.....	.....	.....	.....
Shift mode benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....	.....	.....	.....
Benefits	.....	.....	.....	.....	.....	.....	.....
Shift in origin-destination benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....	.....	.....	.....
(10^3 tons/year)	.....	.....	.....	.....		.....	.....
Benefits					.....		
New movement benefit:	.....	.....	.....	.....	.....	.....	.....
Traffic volume	.....	.....	.....	.....		.....	.....
(10^3 tons/year)					.....		
Benefits	.....	.....	.....	.....		.....	.....
Total navigation benefits							
Other purpose benefits							
Total project benefits							

[1]Comparable tables may be made for all detailed alternatives.
[2]Value for last year of decade. [3]Average annual equivalent.

Table E- 4 Waterway Traffic and Delays, Without Project Condition

	Current Year	Base Year	Time Period[1]					
			Decade					
			1	2	3	4	5	AAE[2]
Waterway traffic (10^3 tons/year).....	.....	.....	.....	.....	.....	.....	.....	.....
(By major commodity group).....								
Delays (minutes/tow):								
Study site	.....	.....	.....	.....	.....	.....	.....	.....
Critical constraints	.....	.....	.....	.....	.....	.....	.....	.....
Total system	.....	.....	.....	.....	.....	.....	.....	.....
Delays (dollars/ton):								
Study site	.....	.....	.....	.....	.....	.....	.....	.....
Critical constraints	.....	.....	.....	.....	.....	.....	.....	.....
Total system	.....	.....	.....	.....	.....	.....	.....	.....

[1]Value for last year of decade.
[2]Average annual equivalent.

Table E- 5 Waterway Traffic and Delays, With Recommended Project[1]

(Applicable discount rate: ____)

	Time Period[1]						
	Base Year	Decade[2]					
		1	2	3	4	5	AAE[3]
Waterway traffic (10^3 tons/year).....	.....	.....	.....	.....	.....	.....	.....
(By major commodity group).....	.....	.....	.....	.....	.....	.....	.....
Delays (minutes/tow):	.....	.....	.....	.....	.....	.....	.....
Study site							
Critical constraints							
Total system.....	.....	.....	.....	.....	.....	.....	.....
Delays (dollars/ton):	.....	.....	.....	.....	.....	.....	.....
Study site	.....	.....	.....	.....	.....	.....	.....
Critical constraints							
Total system.....	.....	.....	.....	.....	.....	.....	.....

[1]Comparable tables may be made for all detailed alternatives.
[2]Value for last year of decade.
[3]Average annual equivalent.benefits.

(a) Same commodity, origin-destination, and harbor. This situation occurs where commodities now move or are expected to move via a given harbor with or without the proposed improvement.

(b) Same commodity and origin-destination, different harbor. This situation occurs where commodities that are now moving or are expected to move via alternative harbors without the proposed improvement would, with the proposed plan, be diverted through the subject harbor. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels.

(c) Same commodity and origin-destination, different mode. This situation occurs where commodities that are now moving or are expected to move via alternative land modes without the proposed improvement would, with the proposed plan, be diverted through the subject harbor or channel. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels. Compute cost reduction benefits for alternate modes in accordance with methodology described in paragraph E-9b.(3).

(2) Shift of Origin Benefits. If there is a change in the origin of a commodity because of a proposed plan but no change in destination, the benefit is the reduction in the total cost of producing and transporting quantities of the commodity that would move with and without the plan.

(3) Shift of Destination Benefits. If there is a change in destination of a commodity because of a proposed plan but no change in origin, the benefit is the change in net revenue to the producer for quantities that would move with and without the plan.

(4) Induced Movement Benefits. If a commodity or additional quantities of a commodity are produced and consumed as the result of lowered transportation costs, the benefit is the value of the delivered commodity less production and transportation costs. More precisely, the benefit of each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. Where data are available, estimate benefits for various increments of induced movement. In the absence of such data, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

c. Planning Setting. The planning setting consists of the physical, economic, and policy conditions that influence and are influenced by a proposed plan or project over the planning period. The planning setting is defined in terms of a without project condition and with project condition.

(1) Without Project Condition. The without project condition is the most likely condition expected to exist over the planning period in the absence of a plan, including any known change in law or public policy. It provides the basis for estimating benefits for alternative with project conditions. Assumptions specific to the study should be stated and supported. The basic assumptions for all studies are:

(a) Nonstructural measures within the authority and ability of port agencies, other public agencies, and the transportation industry determine changes that are likely to occur. These measures consist of reasonably expected changes in management and use of existing vessels and facilities on land and water. Examples are lightering, tug assistance, use of favorable tides, split deliveries, topping-off, alternative modes and ports, and transshipment facilities.

(b) Alternative harbor and channel improvements available to the transportation industry over the planning period include those in place and under construction at the time of the study and those authorized projects that can reasonably be expected to be in place over the planning period.

(c) Authorized operation and maintenance is assumed to be performed in the harbors and channels over the period of analysis unless clear evidence is available that maintenance of the project is unjustified.

(d) In projecting commodity movements involving intermodal movements, sufficient capacity of the hinterland transportation and related facilities, including port facilities, is assumed unless there are substantive data to the contrary.

(e) A reasonable attempt should be made to reflect advancing technology affecting the transportation industry over the period of analysis. However, the benefits from improved technology should not be credited to the navigation improvement if the technological change would occur both with and without the plan.

(2) With Project Condition.

(a) The with project condition is the one expected to exist over the period of analysis if a project is undertaken. Describe the with project condition for each alternative plan. Since benefits attributable to each alternative will generally be equal to the difference in the total transportation costs with and without the project, the assumptions stated for the without project condition are used to establish the with project condition for each alternative.

(b) Management practices that are sometimes within the discretion of a public entity and are therefore subject to change in the with project condition include traffic management, pilotage regulations, addition of berths, and additions or modifications to terminal facilities.

(3) Display. In the planning report, present the derivation and selection of with and without project conditions in accordance with the following guidelines:

(a) State the assumptions specific to the study.

(b) Specify the significant technical, economic, environmental, social, and other elements of the planning setting to be projected over the period of analysis. Discuss the rationale for selecting these elements.

(c) Present the with and without project conditions in appropriate tabular and graphic displays with respect to the elements selected above and as exemplified by Tables E-6, E-8, and E-9.

d. Evaluation Procedures: General. Use the following steps to estimate navigation benefits. The level of effort expended on each step depends upon the nature of the proposed improvement, the state-of-the-art for accurately refining the estimate, and the sensitivity of

project formulation and evaluation to further refinement. A flow chart of navigation evaluation procedures is shown in Figure E-2. Additional detailed support material for conducting NED evaluation may be found in Deep Draft Navigation (IWR Report 91-R-13, October 1987). This manual provides an expanded description of benefit evaluation procedures for all commercial navigation projects not a part of the inland waterways system. It also provides sources of information to identify and estimate future project use. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within this IWR report.

(1) Step 1--Determine the Economic Study Area. Delineate the economic study area that is tributary to the proposed harbor and channel improvement. Assess the transportation network functionally related to the studied improvement, including the types and volumes of commodities being shipped, in order to determine the area that can be served more economically by the improvement. Include foreign origins and destinations in this assessment. Consider diversion from or to adjacent competitive harbors as well as distribution via competing modes of transport. It should be recognized that the lines of demarcation for the economic study area are not fixed and that the area may expand or contract as a result of innovations or technological advances in transportation or production or utilization of a particular commodity. The economic study area is likely to vary for different commodities. Combinations of economic areas will result in a trade area delineated specifically for the improvement under study. However, in many cases, due to the close proximity of adjacent harbors to the proposed improvement, the economic study area may be the same as, or overlap with, such adjacent harbors. Therefore, the final delineation of the economic study area for a given improvement, should adequately discuss the trade area relative to adjacent ports and any commonality that might exist.

(2). Step 2--Identify Types and Volumes of Commodity Flow. To estimate the types and volumes of commodities that now move on the existing project or that may be attracted to the proposed improvement, analyze commerce that flows into and out of the economic study area. This analysis provides an estimate of gross potential cargo tonnage; the estimate is refined to give an estimate of prospective commerce that may reasonably be expected to use the harbor during the period of analysis in light of existing and prospective conditions. If benefits from economies of ship size are related to proposed deepening of the harbor, the analysis should concentrate on the specific commodities or types of shipments that will be affected. Thus, an historical summary of types and trends of commodity tonnage should be displayed. The considerations generally involved in estimating current volumes of prospective commerce are discussed in the following paragraphs.

(a) If the plan consists of further improvements to an existing project, statistics on current waterborne commerce will provide the basis for evaluation. For new harbors with no existing traffic, or for existing commodity movements that may be susceptible to diversion from adjacent

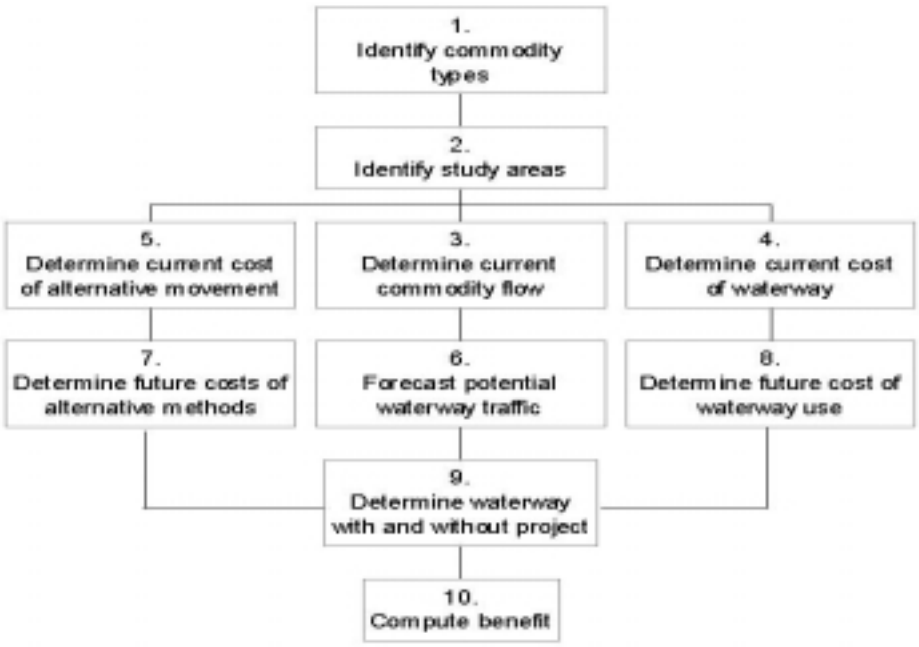


Figure E- 2 Deep-Draft Navigation Benefit Evaluation Procedure

harbors, basic information is collected by means of personal interviews or questionnaires sent to shippers and receivers throughout the economic study area. Secondary commercial data are usually available through State and local public agencies, port records, and transportation carriers. In the case of new movements, give attention of resource and market analyses.

(b) After determining the types and volumes of commodities currently moving or expected to move in the economic study area, it is necessary to obtain origins, destinations, and vessel itineraries in order to analyze the commodity types and volumes that are expected to benefit from the proposed improvement. Commodities that are now moving without the project but would shift origins or destinations with the project, as well as induced movements, should be segregated for additional analysis (see steps 5 and 6). A study should be made of various alternatives for the existing traffic and of new traffic susceptible to diversion from alternative harbors or other modes of transportation. The objective of such a study is to determine the type and volume of those commodities for which savings could be affected by movement via a proposed navigation improvement and the likelihood that such movements would occur. Cost reduction benefits sufficient to divert traffic from established distribution patterns and trade routes are navigation project benefits. In determining the likelihood of prospective commerce,

particular attention should be given to alternative competitive harbors in the case of new movements and to hinterland traffic. Elements of analysis of current tonnage include: size and type of vessel, annual volume of movements, frequency of movements, volume of individual shipments, adequacy of existing harbor and transportation facilities, rail and truck connections, and service considerations. Generally this prospective traffic is the aggregate of a large number of movements (origin-destination pairs) of many commodities; the benefit from the navigation project is the savings on the aggregate of these prospective movements.

(3). Step 3--Project Waterborne Commerce. Develop projections of the potential use of the waterway under study for selected years from the time of the study until the end of the project life, over time intervals not to exceed 10 years. Document commodity projections for the commodity groups identified in step 2.

(a) The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and availability of data and previous studies.

(b) Generally, Bureau of Economic Analysis (BEA), previously OBERS, projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of BEA-derived indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by BEA. Even when total commodity flows can be adequately described through the use of indices derived from BEA projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by BEA.

(c) If problems of the type described in paragraph (b) above are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data with (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts; and (3) historical flow patterns. Commodity projections can then be constructed based on the results of the independent studies.

(d) Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life using general indices on a regional and industry basis. Such indices can be constructed from the BEA projections or other generally accepted multi-industry and regional

models. Describe projection methods selected in sufficient detail to permit a review of their technical adequacy.

(e) Sensitivity analysis of several levels of projections is used for the economic analysis. There may be high-level projection embodying optimistic assumptions and a low-level projection based on assumptions of reduced expectations. The high and low projections should bracket the foreseeable conditions. The third and fourth levels of projections can reflect the with- and without-project conditions based on the most likely estimates of the future. If a proposed plan would not induce commodity growth, one level of projection may be shown for both the with and without project conditions.

(f) The commodities included in the projections should be identified, if possible, according to the following waterborne modes: containerized, liquid bulk, dry bulk, break-bulk, etc. Projection-related variables include estimated value, density, and perishability. Imports, exports, domestic shipments, domestic receipts, and internal trade should also categorize the commodities. Projected tonnages by trade areas both with and without the project should be displayed at least for the study year, the base year, fifth year, tenth year, and then by decades over the period of the analysis.

(g) Most projections of waterborne commerce are static estimates of dynamic events; therefore, the projections should be sufficiently current to support the report conclusions.

(4) Step 4--Determine Vessel Fleet Composition and Cost.

(a) Vessel Fleet Composition. Key components in the study of deep-draft harbor improvements are the size and characteristics of the vessels expected to use the project. Present data on past trends in vessel size and fleet composition, and on anticipated changes in fleet composition over the project life. Use estimates of future fleet consistent with domestic and world fleet trends. Undertake studies to the extent necessary to determine the appropriate vessel fleet. The assessment of available secondary data forms the basis of the independent studies. Data may be obtained from various sources including the U.S. Department of Transportation (Maritime Administration), trade journals, trade associations, shipbuilding companies, and vessel operating companies, as well as forecasts collected and prepared by IWR. Determine the composition of the current and future fleet that would utilize the subject harbor with and without the proposed improvement. Provide adequate lead time for anticipated changes in fleet composition for vessels that are currently a small part of the world fleet. Size selection may vary according to trade route, type of commodity, volume of traffic, canal restrictions, foreign port depths, and lengths of haul. It may not be realistic to assume that the optimum size vessel is always available for charter; the preferred approach is a fleet concept that includes a range of vessels expected to call with and without the project. It is suggested that tabulations in the reports show composition of vessel fleets by deadweight tonnage for each type of vessel

beginning with the current fleet and by decades through the period of analysis. Historical records of trips and drafts of vessels calling at the existing project should also be displayed.

(b) Vessel Operating Costs. To estimate transportation costs, obtain deep-draft vessel operating costs for various types and classes of foreign and United States flag vessels expected to benefit from using the proposed improvement. Since vessel operating costs are not readily available from ocean carriers or from any central source, the Corps of Engineers, Water Resources Support Center, will develop and provide such costs on an annual basis for use in plan evaluation. Planners should determine to what extent these estimates of vessel costs must be modified to meet the needs of local conditions. Document and display selected vessel operating costs in the report.

(5) Step 5--Determine Current Cost of Commodity Movements. Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2. Transportation costs include the full origin-to-destination cost, including necessary handling, transfer, storage, and other accessory charges. Construct costs for the with and without project condition. The without project condition is based on costs and conditions prevailing at the time of the study. Transportation costs with a plan reflect any efficiencies that can be reasonably expected, such as larger vessels, increased loads, reduction in transit time and delays (tides), etc. Use competitive rates, rather than costs, for competitive movements by land (See paragraphs E-10b.(1)(c), E-9b.(5), and E-9d.(5)(b)). This concept also applies to Steps 6, 7, and 9 and elsewhere where a competitive movement by land is an alternative.

(6) Step 6--Determine Current Cost of Alternative Movement. Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2 for alternative movements. The cost includes the full origin-to-destination cost. Such alternatives include competitive harbors, lightering, lightening and topping-off operations, off-shore port facilities, transshipment terminals, pipelines, traffic management, pilotage regulations, and other modes of transportation. Consider competitive harbors with existing terminal facilities and sufficient capacities as possible alternatives for traffic originating in or destined to the hinterland beyond the confines of the harbor and for all other new commerce as well as all diverted traffic. Commerce with final origins and destinations within the confines of the study harbor is normally noncompetitive with other harbors and need not be considered for diversion unless unusual circumstances exist. Diversion of established commerce now moving through the existing harbor to or from the hinterland is dependent on many different cost and service factors; therefore, to ensure that all of these factors are included in the analysis, interviews, and consultations with shippers and receivers should be conducted prior to any determination concerning diversion of traffic. Factors to be considered in the analysis include transportation costs for both inland and ocean movement, handling and transfer charges, available service and schedules, carrier connections, institutional arrangements, and other related factors. In addition, for commodities with shifts in origins and destinations, as well as for new movements, collect data on the value of the delivered product as well as production and transportation costs for

shipments with the project. The specific data and method of collection will vary with the specific situation and the nature of the benefit.

(7) Step 7--Determine Future Cost of Commodity Movements. Estimate relevant shipping costs during the period of analysis and future changes in the fleet composition, port delays, and port capacity under the with and without project conditions for each alternative improvement under study. Base future transportation costs on the vessel operating cost prevailing at the time of the study. Additional data may be needed to analyze the relationship between total volume and delay patterns and the port capacity for the with and without project conditions for each alternative. Changes in costs due to the project should be identified and separated from changes due to other factors.

(8) Step 8--Determine Use of Harbor and Channel With and Without Project. At this point, the analyst will have a list of commodities that potentially might use the proposed improvement; potential tonnages of each commodity or commodity group; transportation costs for alternatives and for the proposed improvement; and present and future fleet composition with and without the proposed plan. To estimate the proposed harbor use over time, both with and without the project, compare costs, other than projects costs, for movements via the proposed plan and via each alternative. Analyze any changes in the cost functions and demand schedules in the current and future without condition and the current and future with condition. Conceptually, this step includes all factors that might influence a demand schedule. Determine the impact of uncertainty in the use of the harbor, the level of service provided, and existing and future inventories of vessels. Provide adequate lead time for adoption for vessels that are currently a small percentage of the world fleet.

(9) Step 9--Compute NED Benefits. Once the tonnage moving with and without a plan is known and the cost via the proposed harbor and via each alternative are known, compute total NED navigation benefits will be computed using the applicable discount rate.

(a) Cost Reduction Benefits.

(1) Traffic with same commodity, origin-destination, and harbor. For traffic now using the harbor or expected to use it, both with and without the proposed project, the transportation benefit is the difference between current and future transportation cost for the movement by the existing project (without project condition) and the cost with the proposed improvement (with project condition).

(2) Traffic with same origin-destination; different harbor. For commerce shifted to the proposed improvement from other harbors or alternatives, including future growth, the benefit is

any reduction in current and future costs when movement via the proposed improvement is compared with each alternative.

(3) Traffic with same commodity and origin-destination, different mode. For commerce shifted to the proposed improvement from other modes, the benefit is any reduction in current and future costs to the producer or shipper. (See paragraph E-10b(1)(c) when movement via the proposed improvement is compared with each alternative.)

(b) Shift of Origin Benefits. For commerce that originates at a new point because of the proposed improvement, the benefit is the difference between the total cost of producing and transporting the commodity to its destination with and without the plan.

(c) Shift of Destination Benefits. For commerce that is destined to a new point because of the proposed improvement, the benefit is the difference in net revenues to producers with and without the plan.

(d) Induced Movement Benefits. If a commodity or additional quantities of commodity are produced and consumed as a result of a plan, the benefit for each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. To determine the maximum cost other shipper would be willing to pay, estimate how much of a price increase it would take to induce the producer to increase its output by each increment or how much of price decrease it would take to induce consumers to increase their consumption by each increment. In the absence of data suitable for incremental analysis, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

e. Problems in Application.

(1) Multiport Analysis. This procedure calls for a systematic determination of alternative routing possibilities, regional port analyses, and intermodal networks that may require the use of computer modeling techniques. The data needed for such a determination are often difficult to obtain; therefore, interviews with knowledgeable experts will often have to be relied upon.

(a) The economic study area tributary to the proposed harbor project is likely to vary for different commodities because of differences in hinterland transportation costs and facilities, and presence of competing ports. The trade area for any given port must be defined in cognizance of trade areas for adjacent or competing ports.

(b) Potential reductions in transportation costs due to a proposed project result in transportation benefits with varying degrees of certainty. The certainty of the benefit is related to

the certainty that the commodity movements will take place, with benefits for existing movements most certain. Analysis of potential or prospective movements must consider competing ports, hinterland transportation, vessel itineraries, ultimate origins or destinations of commodities, and assess the certainty with which benefits will accrue.

(c) A port study must recognize the degrees to which the ships that call or might call at that port are part of a larger waterborne transportation system. Specifically, the characteristics of vessels and the composition of the vessel fleet are affected in varying degrees by changes in costs or conditions at one port. A proposed deepening at a particular port, for example, may have more effect on some ships calling there than others if the ships have different modes of operation. Some bulk carriers may be affected because only one other port is served, while container operations may not be much affected because several additional ports are served. The size and characteristics of ships expected to use a project shall be determined in light of the transportation systems in which they operate, as well as world and domestic trends in fleet composition.

(d) US ports operate in a system(s). A study that appropriately considers a port in isolation will be rare. In such a case the report shall document why systems considerations are not relevant.

(2) Ultimate Origins and Destinations. The procedure calls for an analysis of full origin-destination costs to determine routings as well as to measure benefits in some instances. Problems will arise in determining the ultimate origins and destinations of commodities and in determining costs. Therefore, the analyst should attempt to shorten the analysis to the most relevant cost items.

(3) Underkeel Clearance and Risk Analysis. The purpose of Corps of Engineers' underkeel design standards is to provide clearance between a ship's bottom and a channel's bottom, which minimizes the risk of grounding by a design vessel under design conditions in the design channel. That is, underkeel clearances are engineering judgment on the minimum amount of clearance to assure safety and do not necessarily reflect actual behavior. When ships appear to operate with substandard underkeel clearances, procedures for correct delineation of transportation costs and project benefits may seem ambiguous.

(a) The starting point in analysis is to develop an accurate picture of the existing conditions. Accurate information on operating practices is particularly important; without this, reasonable without-project and with-project conditions, and hence economic analysis, is not possible. Entering and departing vessel drafts in economic analyses shall reflect actual practices. Adherence to Corps' clearance standards shall not be assumed.

(b) Determine whether observed apparent deviations from underkeel clearance standards represent actual encroachments in the safety zone. Apparent encroachments may be due to ships' physical characteristics (e.g. size) and operating characteristics (e.g. speed, trim) which differ from the design ship's characteristics, or from navigation conditions (e.g., wave climate) less severe than the design conditions. Alternatively the apparent deviations may be due to use of favorable tides or lake levels, or to exploitation of actual channel depths which differ from authorized depths. Benefits shall be based on differences in transportation cost, taking into account without-project actual operating practices and with-project actual operating practices. Adjustments may be taken, as appropriate, to the extent that these practices themselves affect transportation costs (e.g., tidal delays, costs of reduced speed or changing trim).

(c) For cases where it is determined that encroachment in the safety zone is taking place, risk accepting behavior may be assumed. The following benefit evaluation logic will be used: Transportation firms will accept risk up until the point where the incremental revenue from accepting risk equals the incremental risk cost of doing so. Estimate the incremental revenue associated with navigation at successively deeper drafts (I. e. smaller clearances) for those ships which use the safety zone. Estimate the risk costs (e.g., probability weighted cost of grounding) for those ships. Equilibrium between incremental revenue and incremental risk cost may be assumed to occur at the actual operating drafts (clearances) of those ships. Benefits are the area under the incremental revenue curve and costs are the area under the incremental risk cost curve, between the without and with operating depths.

(4) User Fees. The Water Resources Development Act of 1986 enabled non-Federal interests, as a means of financing a harbor project's local cost share, to collect user fees from vessels. Non-Federal interests are not directed to use fees to finance the local cost share, but if a fee is used only the benefiting vessels may be assessed charges.

(a) At the time of feasibility studies it may not be known with certainty whether user fees will be charged. The with-project condition for economic analysis shall use planners' best appraisal regarding the likelihood of fees being assessed, taking into account the intentions of the non-Federal interest, practices at other ports, the willingness of vessels to pay user fees, and the competitiveness of alternative ports in light of fees at the project port.

(b) As a sensitivity, conduct an analysis using the alternative assumption.

(c) For cases with user fees, assess the effect of the fees on transportation rates and the levels of traffic at the project port, taking into account the type of use fee (e.g., ad valorem, lump sum, etc.). That portion of transportation charges to shippers that reflects user fees is credited as a benefit of the project. The fees are in effect a reimbursement of project costs which are otherwise accounted for in the benefit-cost analysis.

(5) Sensitivity Analysis. Districts are expected to use risk and uncertainty techniques in all deep draft navigation studies at least in the form of sensitivity analysis. The uncertainty in the estimates of critical variables should be analyzed. These variables specifically related to deep-draft navigation may be traffic projections, especially foreign shipments, fleet composition, and cost of commodity movements.

(6) Data Sources. The following discussion summarizes key data sources including problems in their use:

(a) Interviews. Collect data not available from secondary sources by personal interviews. (Use only interview forms approved by the Office of Management and Budget.) Display the questionnaire used and summary of responses in the project report in such a way that individual sources are not disclosed.

(b) Publications. Data concerning commerce in foreign trade, United States coastal shipping, and activities of U.S. flag vessels in foreign trade, together with limited data concerning the world fleet, are readily available from a number of Federal agencies, trade journals, and port publications. However, data concerning the foreign-flag fleet are often not regularly available in up-to-date form from sources in the United States. Principal governmental sources are the U.S. Army Corp of Engineers, the Maritime Administration and the Bureau of the Census. For more detailed background on world fleet trends, shipping outlooks, and vessel characteristics, available foreign literature must be carefully analyzed. A few of the available foreign ship registers and literature are listed below to illustrate the type of data available from foreign sources. Many of these sources are available through IWR.

- Lloyd's Register of Shipping, London (Annual).
- The Tanker Register, H. B. Clarkson (Annual).
- The Bulk Carrier Register, H. B. Clarkson (Annual).
- Shipping Statistics and Economics (and special reports), H. P. Drewry, London (Weekly).
- Fairplay International Shipping Journal (and special reports), London (Weekly).

f. Report and Display Procedures. Clear presentation of study results, as well as documentation of assumptions and steps in the analysis, will facilitate review of the report. Tables E-6 to E-9 are suggested. The number of displays will depend on the complexity of the study.

Table E- 6 Projected Vessel Fleet Size Distribution,[a]

Ft. Channel Plan

(by Percentage)

Vessel size (D.W.T.)	Current[b]	Percentage of tonnage					
		Base Year[c]	Year 5	Year 10	Year 20	Year —	Year end
Total		With Project					
Total		Without Project					

Table E- 7 Typical Vessel Dimensions of Vessel Fleet by Type and Deadweight Tonnage

Type	Vessel characteristics			
	DWT	Length	Beam	Draft, loaded

Table E- 8 Projected Commerce for Deep-Draft Traffic

Commodity [1]	Current Year[2]	Base Year[3]	Year 5	Year 10	Year 20	Year —	Year —	Year end	Average Annual
With project									
Without Project									

[1]Commodities should be categorized by trade area.
[2]Study year.
[3]First year of project benefits.

Table E- 9 Projected Vessel Trips for Deep-Draft Traffic

Commodity [1]	Current Year[2]	Base Year[3]	Year 5	Year 10	Year 20	Year —	Year —	Year end	Average Annual
With project									
Without Project									

[1]Commodities should be categorized by trade area.
[2]Study year. [3]First year of project benefits.

g. New Waterways. Determine the origins and destinations primarily by interviews of shippers and by resource studies.

h. Existing Waterways. Determine origins and destinations by analysis of data on existing use of the waterway segment under study; e.g., PMS and WCSC traffic traced to its ultimate origin and destination.

E-11. NED Benefit Evaluation Procedure: Commercial Fishing

a. Purpose. This section provides procedural guidance for the evaluation of the national economic development (NED) benefits of water and related land resources plans to commercial fishing. These procedures apply to marine, estuarine, and fresh water commercial fisheries for both fish and shellfish.

b. Conceptual Basis.

(1) The NED benefits are conceptually measured as the change in consumers' and producers' surplus as a result of a plan. However, since proper measurement of these quantities ordinarily requires estimates of supply and demand elasticities, reasonable approximations may be obtained by the following methods:

(a) When no change in aggregate fish catch is expected as a result of a plan (perhaps because of an effective quota system), NED benefits may be measured as cost savings to existing fish harvests.

(b) When the fish catch is projected to change as a result of a plan, but the change is too small to affect market prices, a seasonally-weighted average of recent prices may be used to

value the without and with plan harvests. In this case, it may be convenient for computational purposes to break the total change in income into two parts: (a) the cost savings for the existing (without plan) catch; and (b) the change in net income associated with the incremental catch. This latter part may be measured as the change in total revenue due to the increased catch minus the change in total cost due to harvesting the increased catch.

(c) When the additional fish catch is expected to affect market prices, the change in net income may be estimated in two parts: (1) the cost savings for the existing, or without plan, catch; and (2) the change in net income associated with the incremental catch. The incremental gross revenue may be estimated by multiplying the change in catch by a price midway between expected without and with plan prices. The incremental cost of the harvest is then subtracted from the estimated incremental gross revenue.

(2) Harvest costs expected to vary between the with and without plan conditions should be analyzed.

(a) These include the cost of equipment ownership and operation; harvesting materials; labor and management; maintenance operation, and replacement. Examples of changed costs include reduced travel time, reduced travel time to safe moorage in storm conditions, reduced costs associated with more efficient or larger boats, reduced time awaiting favorable tides, damage reduction to vessels or facilities, reduced fish spoilage, and reduced maintenance expenditures. If costs associated with plan measures (e.g., dock costs, harbor facilities, etc.) are included in the plan cost analysis, exclude them from harvest costs.

(b) Value purchased input at current market prices. Value all labor, whether operator, hired or family at prevailing labor rates. Value management at 10 percent of variable harvest costs and interest at plan discount rates.

(c) Project current production costs to the selected time periods; any changes should reflect only changes in catch or physical conditions.

c. Planning Setting.

(1) Without Plan Condition. The without plan condition is the most likely condition expected to exist in the future in the absence of any of the alternative plans being considered. Several specific elements are included in the without plan condition:

(a) Habitat Condition. The biological resources consist of stocks of living resources subject to commercial fishing, any living resources ecologically related to the stocks, the migration pattern and reproduction rate of the stocks, and any physical characteristic of the environment essential to these living resources.

(b) The Institutional Setting. Existing and expected local, State, regional, national, and international policies and regulations governing the harvest and sale of the affected species, including the level of access to the fishery are included in the without plan condition. Other revisions of such policies and rules of the alternative plans being studied.

(c) Nonstructural Measures. The effects of implementing reasonably expected nonstructural measures. Nonstructural measures include prevention of pollution to the marine environment or relocation of shore facilities.

(d) Market Conditions. Information on the without plan situation includes the projected number of harvesters, the percentage of their time and capacity utilized, harvest technology, the markets in which they buy inputs, fishing efforts, probable harvests, harbors and channels utilized, ex-vessel price of harvests, and probable processing and distribution facilities. (See paragraph E-11c(1).) Project market conditions that are consistent with the projected biological and institutional conditions.

(2) With Plan Condition. The with plan condition is the most likely condition expected to exist in the future with a given alternative. The elements and assumptions included in the without plan condition are also included in the with plan condition. Special attention should be given to tracing economic conditions related to positive or negative biological impacts of the proposed plan.

d. Evaluation Procedure: General. Follow the steps described in the following paragraphs to estimate NED benefits to commercial fishing from water or related land resources plans. The level of effort expended on each step depends on the nature of the proposed project, the reliability of data, and the degree of refinement needed for plan formulation and evaluation (See Figure E-3). No specific risk-based procedures have been developed for commercial fishing evaluations. In studies where commercial fishing benefits constitute a significant portion of NED effects, FOAs are expected to perform, at a minimum, sensitivity analysis of key variables such as harvest costs, harvest rates an/or ex-vessel prices. FOAs should incorporate the key variables applicable to their specific study area in the risk-based analysis.

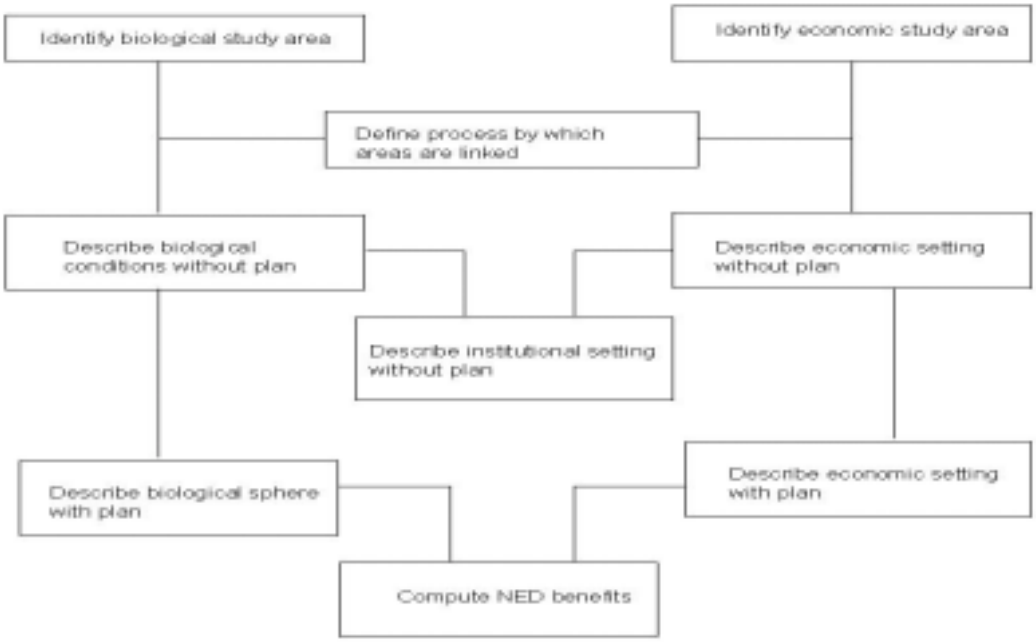


Figure E- 3 Commercial Fishing Benefits Evaluation Procedures

(1) Step 1: Identify the Affected Areas. Identify the areas which the proposed alternative plans will have biological impacts. Identify the areas in which the proposed alternative plans will have economic impacts. Describe the process by which the biological and economic study areas are linked.

(2) Step 2: Determine the Without Project Condition. Estimate the harvest of the relevant species in physical terms if a plan is not undertaken. Include a detailed description of the stock, including catch per unit of effort and whether the estimated harvest is at, or near, the range of absolute decreasing returns. Describe the most likely set of institutional conditions that would exist without a project. Estimate the total cost of harvesting the relevant species in each of the relevant years if a plan is not undertaken. For each relevant species, determine the current weighted ex-vessel price corrected for seasonal fluctuations.

(3) Step 3: Determine Conditions That Would Exist With an Alternative Plan. Estimate the harvest of the exploited stocks in each of the relevant years if an alternative plan is undertaken. Estimate the seasonally corrected current price of the harvested species and the total cost of harvesting in each of the relevant years if a plan is undertaken. This will require an understanding of the economics of entry and exit for the fish harvesting industry, as well as the effects of a change in harvest rates on the catch per unit of effort.

(4) Step 4: Estimate NED Benefits. Calculate the ex-vessel value of the harvest (output) for each alternative plan and for the without plan condition. Determine the harvesting costs, including non-project operation, maintenance, and replacement, for the level of catch (output) identified by each alternative plan and the without plan condition. Compute the NED benefit from an alternative plan as the value of the change in harvest less the change in harvesting cost from the without plan condition to the with plan condition.

e. Problems in Application.

(1) As the harvest rate of living stocks goes up, it is possible to reach a range in which the increases in annual harvesting efforts will actually produce a long-run decrease in the quantities harvested. In the absence of effective limits on harvesting, it is possible that commercial fishing will operate in this range of absolute decreasing returns. This is possible because individual operators will compare only their revenues and costs; they will not be concerned with the absolute productivity of the stock. This can be very important in determining NED benefits because what may appear to be a positive effect (something that encourages an increase in harvesting effort) may ultimately result in negative benefits (decreased total harvest and increased total cost per unit of harvest).

(2) The fact that fish are common, as opposed to private, property creates special problems in measuring NED benefits. Unless entry is restricted, excessive quantities of capital and labor may enter a fishery; that is, entry may continue until the “economic rent” from the living stock is dissipated. This excess entry will result in economic inefficiency in the utilization of fishery resources because the value of the resulting extra output will be less than the social opportunity cost of the entry. Some economic benefits may be realized but the total benefits will not be as large as they might be if entry were restricted. Although evaluation of this potential has been limited by the specification of the with and without plan condition in paragraph E-11c(1), three specific points are worth of separate mention.

(a) Transitory benefits. Because the benefits from harvesting open-access fisheries tend to be dissipated through entry of excess capital and labor, some NED benefits from commercial

fishing can be transitory. It will therefore be necessary to determine how many years these benefits will last and in what amounts for each year.

(b) Industry capacity. The excess capacity that will normally exist will make it difficult to obtain a proper estimate of changes in cost associated with changes in harvests. In some instances, idle boats will be available and the only additional costs will be operating costs. In other instances, vessels that are already operating will be able to harvest the extra catch without significant change in variable costs.

(c) Regulation. Because of the tendency of open-access fisheries to attract excess capital and labor which can deplete the stocks, most commercial fishing operations are currently subject to government regulations which stipulate the manner, time, place, etc., in which harvesting may take place. These stipulations usually result in harvesting activity that is not as economically efficient as it might be. These stipulations will therefore affect the size of NED benefits.

f. Data Sources.

(1) Data for annual harvests, demand, harvesting and processing costs, ex-vessel and other prices, physical production, biological modeling, models or information about management policies and regulations, and survey results are available from several Federal, State, and local government agencies, universities (especially those with sea grant programs), private organizations (such as industry groups, fishermen unions, or cooperatives), regional fisheries management councils, and international commissions or organizations.

(2) Initial contacts should be made with the National Marine Fisheries Service Regional Office, United States Coast Guard, State resource agencies having management or other responsibility for the fishery or resource in question, and all local or regional fishery councils, commissions, or institutes that have responsibility or jurisdiction or that are functioning within the area affected by the project. Fisheries dynamics biologists at universities or at National Marine Fisheries Service regional laboratories will be the best source of information on biological effects and their repercussion in the market.

g. Report and Display Procedures.

(1) Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Table E-10 is a suggested method of data presentation. Its use will provide the reader with information on physical changes in output as well as value.

Table E- 10 Commercial Fishing Benefits

Benefit	Years		
	1	2	3
(1) Change in output.....	.....	.....	.....
(2) Value of change in output (line 1 times expected price).....	.....	.....	.....
(3) Change in costs.....	.....	.....	.....
(4) NED benefit (line 2 minus line 3).....	.....	.....	.....

(2) Because the benefits are broken down into annual flows, it will be possible to determine if and when the open access nature of commercial fishing will lead to a dissipation of any NED benefits provided by the project.

E-12. Navigation: Small Boat Harbors.

a. Introduction. Small boat harbor projects consist of Federal features (e.g. channels, breakwaters), usually in combination with non-Federal features (e.g. docks, ramps, berthing or mooring areas, dredging). Project outputs are enhanced access to recreational boating and sport fishing opportunities, and commercial fishing activities. Benefit estimation for recreation boating and sport fishing is conceptually no different than for other forms of recreation, and any benefit estimation method may be employed as long as it reflects NED criteria. Charter fishing craft, head boats and similar recreation oriented commercial activities are considered commercial vessels for cost allocation purposes by law. Provided commercial recreation activities are evaluated based on changes in net income to the owner/operator, project output will be considered commercial navigation benefits. This change in net income measure of benefits is appropriate only for existing vessels currently using harbor facilities.

b. Recreational Boating. Section VII of this appendix identifies three evaluation methods for recreational boating: travel cost, contingent valuation (survey method) and unit day values. All are acceptable for evaluating boating recreation benefits. The unit day value method is applicable subject to restrictions (see paragraph E-48b.(4)(a).). The travel cost method employs expenditures associated with travel to and use of a resource as input data in determination of willingness to pay schedules. The contingent valuation method is a survey approach for determining willingness to pay. It can be useful for a wide variety of evaluation problems, and can be particularly applicable in valuing changes in quality (e.g. improved access in and out of harbor due to provision of breakwater) where changes in the scale of a project are not substantial.

Unit day values will ordinarily be chosen from the range of general recreation values (General Recreation or General Fishing and Hunting) although selection from the range of specialized recreation values (Specialized Fishing and Hunting and Specialized Recreation other than Fishing and Hunting) will sometimes be acceptable when participation in specialized activities is documented. Reduction of damage to boats and facilities may be a component of benefits. If damage reduction benefits are estimated, care should be taken to avoid double counting of benefits if other benefit estimation techniques are also used.

c. Commercial Fishing. Paragraph E-11 states that changes in net income to fish harvesters or boat operators is the appropriate measure of NED benefits. Two considerations, the habitat condition and the institutional setting, must be analyzed in planning reports. Reduction of damage to boats and facilities is frequently a component of commercial fishing benefits, and may apply as well to recreational boating. Reduced damages may be a part of the net income analysis or it may proceed as a separate analysis (e.g. damage reduced to public facilities not included in fish harvester's net income). It is frequently convenient to treat this damage on a probabilistic basis, i.e. product of probability of occurrence times dollar value of damage.

E-13. Federal and Non-Federal Participation.

a. Harbors and Waterways. Cost sharing is as modified by the Water Resource Development Act of 1986 (Public Law 99-662), as amended.

(1) Studies, Planning, Engineering, and Design. See Table E-11.

Table E- 11 Navigation, PED

Non-Federal Share: Studies, Preconstruction Engineering and Design (PED)

Pre-construction Work	Commercial Navigation	Recreational Navigation	Inland Waterways
Reconnaissance Study	-0-	-0-	-0-
Feasibility Study	50%	50%	-0-
Preconstruction Engineering and Design	25%	25%	-0-

(a) Section 105(a) of Public Law 99-662 specifies a 50 percent non-Federal cost share for all feasibility studies, except for studies of "inland waterway system" improvements. The law

does not define that system, and current Army policy is to limit the exemption to the waterways subject to waterway fuel taxes.

(b) Section 105(c) requires cost sharing of post-feasibility pre-construction engineering and design. Preconstruction engineering and design (PED), is all engineering, design, and planning, if any, accomplished after the feasibility phase. All preconstruction engineering and design for all projects authorized in or subsequent to Public Law 99-662 is to be cost shared at 75 percent Federal and 25 percent non-Federal.

(2) Construction, Operation, and Maintenance. Sections 101, 102 and 103(c)(4) of Public Law 99-662 specify the cost sharing for commercial harbor, inland waterway and recreational navigation projects.

(a) Harbors, General Navigation Features. (See Table E-12) Section 101 specifies cost shares for general navigation features that vary according to the channel depth: (20 feet or less, greater than 20 feet but not more than 45 feet, and greater than 45 feet). For general navigation features not changing depths, such as breakwaters, locks, channel widening, etc., cost sharing shall be at the percentage-applicable to the authorized or existing depth, whichever is greater. The percentage applies as well to mitigation and other work cost shared the same as general navigation features. The cost share is paid during construction. Section 101 also requires the project sponsor to pay an additional amount equal to 10 percent of the total construction cost for general navigation features. This may be paid over a period not to exceed thirty years, and LERRs may be credited against it.

(b) Waterways. Section 102 of PL 99-662 and subsequent legislation specify 100 percent Federal operation and maintenance on those parts of the inland waterways system paying fuel taxes. Section 102 also directs that 50% of the cost of construction is to come from the general fund of the treasury and 50% from the Inland Waterways Trust Fund. All other inland waterway construction is cost shared as commercial or recreational harbors depending on purpose. See the tables below, ER 1165-2-131, and Appendixes F and G for cost sharing percentages. If a project crosses cost share depth ranges, use each applicable range to determine overall cost share. Overdepth dredging is a maintenance strategy; cost sharing is at the nominal depth.

Table E- 12 Navigation, Construction and O&M

	Non-Federal Share, Construction, Operation, and Maintenance				
	Commercial Navigation			Recreation	Inland
	to 20’	>20 to 45’	>45’	Navigation	Waterways

Construction					
Gen'l Nav.Features	10+10%1/	25+10%1/	50+10%1/	50%	-0-
Aids to Navigation	-0-	-0-	-0-	-0-	-0-
Service Facilities	100%	100%	100%	100%	-0-
LERR	100%	100%	100%	100%	-0-
Operation & Maint.					
Gen. Nav. Features (incl mitigation)	-0-	-0-	50%	100%	-0-
Aids to Nav.	-0-	-0-	-0-	-0-	-0-
Service Facilities	100%	100%	100%	100%	100%
LERRD	100%	100%	100%	100%	-0-

1/ Ten percent (10%) post-construction contribution is reduced by credit amount for LERR.

b. Recreation. Section 103(c)(4) sets the non-Federal share of construction cost at 50 percent and O&M cost at 100 percent for recreation projects. For navigation projects these cost shares apply to separable recreation costs and costs allocated to recreation.

c. Special Navigation Programs. (See Table E-13.) Cost sharing is in accordance with program authorizations as amended by Public Law 99-662. Section 940 of Public Law 99-662 shifts all responsibility and costs for operation and maintenance of shore damage mitigation projects to a non-Federal public agency. Section 939 of Public Law 99-662 increases Corps authority to recover the cost of removing wrecks and obstructions from vessel owners, lessees, or operators.

d. Land Creation or Enhancement at Inland Harbors. Federal participation in inland waterway harbor improvements under the Civil Works program is not warranted when: (1) resale or lease of the lands used for disposal of excavated material can recover the cost of the improvements; or (2) the acquisition of land outside the navigation servitude is necessary for construction of the improvements, or would permit local interest to control access to the project. The latter case is assumed to exist where the proposed improvement consists of a new channel cut into land.

Table E- 13 Navigation, Special Navigation Programs

Non-Federal Share, Special Navigation Programs

Program	Study	Construction	O&M
Removal of Wrecks, Obstruction	-0-	100% recoverable	NA
Snagging and Clearing	50%	10+10% (<20')	NA
Drift & Debris Removal	50%	one-third	100%
Small Navigation Projects			
Commercial navigation	50%	10+10 (<20')	-0-
Recreational navigation	50%	50%	100%
Modification of Bridges	-0-	project % (after cost apportionment to bridge owner)	100%
Project Induced Damages			
Project damage only	-0-	project %	100%
Additional Purposes	50%	purpose %	100%
Beneficial Uses of Dredged Material for Ecosystem Restoration			
(Section 204)	Same as base plan		100%
(Section 1135)		25%	100%

e. Land Creation at Harbors (Other Than Inland Harbors). Formulation and cost sharing of harbor projects that include land creation benefits must be in accordance with the following procedures.

(1) The NED plan relies on navigation benefits exclusively (land creation is not considered in the net benefit evaluation). Special cost sharing is required; it is based on the magnitude of land creation benefits relative to total benefits. The cost sharing formula is as follows:

(a) Assign LERR to the non-Federal sponsor. (Full credit of LERR toward 10% of GNF)

(b) Special non-Federal (GNF) cost sharing is equal to:

$$\text{GNF} \quad \frac{\text{(Land Creation Benefits for this plan) X (GNF Costs)}}{\text{Total Benefits for this Plan}}$$

(c) Remaining costs are shared in accordance with Section 101 of PL 99-662, as amended, as described in Paragraph E-13a.

(2) Non-Federal requests for modification of the NED Plan formulated using navigation benefits may be allowed provided all additional implementation costs are non-Federal and the incremental navigation benefits equal or exceed the incremental O&M costs for the GNF. No additional cost sharing will be required for the land creation benefits associated with the project modifications beyond the NED Plan which are requested and paid for by non-Federal entities. The cost sharing formula by which this policy is to be applied is as follows:

(a) The non-Federal share shall be the non-Federal costs determined in paragraph E-13e.(1) plus 100 percent of the difference between the NED Plan and the cost of the requested modified plan; or all costs not assigned to the Federal government under paragraph (b) below, whichever is greater.

(b) The Federal share shall be the Federal costs determined in paragraph E-13e(1); or, when the modified NED Plan results in a cost for GNF that is less than the cost for GNF for the NED Plan, the Federal share of costs will be limited to the Federal percentage of the total GNF derived in paragraph E-13e(1), times the cost of the GNF for the modified NED Plan.

f. Land Creation Requirements. Reports proposing land creation, where the lands are necessary for development of port facilities to accommodate traffic, shall require the non-Federal sponsor to ensure the lands are retained in public ownership for uses compatible with the authorized purposes of the project. The non-Federal sponsor shall regulate the use, growth and development on such lands for those industries whose activities are dependent upon water transportation.

E-14. Special Considerations.

a. Study Authorities.

(1) Navigation Facilities Replacement. Continuing authority to study the replacement, reconstruction, or rehabilitation of Congressionally authorized navigation improvements is contained in Section 4 of the River & Harbor Act of 1884 as amended by Section 6 of the River & Harbor Act of 1909. This study authority is no longer used.

(2) Review of Completed Projects. Authority to study completed projects and report thereon to Congress, when advisable due to changed physical or economic conditions, is contained in Section 216 of the River & Harbor and Flood Control Act of 1970. Studies are initiated through the regular budget process as new reconnaissance starts.

(3) Special Programs. Continuing authority to study certain small or special purpose projects is contained in the legislation cited in “Special Navigation Programs” earlier in this section. Those study authorities are used routinely.

(4) Specific Authorization. All other projects require specific authorization in the form of legislation or resolutions by the appropriate committees of Congress.

b. Shoreline Changes. Pursuant to Section 5 of the River & Harbor Act of 1935 each investigation on navigation improvements potentially affecting adjacent shoreline will include analysis of the probable effects on shoreline configurations. A distance of not less than ten miles on either side of the improvement should be analyzed.

c. Charter Fishing Craft, Head Boats, and Similar Recreation-Oriented Commercial Activities. Section 119 of the River and Harbor Act of 1970 (Public Law 91-611), states, “The Chief of Engineers, For the purpose of determining Federal and non-Federal cost sharing relating to proposed construction of small-boat navigation projects, shall consider charter fishing craft as commercial vessels.” This Act applies only to cost allocation and cost apportionment and does not involve project evaluation in any way. Particularly, it does not determine consistency with Corps primary missions. This depends on whether the benefits are commercial navigation or recreation. Only if benefits to charter fishing craft are based on change in net income to the owner/operators of vessels which would exist and operate in the without project condition can commercial navigation benefits be claimed.

d. Subsistence Fishing. This is fishing, primarily for personal or family consumption, by those whose incomes are at or below the minimum subsistence level set by the Department of Commerce. For cost allocation purposes subsistence fishing is considered commercial fishing. Subsistence fishing is not a high priority output however.

e. Coast Guard Coordination. The U.S. Coast Guard is responsible For Federal aids to navigation and enforcement of navigation regulations. In addition to enforcing its own regulations, the Coast Guard also administers and enforces speed limits, anchorage areas, and other regulations issued under Corps authority. Corps districts should confer directly with the Coast Guard concerning establishment or alteration of aids to navigation, and the regulation of lighterage areas, anchorages and channels.

f. Permit Coordination. Formulation should consider whether associated or ancillary sponsor activities (or project user activities) are required to achieve project benefits, and whether Department of the Army (DA) permits are necessary. Examples are provision of mooring/berthing areas, dredge material containment areas and landside infrastructure. Once

activities are identified, a preliminary determination of whether they require DA permits, and of what types (i.e., an individual permit, a letter of permission, an existing general permit or a nationwide permit), will be made by the district regulatory element.

(1) When an activity likely will necessitate a DA permit it should be addressed in the environmental documentation of the project as required by NEPA, the Section 404 (b) (1) guidelines and other appropriate environmental statutes. It may be assumed that more detailed analysis for permitting purposes will proceed concurrent with PED studies.

(2) DA permitting activities should be discussed at public meetings or workshops held during planning or during PED. Public notices announcing meetings/workshops shall identify sponsor activities that could require DA permits. Public meetings or workshops should be coordinated with regulatory staff; coordination is particularly important if there is or will be an abbreviated processing procedure or a special management plan.

(3) Normally, Coastal Zone Management (CZM) concurrence or Section 401 water quality certification for an abbreviated processing procedure or special area management plan should be obtained concurrently with those required for the Corps project. It remains the responsibility of the project sponsor (or users) to obtain all required state and/or local permits.

g. Beneficial Use of Dredged Material. Construction and maintenance dredging of Federal navigation projects shall normally be accomplished in the least costly manner possible (ER 1130-2-520). Section 204 of the WRDA of 1992 established programmatic authority which allows the Corps to carry out ecosystem restoration projects in connection with dredging for construction, operation or maintenance of authorized navigation projects. Guidance for Section 204 is provided in Appendix F. Section 207 modifies Section 204 to allow the Corps select a disposal method that is not the least cost if determined that the incremental costs are reasonable in relation to the environmental benefits. Section 207 establishes an authority which is separate and distinct from the authority established by Section 204. Section 207 projects are not subject to the programmatic limitation of Section 204 and are budgeted through the standard appropriation process. Cost-sharing and decision making criteria are described in the following subparagraphs.

(1) Cost-Sharing. The cost-sharing for Section 207 projects is the same as Section 204 projects. The non-Federal interests must enter into a cooperative agreement in accordance with the requirements of section 221 of the Flood Control Act of 1970 in which the non-Federal interests agree to provide 25 percent of the cost associated with construction of the project for the protection, restoration, and creation of aquatic and ecologically related habitats, including provision of all lands, easements, rights-of-way, and necessary relocations; and pay 100 percent of the operation, maintenance, replacement, and rehabilitation costs associated with the project.

(2) Decision-Making Criteria. The decision making criteria is whether the incremental cost is reasonable in relation to the environmental benefits achieved. Where the incremental Federal costs is 25 percent of the total project cost or $300,000, whichever is less, the incremental costs are judged to be "reasonable" in relation to the environmental benefits without the need for detailed analysis. However, it must still be demonstrated that the environmental resources to be protected, restored, or created are valuable, the environmental outputs can be quantified and described and the environmentally beneficial disposal method is supported by Federal and state resource agencies. The environmental disposal method would be subject to appropriate National Environmental Policy Act requirements. For environmentally beneficial disposal methods that have incremental Federal costs which exceed 25 percent or $300,000, the incremental costs must be justified by demonstrating that the monetary and non-monetary benefits (outputs) of the ecosystem restoration project justify its incremental costs using cost effectiveness and incremental cost analysis. Where the environmentally beneficial use involves separable increments each increment must be justified. Refer to Section V of this appendix for further information on cost effectiveness and incremental cost analysis.

h. Placement of Dredged Material on Beaches for Hurricane and Storm Damage Reduction. When placement of dredged material (beach quality sand) on a beach is the least costly acceptable means for disposal, then such placement is considered integral to the project and cost shared accordingly. In cases were placement of dredged material on a beach is more costly than the least costly alternative, the Corps may participate in the additional placement costs when: (1) requested by the state; (2) the Secretary of the Army considers it in the public interest; and (3) the added cost of disposal is justified by hurricane and storm damage benefits (see Section IV of this appendix). When all local cooperation requirements are met the Corps may cost share the additional costs 50 percent (Section 933, WRDA 1986, as amended). In cases where the additional costs for placement of the dredged material is not justified, the Corps may still perform the work if the State requests it, and the state or other sponsor contributes 100 percent of the added cost. If the State requests, the Corps may enter into an agreement with a political subdivision of the State to place the sand on its beaches, with the subdivision responsible for the additional costs. The Corps should consider and accommodate to the degree reasonable and practicable a state’s or subdivision’s schedule for providing its cost share. Each placement event should be supported by a separate decision document. Subsequent decision reports may be supplements to the original Section 933 decision document.

E-15. Dredged Material Management Plans. All Federally maintained navigation projects must demonstrate that there is sufficient dredged material disposal capacity for a minimum of 20 years. A preliminary assessment is required for all Federal navigation projects to document the continued viability of the project and the availability of dredged material disposal capacity sufficient to accommodate 20 years of maintenance dredging. If the preliminary assessment

determines that there is not sufficient capacity to accommodate maintenance dredging for the next 20 years, then a dredged material management study must be performed.

a. Policy.

(1) General.

(a) Sound management of dredged material is a priority mission of the Corps.

(b) The Corps is committed to conducting dredging and managing dredged material in an environmentally sound manner.

(c) The interests of economic development and environmental sustainability will best be served when dredged material placement proceeds according to a management plan. Therefore each existing and proposed navigation project will have a dredged material management plan that ensures warranted and environmentally acceptable maintenance of the project.

(d) Beneficial uses of dredged material are powerful tools for harmonizing environmental values and navigation purposes. It is the policy of the Corps that all dredged material management studies include an assessment of potential beneficial uses for environmental purposes including fish and wildlife habitat creation, ecosystem restoration and enhancement and/or hurricane and storm damage reduction. Districts and MSCs will make every effort to ensure that sponsors and other interests understand the valuable contributions that beneficial uses can make to management plans and will maximize use of regional forums to share experiences of opportunities for beneficial uses.

(e) Dredged material management goals are to be achieved by District and Division Commanders within existing delegations of authority. Exceptions to this principal are when problems arise that are of such significance that HQUSACE or Administration commitment is required such as changes in dredged material management practices that require substantial capital investment.

(2) Requirements. Dredged Material Management Plans (Management Plans) shall be prepared, on a priority basis, for all Federal navigation projects, or groups of inter-related harbor projects, or systems of inland waterway projects (or segments).

(a) Priority will be given to projects for which existing dredged material disposal sites, including existing confined disposal facilities, are expected to reach capacity or to no longer be available sometime in the next 10 years, or

(b) Existing and projected navigation usage of the project indicates that continued maintenance of the project, or of any substantial increment thereof, may not be warranted.

(c) Management Plans shall identify specific measures necessary to manage the volume of material likely to be dredged over a twenty year period, from both construction and maintenance dredging of Federal channel and harbor projects. Non-Federal, permitted dredging within the related geographic area shall be considered in formulating Management Plans to the extent that disposal of material from these sources affects the size and capacity of disposal areas required for the Federal project(s). In those cases where two or more Federal projects are physically inter-related (e.g., harbors which share a common disposal area or a common channel) or are economically complementary, one Management Plan may encompass that group of projects.

(3) Base Plan. It is the Corps of Engineers policy to accomplish the disposal of dredged material associated with the construction or maintenance dredging of navigation projects in the least costly manner. Disposal is to be consistent with sound engineering practice and meet all Federal environmental standards including the environmental standards established by Section 404 of the Clean Water Act of 1972 or Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. This constitutes the base disposal plan for the navigation purpose. Each management plan study must establish this “Base Plan”, applying the principles set forth below.

b. Management Plan Development Principles.

(1) Existing Projects.

(a) Process. Management Plans are intended to cost effectively and expeditiously support environmentally acceptable channel and harbor maintenance. Plan development shall employ a phased process determining the appropriate scope and detail of required assessment. This process will:

(1) Establish the Base Plan for the project;

(2) Include an assessment of the potential for beneficial uses of dredged material which is proposed to be undertaken as separate plan elements pursuant to separate authority; and,

(3) Establish the Management Plan for the project, or if approval by higher authority is required elsewhere in this guidance, the District Commander’s recommended Management Plan.

(4) Demonstrate continued maintenance is economically warranted based on high priority (non-recreation) benefits. If it cannot be demonstrated based on high priority benefits but would otherwise be warranted considering recreation benefits, recommendations will state that project is economically warranted using recreation benefits.

(b) Phases. Management Plan development shall proceed in the following phases:

(1) Preliminary Assessment. Preliminary assessments establish whether more detailed study is required to establish a management plan, and, if so, provides information to justify the study and permit its prioritization in the budgetary process. For many projects with readily available maintenance and usage information, a preliminary assessment, based on indicators such as annual O&M costs per ton of cargo, volume and frequency of traffic, and vessel dimensions, may establish the Base Plan and confirm that continued maintenance appears to be warranted. Where these conditions are met, the findings of the Preliminary Assessment would complete the requirement for a Management Plan. Where these conditions are not met, the Preliminary Assessment will recommend a Management Plan Study.

(2) Management Plan Studies. A Management Plan Study shall be required to establish the Base Plan and the recommended Plan if basic indicators are inconclusive, or if attempts to define the Base Plan disclose significant problems, a major new investment, or other significant increase in maintenance costs. For example, the provision of a new confined disposal facility or use of more distant ocean disposal site would trigger this requirement. Management Plan studies shall be conducted in two phases: initial and final. The initial phase concentrates on developing a detailed scope of work, and the final phase executes that scope of work.

(2) Proposed Projects. Feasibility and Pre-construction Engineering and Design (PED) studies for proposed projects shall include a Management Plan in accordance with the criteria and procedures herein, as applicable.

c. Study Authority. Preliminary Assessment and Management Plan studies shall be conducted pursuant to existing authorities for individual navigation project feasibility studies, PED, construction, or O&M, as provided in Congressional Committee study resolutions and public laws authorizing specific projects. These specific study and/or project authorities are supplemented by general authorities relating primarily to beneficial uses of dredged material, as set forth in paragraph E-15f. Where Management Plan studies disclose the need to consider expanding or enlarging existing projects, such studies may only be pursued under specific study authority or under authority of Section 216 of the Flood Control Act of 1970.

d. Responsibilities.

(1) Existing Projects. Operations functional elements have program management responsibility for administering Dredged Material Management Plan preparation efforts for existing Federal projects. Those responsibilities include prioritizing and budgeting studies and providing subject matter expertise and guidance as members of the interdisciplinary study team. Planning functional elements have study management responsibility for conducting the studies required to implement effective dredged material management. Both elements have joint functional responsibility to ensure efficient use of shared resources.

(2) Proposed Projects. Planning functional elements are responsible for administering and conducting Management Plan studies for proposed projects. The Operations functional elements are essential participants and assume on-going responsibility for dredged material management following project completion.

e. Study Components.

(1) Alternatives. Management plan studies shall consider the full range of measures for dredged material management including: management of existing disposal sites to extend their life; various combinations of new disposal sites involving different disposal methods, disposal area locations, and periods of use; and, measures to reduce dredging requirements, including reduced dimensions. The Federal interest in continued O&M of an existing project for its navigation purpose is defined by that project of maximum scale and extent, within project authorization, for which continued maintenance is warranted in terms of vessel traffic and related factors.

(2) Beneficial Uses. Each Management Plan study shall include an assessment of potential beneficial uses of dredged material, for meeting both navigation and non-navigation objectives, including fish and wildlife habitat creation and restoration, hurricane and storm damage reduction, and recreation. Where a beneficial use is part of the Base Plan, it shall be treated as a general navigation O&M component. Beneficial uses which are not part of the Base Plan shall be considered separable elements of the management plan, and will be pursued in accordance with guidance implementing other available authorities. However, even though funded from different sources, the beneficial use planning effort must be pursued in conjunction with the overall management plan effort to assure the timely availability of dredged material for the beneficial use project. The beneficial use project site must be available to meet maintenance dredging disposal needs.

(3) Study Involvement and Coordination. District Operations and Planning functions must jointly ensure appropriate involvement of all resources and affected non-Federal interests in Management Plan studies, as follows:

(a) Interdisciplinary Analysis. The relevant professional disciplines needed to ensure sound professional decisions are to be involved.

(b) Partnership. Project sponsors, local governments, port authorities, and other project users and beneficiaries are partners in dredged material management, and have a key role as the project proponents in building local consensus for the Management Plan. A potential key role is played by the state governor to mediate sometimes competing state environmental, regulatory and economic objectives. All those having a partnership interest must be informed and involved throughout the course of all management plan studies.

(c) Review and Consultation. Federal, State and other public agencies with legal review, consultation, or other regulatory responsibilities are to be involved. Dredged material disposal is a multi-faceted issue, which involves both the water resources development, and regulatory responsibilities of the Corps. It involves the regulatory, water quality, hazardous, toxic, and radiological waste responsibilities of the U.S. Environmental Protection Agency (EPA) and state agencies. It also involves the environmental resources protection and management responsibilities of the National Marine Fisheries Service, the U.S. Fish and Wildlife Service and various state agencies as well as the economic and regional economic development interests of states, local governments, port authorities, maritime users and shippers.

(d) Public Involvement. Members of the public who are interested, likely to be affected, or otherwise have a stake in outcomes are to be kept informed and appropriately involved.

(4) Environmental Consistency. Management Plans shall be consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable executive orders, and other Federal requirements. Management Plan studies shall address the requirements of all applicable environmental statues for all disposal options considered, including the requirements of the National Environmental Policy Act, Section 404 of the Clean Water Act, Section 103 of the Marine Protection, Research and Sanctuaries Act, and the Coastal Zone Management Act. Any dredged material assessment to determine compliance with the Clean Water Act, Section 404(b)(1) guidelines, will be performed in accordance with the manual "Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters: Testing Manual". The manual "Evaluation of Dredged Material Proposed for Ocean Disposal: Testing Manual, commonly referred to as the "Green Book", will be used for assessing material proposed for ocean disposal under Section 102 of the Marine Protection, Research and Sanctuaries Act. Regional variations of these two manuals, where approved by both the Corps and EPA, may also be used.

f. Cost Sharing and Financing.

(1) Management Plan Studies.

(a) Existing Projects.

(1) General. The cost of Management Plan studies for continued maintenance of existing Federal navigation projects are O&M costs and shall be Federally funded. For harbor projects, including inland harbors, such costs shall be reimbursable from the Harbor Maintenance Trust Fund, subject to the following:

(a)Project sponsors, port authorities and other project users, are partners in dredged material management and must pay the costs of their participation in the dredged material management studies including participation in meetings, providing information and other coordination activities.

(b) Budgeting priority for the navigation purpose is limited to the Base Plan. Therefore, the cost for any component of a management plan study attributable to meeting local or state environmental standards that are not provided for by the requirements of Federal laws and regulations, shall be a non-Federal cost.

(c) Study activities related to dredged material management for the Federal project, but not required for continued maintenance dredging and dredged material disposal, will not be included in dredged material management studies unless funded by others.

(d) Studies of project modifications needing congressional authorization, including dredged material management requirements related to the modification, will be pursued as feasibility studies under the authority of Section 216 of the Flood Control Act of 1970.

(2) Beneficial Uses. The cost of studies for beneficial uses that are consistent with, and part of, the Base Plan are Federal O&M costs. However, study costs for beneficial uses, which are not part of the Base Plan, are either a non-Federal responsibility, or are a shared Federal and Non-Federal responsibility. These include reconnaissance level studies needed to identify these potential uses as part of management plan studies. Depending on the type of beneficial use, it might also include:

(a) Ecosystem Restoration. The incremental costs of studies beyond those required for the Base Plan for the use of dredged material to improve, restore and protect environmental resources, pursuant to Section 204 of the WRDA of 1992 or Section 207 of the WRDA of 1996 are not navigation O&M costs. If a potential environmental improvement or ecosystem

restoration beneficial use project exceeds the cost limitations of Section 204, it may be pursued as a cost shared feasibility study leading to specific authorization, in accordance with existing procedures.

(b) Placement of Materials on Beaches. The Corps of Engineers, under Section 933 of the Water Resources Development Act of 1986, may participate in the additional costs of placing clean sand or other suitable material on beaches. This may include material dredged by the Corps during construction or maintenance of Federal navigation projects, and the placement onto adjacent beaches or near-shore waters. This is only permitted if the added cost of placement is justified primarily by the benefits associated with the hurricane and storm damage protection provided by such beach or beaches, and the beach involved is open to the public with public access. The non-Federal sponsor must provide 50 percent of the incremental study costs.

(c) Other Beneficial Uses. Other potential beneficial uses include placement of dredged material for land creation or land enhancement for development purposes, disposal of material on beaches not meeting the criteria for Corps participation, and environmental enhancement projects not meeting the criteria for Corps participation. In these cases, all incremental study costs and implementation costs above those costs required for the Base Plan, must be paid by non-Federal interests.

(b) Proposed Projects.

(1) General. Management Plan studies to be included with feasibility studies shall be subject to the cost sharing provisions set forth in the Project Study Plan. Study cost sharing for projects in PED shall be in accordance with the specific PED cost sharing requirements for that project as authorized.

(2) Allocation of Study Costs. The costs of Management Plan studies will be allocated between the existing project and the feasibility study for the project modification. Costs will be allocated by first identifying all costs that would be associated with planning for dredged material management for the existing authorized Federal project at existing depths and widths. These costs will be allocated to maintenance of the existing project and be funded from the Operation and Maintenance (O&M), General, appropriation at 100% Federal cost. Increments of dredged material management study costs above those required for planning for continued maintenance of the existing project, shall be allocated as feasibility study costs. Those costs which are associated with disposal of dredged material from construction of the project modification or increments of new maintenance cost attributable to the project modification, shall also be allocated as feasibility study costs. The definition of the required dredged material management studies and the allocation of the costs of these studies between the existing project and the feasibility study must be a carefully coordinated effort involving Planning and Operations elements and the non-

Federal sponsor. While the costs for dredged material management are allocated between O&M and the feasibility study, the dredged material management studies will be conducted as a unified study within the context of the feasibility study.

g. Implementation.

(1) Operation and Maintenance.

(a) Existing Projects. Costs for implementing Management Plans for existing projects are O&M costs and shall be shared in accordance with navigation O&M cost sharing provisions applicable to the project as authorized. Dredged material disposal facility costs shall be shared in accordance with Section 201 of the Water Resources Development Act of 1996 (P.L. 104-303). The cost for any component of a Management Plan attributable solely to meeting state water quality standards which are more restrictive than those upon which the Base Plan is based, shall be non-Federal cost.

(b) Proposed Projects. Costs for implementing management plans for proposed projects are O&M costs and shall be shared in accordance with navigation O&M cost sharing provisions of the Water Resources Development Act of 1986. The cost for any component of a Management Plan attributable solely to meeting state water quality standards which are more restrictive than those upon which the Base Plan is based, shall be non-Federal cost.

(2) Beneficial Uses. Costs for beneficial uses consistent with, and part of, the Base Plan are O&M costs and shall be shared in the same manner as other navigation O&M costs. Where beneficial uses involve an incremental cost over the Base Plan, these incremental costs are either a non-Federal responsibility or are a shared Federal and non-Federal responsibility depending on the type of beneficial use, as follows:

(a) Environmental Improvement and Ecosystem Restoration. The incremental costs above the Base Plan for the use of dredged material to improve, restore and protect environmental resources, pursuant to Section 204 of the WRDA of 1992 or Section 207 of the WRDA of 1996 must be shared in accordance with procedures set forth in Section E-14g.(1) of this Appendix.

(b) Placement of Materials on Beaches. Under the authority of Section 145 of the Water Resources Development Act of 1976, as amended by Section 933 of WRDA 86, the additional cost, beyond the cost of the Base Plan, for the placement of materials on beaches must be shared 50 percent Federal and 50 percent non-Federal. The non-Federal sponsor must provide (without cost sharing) any necessary additional lands, easements, rights-of-way, and relocations.

h. Procedures for Existing Projects.

(1) Phased Plan Development Process. A phased process will be used to determine the need for, and to develop, Management Plans on a priority basis; to manage existing projects in the interim while Management Plans are being developed; and, to review, approve and implement the Management Plans.

(2) Preliminary Assessment. Preliminary assessments shall be undertaken for all navigation projects. Priority shall be given to projects for which maintenance is expected to be required within the next ten years. Preliminary assessments shall include the following components:

(a) An economic assessment to determine whether continuing O&M of the overall project and separable increments appears to be warranted;

(b) A preliminary assessment of potential impediments to continuing maintenance;

(c) An evaluation of the consistency of existing environmental compliance documents with ongoing O&M activities; and,

(d) An assessment of need for Management Plan studies;

(e) Summary of Findings and Recommendations. Preliminary assessments will produce a summary of Findings and Recommendations, prepared in accordance with the format and guidance presented herein, and signed by the District Commander. If applicable, the District Commander may request for funds to initiate Management Plan studies in accordance with instructions in annual guidance for preparation of the program and budget request.

(3) Management Plan Studies.

(a) General Requirements. The purpose of Management Plan studies (studies) is to ensure timely and economical completion of quality reports that recommend implementable solutions to identified management problems, in the form of Management Plans. The Management Plan shall include sufficient detail to ensure unimpeded maintenance, with respect to dredging, for a 20-year time horizon. The study shall be conducted in two phases: initial and final. The initial phase shall be completed within 12 months of receipt of funds by the district, and shall produce a Scope of Work for the final phase of the study.

(b) Scoping. Management Plan studies are intended to cost effectively and expeditiously support project maintenance. The scoping of the final phase of the study is the most important activity in the initial phase. The scope of the final phase is dictated by the study objective of formulating a plan for the continued O&M of the Federal project.

(1) The most important scoping factor, and therefore the focus of the initial phase, is the degree of engineering, environmental and economic risk and uncertainty associated with the project.

(2) Related activities, such as surveys of bottom sediments outside the limits of the Federal project, identification and elimination of sources of contamination, and control of non-point sources of pollution, shall be included only if these activities are funded by local, state or other Federal agencies.

(3) In some cases, the need for a project modification requiring Congressional authorization (for example the need for an enlarged project to meet increased shipping demands) may be identified. Studies to support recommendations for authorization of such modifications are outside the scope of Management Plan studies. In these cases, a new feasibility study (General Investigations funded new start Reconnaissance) under authority of Section 216 of the Water Resources Development Act of 1970 should be sought through the budget process. O&M study funding should be terminated unless there is an immediate need for additional planning for continued maintenance of the existing project pending the project modification.

(c) Scope of Work. A Scope of Work (SOW) shall be prepared during the initial phase to ensure that the work required for the final phase has been carefully developed and considered.

(1) The SOW shall be the basis for estimating the total study cost and local share, if any, and shall allow not longer than 36 months to complete the final phase. The SOW will guide the allocation of study funds among tasks to assure that all interests are given adequate attention.

(2) As a minimum, the SOW should address the work tasks, their milestones, negotiated costs, and responsibility for their accomplishment. The SOW should also address the Corps and other professional criteria to assess the adequacy of the completed work effort; the schedule of performance; the coordination mechanism between the Corps and the non-Federal sponsor; and references to regulations and other guidance that will be followed in conducting the tasks.

(3) The SOW will address the level of technical and scientific detail required for the final phase. Technical studies and analysis should be scoped to the minimum level needed to establish project features and elements that will form an adequate basis for the plan implementation

schedules and cost estimate. Risk and uncertainty should be sufficiently identified and addressed to provide the basis for appropriate contingencies.

(4) The SOW should include the work items typically necessary to support the review process from the signing of the report through approval. These items could include answering comments, attending Washington Level meetings (including the non-Federal sponsor), and minor report revisions as a result of review by higher authority. Any significant increase in study scope shall require HQUSACE approval in accordance with guidance provided as conditions of approval of the Scope of Work.

(d) Management Plan Reports. Management Plan Reports (reports) should be complete decision documents that present the results of both study phases. The reports will:

(1) Provide a complete presentation of study results and findings, including those developed in the initial phase so that readers can reach independent conclusions regarding the reasonableness of recommendations;

(2) Indicate how compliance with applicable statutes, executive orders and policies is achieved; and

(3) Provide a sound and documented basis for decision makers at all levels to judge the recommended Management Plan. The reports shall, at a minimum, address the subject matter outlined in Table E-14, and shall identify all necessary agreements (Federal, sponsor, real estate, etc.) and procedural requirements (appropriate NEPA documentation, long-term permits, certifications, etc.) necessary to cover, at a minimum, the next twenty years of project maintenance. The reports shall include executed copies of all such agreements or schedules for obtaining them. District Commanders shall sign and submit Management Plan Reports to the Division Commander for appropriate action.

Table E- 14 Management Plan Report Outline

Project Description(s) *[include project map(s)]*
Scope of Study *[indicate whether single project or group of projects; relationship to permittee dredging, etc.]*
Authorization and Development History *[include all project authorizations, Section 221 agreements, Project Cooperation Agreements (PCAs), other agreements entered into, easements obtained, fee acquisition, construction dates, etc.]*

Description of existing conditions

Projections of future conditions in the absence of a Management Plan

Concise statement of specific problems and opportunities

Alternative plans:

- X Alternative disposal measures to address identified problems and opportunities
- X Beneficial uses alternatives
- X Reasons for selecting and combining measures to form alternative plans

Evaluation of Alternative Plans

Trade-off analysis

Selection of final plan *[discuss rationale for selection, sensitivity analysis, and risks and uncertainties]*

Description of selected Management Plan

- X Plan components
- X Implementation requirements and schedules
- X Consistency with the Base Plan

NEPA documentation, as required

Results of coordination with local, state and Federal agencies

Recommendations

(e) Issue Resolution Conferences. Issue Resolution Conferences (IRCs) with HQUSACE and laboratory participation shall be held for all Management Plan studies whenever significant problems or issues require higher level guidance or concurrence during the course of the study. Issue Resolution Conferences may be called by Division Commanders at their discretion. Upon review of the SOW, HQUSACE may call for an IRC to resolve pertinent issues. HQUSACE participation shall include at a minimum, senior staff of both CECW-0 and CECW-P. IRCs shall identify required follow-up actions and assign responsibilities for their execution. These actions and assigned responsibilities shall be documented explicitly.

(f) Review and Approval. Division Commanders shall ensure full technical review of Management Plan reports, and may approve Management Plans except in those cases where one or more of the following conditions apply:

(1) Implementation of the Management Plan will require a non-recurring item of work or aggregate item of related work which qualifies as major maintenance as defined in the annual guidance for preparation of the program and budget request.

(2) Implementation of the Management Plan requires an adjustment to the District's funding targets (a Corps-wide Priority Incremental Request, CPIR) as defined in the annual guidance for preparation of the program and budget request.

(3) Implementation requires additional congressional authority. Where one or more of the above conditions apply, the Division commander will transmit the final report and associated NEPA documentation by concurring endorsement to HQUSACE, CECW-0 for review and approval. Upon approval of the report, the Major Subordinate Commander shall prepare the draft Record of Decision following the completion of the final NEPA review, and if required, shall file the final NEPA documentation.

(g) Implementation.

(1) Project Cooperation Agreement and Financing Plan.

(a) For Management Plans that involve new capital investments, (such as a new confined disposal facility) relocations, or acquisition of interests in real estate, and require the execution of a Project Cooperation Agreement (PCA), a draft PCA and financing plan shall be developed in connection with preparation of the Management Plan report and submitted therewith in accordance with procedures outlined in ER 1165-2-131.

(b) The full implication of PCA requirements should be discussed with the local sponsor. The first draft PCA is prepared, by the District Commander, in coordination with the local sponsor. However, no commitments relating to a construction schedule or specific provisions of the draft PCA can be made to the local sponsor on any aspect of the project until the Management Plan report and the draft PCA have been approved.

(c) Once the Management Plan has been approved, the District Commander shall begin final negotiations with the local sponsor and submit the PCA package for review by HQUSACE, attention CECW-A, and approval by the ASA(CW).

(2) Monitoring and Periodic Review. Division Commanders shall ensure monitoring and review of approved Management Plan implementation.

(3) Curtailment and Disposition. Curtailment refers to the indefinite discontinuance of maintenance of a project or a substantial portion thereof (e.g., segment or length, depth, width increment of channel or turning basin). Curtailment requires the development of a plan for disposition of the project. Disposition requirements and procedures generally are project specific; and guidance thereon should be obtained from HQUSACE. Where continued O&M of a project, or substantial portion thereof, is determined by the District Commander to no longer be warranted, the District Commander shall submit, subject to concurring endorsement by the Division Commander, a report recommending disposition of the project, to HQUSACE (attn: CECW-P).

(h) Budgeting and funding.

(1) General Requirements. Study activities required to develop Preliminary Assessments for all eligible projects shall be funded from available project O&M funds in accordance with priorities established annually by HQUSACE. Requests for funding to accomplish Management Plan studies to cost no more than $150,000 to complete shall be included in project O&M funding requests, provided that a Summary of Findings and Recommendations has been completed in accordance with the requirements of outlined in this section. Requests for funding to initiate Management Plan studies to cost more than $150,000 will be considered on a national priority basis, commensurate with the urgency and significance of impediments to continued maintenance. These will be considered upon HQUSACE review of submission documents, in accordance with annual budget guidance, as may be supplemented by guidance to be provided periodically by HQUSACE.

(2) Limitations. Preliminary Assessments shall be limited to an expenditure of $20,000 per project, or multiples thereof for assessments involving more than one deep draft project. If more than $20,000 (or multiple thereof) is required, written approval must be requested from HQUSACE (attention CECW-O). The request must include sufficient information to justify the additional expenditure.

(i) Ongoing Studies. Ongoing O&M studies for planning, managing or regulating dredging and dredged material disposal activities shall be phased into conformity with the procedures and guidance of this ER. This includes any O&M studies of disposal options including studies of alternative open water disposal sites or studies of sites for new confined disposal facilities. The following procedures shall be used to bring the existing studies into conformity with the new procedures.

(1) Review of Continuing Economic Justification. Continuation of ongoing dredged material management studies is conditioned on a confirmation that continued maintenance is warranted. Therefore, for each ongoing study, a review of indicators of continued economic justification will be conducted.

(2) Scope of Work. For each ongoing study, the district shall prepare a review of studies accomplished to date, and a SOW for studies yet to be accomplished. This SOW, along with the results of the review of indicators of continued economic justification, will be included in the Preliminary Assessment or the Management Plan Report, as appropriate.

(3) Management Plan Report. The results of ongoing studies, when completed, will be presented in a management Plan report conforming with the guidance for preparation, review and approval of such reports as presented in this appendix.

i. Procedures for Proposed Projects. Feasibility reports recommending Congressional authorization of new navigation projects or modifications of existing projects shall include a plan for management of dredged material associated with the construction and maintenance of the new project or project modification, consistent with the requirements for Management Plans for existing projects. This plan shall satisfy all identified dredged material management requirements associated with the project, to include construction dredging, projected maintenance dredging for the established project economic life, and other dredged material disposal requirements (for example dredging of berthing areas) needed to realize project benefits.

SECTION III - Flood Damage Reduction

E-16. Federal Interest. The Flood Control Act of 1936 established the policy that flood control on navigable waters or their tributaries is in the interest of the general public welfare, and is therefore a proper activity of the Federal Government. It provided that the Federal Government, cooperating with state and local entities, may improve streams or participate in improvements "for flood control purposes, if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected." The 1936 Act, as amended, and more recently the Water Resources Development Act of 1986 and other acts, specify the details of Federal participation.

E-17. Types of Improvements.

a. Structural Measures. These include dams with reservoirs, dry dams, channelization measures, levees, walls, diversion channels, ice-control structures, and bridge modifications.

b. Nonstructural Measures. Section 73 of the 1974 Water Resources Development Act requires consideration of nonstructural alternatives in flood damage reduction studies. They can be considered independently or in combination with structural measures. Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. They do this by changing the use made of the flood plains, or by accommodating existing uses to the flood hazard. Examples are flood proofing, relocation of structures, flood warning/preparedness systems, and regulation of flood plain uses.

(1) Permanent Relocation/Evacuation Plans. These plans provide for permanent evacuation and relocation/demolition of flood plain structures. There are no damages avoided claimable as benefits for the properties which are relocated or evacuated. Benefits accrue in four ways: a) the value of new use of the vacated land; b) reduction in damage to public property, such as roads and utilities; c) reduction in emergency costs; and d) reduction in the administrative costs of the National Flood Insurance Program and disaster relief. Benefits from future use of the vacated flood plain (usually recreation) will generally be the dominant NED benefit. Non-monetary benefits accruing from ecosystem restoration may also be considered. For evacuation plans that are clearly formulated for flood damage reduction there is no limitation on the amount of recreation benefits, as may exist for structural projects. Thus for these plans the recreation benefits may exceed 50 percent of the benefits needed for justification. Separable costs for improvements necessary to achieve ecosystem and or recreation benefits are cost shared in accordance with specific cost-sharing provisions for those purposes.

(2) With Project Land Use and Benefit Evaluation for Nonstructural Projects. The central fact about nonstructural projects, changes in land use, has several important implications. First, eliminating the existing land uses eliminates all services previously provided in the area, not just the flood damages. That is, all housing services, all retailing or commercial services and all other services provided by the removed structures (and associated activities) will also be eliminated. Second, in most cases, most of the benefits for the nonstructural project will be associated with new uses of the vacated land, yet frequently little effort is devoted to forecasting and evaluating the new land uses. Recreational and environmental uses will be the most common post-project uses. If non structural projects are to be justified, plans for the post-project land use will generally be needed. In other words, just simply stating that post-project land use will be "open space" will not be sufficient to support the benefits of the nonstructural projects. Third, land use changes will have spillover effects, that is, they can affect nearby property values. Most frequently, spillover effects are negative and are used to justify zoning changes, but spillover effects for nonstructural projects will be, in all likelihood, positive and the task is therefore not to prevent them through zoning but to estimate their magnitude through analysis.

(3) Flood Proofing Measures. These are modifications of structures to minimize flood damages by such methods as elevating buildings, sealing walls, closing off openings, protecting plumbing and utilities and installing pumps and valves. Corps participation in flood proofing plans is permitted as long as they address two or more structures.

(4) Flood Warning Systems.

(a) The typical flood warning system consists of methods for determining the flood threat, methods for disseminating the flood warning, and a preparedness plan detailing the response to that warning. The Corps involvement in development of methods for determining the flood threat and disseminating the warning can include selection, siting, installation, and calibration of gages and other equipment to collect, evaluate and disseminate pertinent data. In addition, the Corps can provide assistance and guidance to ensure that the preparedness plan is adequate and will provide the necessary response to minimize the possibility of loss of life, and to reduce damages. This includes coordinating with local officials, providing technical advice and planning guidance, and developing adequate mapping to identify flood threatened areas, evacuation routes, temporary shelters, etc.

(b) A flood warning system can be recommended as a stand-alone project, or as a component of a more complex, flood damage reduction plan. For example flood warning could be combined with levee closing devices or with a channel modification. In addition, a flood warning system can be proposed as an interim measure until other structural or non-structural measures can be implemented.

(5) Regulation of Flood Plain Uses. Adoption and enforcement of regulations for flood plain management are entirely a local responsibility. However, the Corps can provide technical assistance and planning guidance in conjunction with a flood control project. Also, flood plain management planning assistance is continuously available through the Corps Flood Plain Management Services Program.

c. Major Drainage. Drainage projects are usually undertaken in rural areas to increase agricultural outputs. Some portions of drainage improvements may be considered flood control measures in accordance with Section 2 of the 1944 Flood Control Act. The typical drainage system consists of drainage ditches, dikes, and related work. An outlet structure is provided at the downstream end where the system empties into a larger channel. The Federal interest in these projects is normally limited to the outlet works. Drainage in urban areas can also qualify under the 1944 Act if the major outlet works do not substitute for works that are a local responsibility, such as municipal storm sewer improvements.

d. Groundwater. Section 403 of the WRDA of 1986 expands the definition of flood control to include flood prevention improvements for protection from groundwater induced damages. Budget and authorization support is not available for a groundwater induced damage reduction program.

E-18. Specific Policies.

a. Without Project Condition.

(1) Assume flood plain communities belong to the National Flood Insurance Program administered by the Federal Emergency Management Agency. To participate in the program a community must preclude new development in the regulatory floodway, and require that new development outside the floodway, but within the median discharge 1% chance flood plain, be constructed with first floor elevations at or above the median discharge 1% chance flood level.

(2) Uncertainties in without project conditions must be explicitly considered. For example, for any particular damage reduction study there may be other Federal or non-Federal flood control or drainage plans, which are authorized or in various stages of planning but, which are not yet constructed. Whether or not some other project will actually be constructed can be quite uncertain; when present this uncertainty should be explicitly treated in Project Study Plans (PSP). Any such uncertainties potentially affecting study recommendations must be similarly addressed.

b. Flood Plain Management (E.O. 11988). This executive order was issued in 1977 and remains in effect. The intent is to avoid flood plain development, reduce hazards and risk associated with floods, and restore and preserve natural flood plain values (ER 1165-2-26). In

the event there is no alternative to construction in the flood plain, as is the case with flood control projects, the Corps is required to minimize the adverse impacts induced by construction of the project. In considering adverse impacts, the following should be addressed:

(1) Induced new development in the flood plain or induced improvements to existing development in the flood plain that would increase potential flood damages; and,

(2) The detrimental effect of induced activities on natural flood plain values.

c. Project Performance and Risk Framework.

(1) Projects are analyzed and described in terms of their expected performance, not in terms of levels of protection. Contingencies are acknowledged and residual risk is not routinely reduced by overbuilding or by inclusions of freeboard. A levee, for instance, is described as having a probability of overtopping of x percent in any given year, without implication for level of protection. If there are particular floods of reference or interest, the levee is described as having a probability y of containing the z percent flood, and so on. For example, a levee of a given height is described as having a (say) two percent chance of being overtopped in any year. If the one percent flood flow is of interest, the levee is said to have a (say) twenty-five percent chance of containing the one percent flow event, should it occur.

(2) There is no minimum level of performance or protection or size required for Corps projects. The smaller in size or the lower the level of performance however, the higher the residual risk. Residual risk must therefore be carefully analyzed and communicated. Departures from the NED plan may be considered options to manage this risk; in addition, explicit risk management alternatives may be formulated. . Documentation requirements for deviation from the NED plan for flood control projects should be based primarily on consideration of residual risk. Other considerations can include reducing the non-Federal eligibility requirements for the National Flood Insurance Program and /or unique characteristics of the protected area such as historic structures, hospitals and public buildings essential to the operation of government or essential public service. In all cases the incremental costs for the higher level of protection must be shown to be reasonable with respect to total project costs.

(3) Flood damage reduction studies are conducted using a risk-based analytical framework. Models, data, and measurement and many physical, social, economic and environmental conditions are subject to variation and uncertainty. This has been long known, if in the past incompletely acknowledged. Management by routine overbuilding and freeboard are not affordable. The risk framework captures and quantifies the extent of the risk and uncertainty, and enables quantified tradeoffs between risk and cost. Decision making considers explicitly what is gained at what cost.

d. Existing Levees/Dams. If there is any question about the reliability of an existing levee, reliability should be specifically included in the risk analysis (see ER 1105-2-101). The Corps is moving toward a risk-reliability framework for evaluation of dam reliability; methods development is just beginning. Downstream consequences are analyzed in a risk framework however.

e. Residual Damages. Levees interrupt interior drainage, and levee benefit analysis should reflect any residual damages. Interior damages can be mitigated by ponding areas or pumping. The amount and kind of recommended mitigation should be that which maximizes net benefits, unless other considerations override.

f. Induced Flooding. When induced flooding results in induced damages, mitigation should be investigated and recommended if appropriate. Mitigation is appropriate when economically justified or there are overriding reasons of safety, economic or social concerns, or a determination of a real estate taking (flowage easement, etc.) has been made. Remaining induced damages are to be accounted for in the economic analysis and the impacts should be displayed and discussed in the report.

g. Minimum Flows, Minimum Drainage Area and Urban Drainage. In urban and urbanizing areas provision of a basic drainage system to collect and convey local runoff is a non-Federal responsibility. Water damage problems may be addressed under flood control authorities downstream from the point where the flood discharge is greater than 800 cubic feet per second for the median discharge 10 percent chance flood. Drainage areas of less than 1.5 square miles are assumed to lack sufficient discharge to meet the above criterion. Exceptions may be granted in areas of hydrologic disparity, that is areas producing limited discharge for the median discharge 10 percent chance event but in excess of 1800 cubic feet per second for the one percent event (See ER 1165-2-21).

h. Single Properties. The Corps will not participate in structural flood control for a single private property. Nor will it participate in nonstructural flood control measures, unless single property protection is part of a larger plan for structural or nonstructural measures benefiting multiple owners collectively The Corps may consider participation in structural and nonstructural flood control measures protecting a single, non-Federal, public property. Public facilities, which are separable portions of larger protection plans, must have their own distinct presentations in budget requests so that they compete for limited study and construction funds.

i. Recreation at Non-Lake Projects. Recreation activities must have a strong, direct relationship to the proposed flood control measures, for example trails along the channel or levee right-of-way. Constraints on development and requirements for participation are discussed in Section VII of this appendix.

j. Environmental Mitigation. There are adverse impacts associated with practically all flood control projects. If these impacts are significant, mitigation measures should be evaluated. If justified by tangible and intangible benefits, the measures can be included in the recommended plan. Specific policies and planning guidance for consideration of environmental mitigation are discussed in Appendix C.

k. Agricultural Flood Protection. The Corps flood control programs apply to agricultural as well as urban flood damages. Usually the NED plan for agricultural areas provides only a low degree of flood prevention. The Food Security Act of 1985 (Public Law 99-198), as amended by the Federal Agriculture Improvement and Reform Act of 1996 (PL 104-127), contains so-called "Swampbuster" provisions (affecting conversion of wetlands) that may be triggered with implementation of a flood protection project.

l. Land Development. The following general policy principles apply to land development benefits at structural flood damage reduction projects.

(1) Projects or separable increments producing primarily land development opportunities do not reduce actual flood damages and therefore have low budget priority. Federal participation in these projects will not be recommended.

(2) The NED plan is formulated to protect existing development, but inclusion of vacant property interspersed with existing development is acceptable. The NED plan may also provide for the protection of vacant property that is not interspersed with existing development,if it can be demonstrated that the vacant property would be developed without the project, and benefits are based on savings in future flood proofing costs or reduction in damages to future development.

(3) If no project or separable project increment can be economically justified to protect existing development, interspersed vacant property and/or property that would be developed without the project, there is no interest in expanding the area of protection to achieve land development (location) benefits, even if net benefits are increased and economic justification can be achieved.

(4) A special case can be considered where the cost of protecting existing development can be substantially reduced if some vacant property not interspersed with existing development

is included in the protected area. Such cases will be considered on their individual merits. Compatibility with Executive Order 11988 must be demonstrated.

m. Groundwater-Induced Damages. Prevention of groundwater induced damages is not a traditional mission; restricted budgets prevent taking on this new mission.

n. Flood Insurance Considerations. Flood damage reduction projects can greatly impact what is required of a local community for participation in the National Flood Insurance Program. In addressing these impacts, the following should be considered:

(1) During development of the Project Management Plan (PMP) in reconnaissance, and in concert with the sponsor, consideration should be given to including work items to develop flood maps and flood profiles depicting post-project conditions. The information should be in a form useful to FEMA in revising flood insurance rate maps.

(2) The appropriate FEMA Regional office should be notified of proposed flood protection works or of changes to established flood protection works.

E-19. NED Benefit Evaluation Procedures: Urban Flood Damage

a. Purpose. This section presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the urban flood hazard reduction features of water resource plans and projects.

b. Conceptual Basis.

(1) General. Benefits from plans for reducing flood hazards accrue primarily through the reduction in actual or potential damages associated with land use.

(2) Benefit Categories. While there is only one benefit standard, there are three benefit categories, reflecting three different responses to a flood hazard reduction plan.

(a) Inundation Reduction Benefit. If floodplain use is the same with and without the plan, the benefit is the increased net income generated by that use. If an activity is removed from the floodplain, this benefit is realized only to the extent that removal of the activity increases the net income of other activities in the economy. Engineering Regulation 1105-2-101, Risk-Based Analysis for Evaluation of Hydrology/Hydraulic and Economics in Flood Damage Reduction Studies, requires risk-based analysis in all flood-damage reduction studies. The regulation and the complementary Engineering Manual 1110-2-1619 provide the evaluation framework to be used in these studies. The regulation identifies key variables that must be explicitly incorporated into the risk-based analysis. At a minimum, the stage-damage function for economic studies

(with special emphasis in structure first floor elevation, and content and structure values for urban studies); discharge associated with exceedence frequency for hydrologic studies; and conveyance roughness and cross-section geometry for hydraulic studies must be incorporated in the risk-based analysis. The ER further requires a probabilistic display of benefits and eliminates freeboard to account for hydraulic uncertainty.

(b) Intensification Benefit. If the type of floodplain use is unchanged but the method of operation is modified because of the plan, the benefit is the increased net income generated by the floodplain activity.

(c) Location Benefit. If an activity is added to the floodplain because of a plan, the benefit is the difference between aggregate net incomes (including economic rent) in the economically affected area with and without the plan

(3) Types of Flood Damage. Flood damages are classified as physical damages or losses, income losses, and emergency costs. Each activity affected by a flood experiences losses in one or more of these classes.

(a) Physical Damages. Physical damages include damages to or total loss of buildings or parts of buildings; loss of contents, including furnishings, equipment, [motor vehicles,] decorations, raw materials, materials in process, and completed products; loss of roads, sewers, bridges, power lines, etc.

(b) Income Loss. Loss of wages or net profits to business over and above physical flood damages usually results from a disruption of normal activities. Estimates of this loss must be derived from specific independent economic data for the interests and properties affected. Prevention of income loss results in a contribution to national economic development only to the extent that such loss cannot be compensated for by postponement of an activity or transfer of the activity to other establishments.

(c) Emergency Costs. Emergency costs include those expenses resulting from a flood what would not otherwise be incurred, such as the costs of evacuation and reoccupation, flood fighting**,** cleanup including hazardous and toxic waste cleanup**,** and disaster relief; increased costs of normal operations during the flood; and increased costs of police, fire, or military patrol. Emergency costs should be determined by specific survey or research and should not be estimated by applying arbitrary percentages to the physical damage estimates.

c. Planning Setting.

(1) General. The benefit of flood hazard reduction plans is determined by comparison of the with and without project conditions.

(2) Without Project Condition. The without project condition is the land use and related conditions likely to occur under existing improvements, laws, and policies. There are three significant assumptions inherent to this definition:

(a) Existing and authorized plans. Existing flood hazard reduction plans are considered to be in place, with careful consideration given to the actual remaining economic life of existing structures. Flood hazard plans authorized for implementation but not yet constructed are evaluated according to the relative likelihood of actual construction. If there is a high likelihood of construction, the authorized plan is considered to be in place.

(b) Flood Disaster Protection Act. The adoption and enforcement of land use regulations pursuant to the Flood Disaster Protection Act of 1973 (Public Law 93-234) is assumed.

(1) Regulation certified or near certification. If the local land use regulation has been or will be certified, partially waived, or adjusted by the Flood Insurance Administration (FIA) as adequate under 24 CFR 1910.3(c) and/or (d) and 24 CFR 1910.5, that regulation defines the without project condition.

(2) Regulation not yet certified. It is assumed that the local jurisdiction will adopt in the near future land use regulations certifiable to FIA under the without project condition as a datum and under the with project condition if a residual hazard will remain. This applies to floodplains regulated under 24 CFR 1910.3(a) and (b); to floodplains regulated by local ordinances independent of FIA; and to floodplains with no flood regulation in effect. For riverine situations, the following two crucial features are included: no future confinement or obstruction of the regulatory floodway; and no future occupancy of the flood fringe unless residences are elevated to or above 100-year (.01 annual probability) flood level and nonresidential buildings are flood proofed to that level.

(3) Application. It is assumed that flood proofing costs will be incurred if an activity decides to locate in the floodplain.

(4) Executive Orders. Compliance with E.O. 11988, Floodplain Management and E.O. 11990, Protection of Wetlands, is assumed.

(5) Individual actions. In addition to the three assumptions stated above, the analyst shall consider the likelihood that individuals will undertake certain flood hazard reduction

measures, such as flood proofing, when the cost of such measures is reasonable compared to the costs of potential flood damages.

(3) With Project Condition. The with project condition is the most likely condition expected to exist in the future if a specific project is undertaken. There are as many with project conditions as there are alternative projects.

(a) In projecting a with project condition, the analyst must be sensitive to the relationship between land use and the characteristics of the flood hazard for the alternative project being analyzed.

(b) The same assumptions underlie the with project condition and without project conditions.

(c) Consideration should be given to both structural and nonstructural alternatives and to alternatives incorporating a mix of structural and nonstructural measures. Non structural measures include:

(1) Reducing susceptibility to flood damage by land use regulations, redevelopment and relocation policies, disaster preparedness, flood proofing, flood forecasting and warning systems, floodplain information, floodplain acquisition and easements; and

(2) On-site detention of flood waters by protection of natural storage areas such as wetlands or in manmade areas such as building roofs and parking lots.

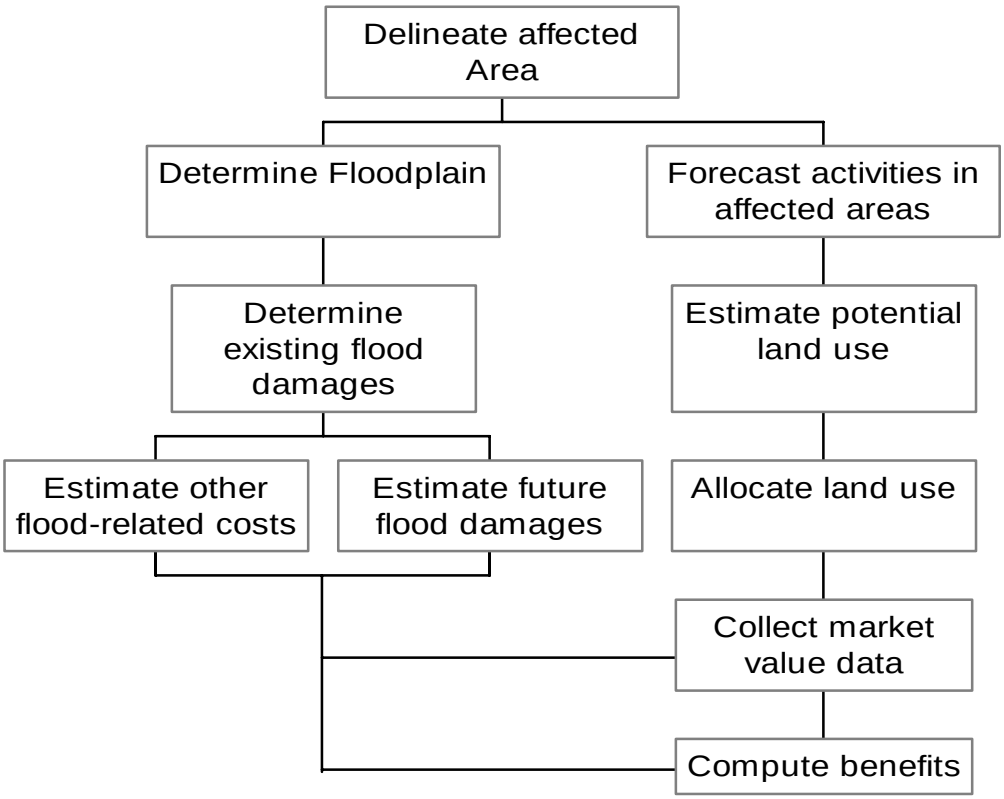
(3) Since project alternatives can differ in their physical characteristics, the optimal timing of projects and of individual project features should be considered in project formulation.

commercial. If the potential use of the floodplain includes industrial use within a standard metropolitan statistical area (SMSA**)** (now called metropolitan statistical area (MSA)), the entire SMSA (MSA) is the affected area; for residential use, even within an SMSA (MSA), a much smaller area may be designated the affected area.

d. Evaluation Procedure: General. Ten steps are involved in computing benefits (see Figure E-4). The steps are designed primarily to determine land use and to relate use to the flood hazard from a NED perspective. The level of effort expended on each step depends on the nature of the proposed improvement and on the sensitivity of the project formulation and justification to further refinement. The first five steps result in a determination of future land use; emphasis is on the overall reasonableness of local land use plans with respect to OBERS (OBERS no longer exist, but population, income and economic projections can still be obtained from the U.S.

Department of Commerce, Bureau of Economic Analysis) and other larger area data, and to recognition of the flood hazard.

Figure E- 4 Urban Flood Damage Benefit Evaluation Procedure



e. Step 1--Delineate Affected Area. The area affected by a proposed plan consists of the floodplain plus all other nearby areas likely to serve as alternatives sites for any major type of activity that might use the floodplain if it were protected.

f. Step 2--Determine Floodplain Characteristics. The existing characteristics of the floodplain must be determined before its actual use can be estimated; therefore, undertake an inventory of the floodplain to determine those characteristics that make it attractive or unattractive for the land use demands established in steps 3 and 4, with emphasis on those characteristics that distinguish the floodplain from other portions of the affected area. Use the following categorizations as a guide:

(1) Inherent Characteristics of a Floodplain. Floodplain characteristics may include:

(a) Flooding. Describe the flood situation, including a designation of high hazard areas. The description should include characteristics of the flooding, such as depths, velocity, duration, and debris content; area flooded by floods of selected frequencies, including 100-year frequency [.01 annual probability]; historical floods, and, where applicable, larger floods. [Description of flood characteristics for a given frequency or discharge should be based on the median probability discharge. The regulatory floodplain as defined by the National Flood Insurance Program will always be described.]

(b) Floodway, Natural Storage. Describe and delineate those areas which, if urbanized or structurally protected, would affect natural storage, velocity, or stage, or would affect flood flows elsewhere.

(c) Natural and Beneficial Values. Many floodplains, particularly those near urban areas, are potential sites for recreation, open space, wetland, or wildlife preserves. This potential should be recognized and presented.

(d) Transportation. Floodplains near navigable streams have inherent attractiveness for industries that demand water-oriented transportation. Floodplains also serve as sites for railroads, highways, pipelines, and related facilities that are not susceptible to serious flood damage but have a tendency to attract industry to the area. [Flood damage to transportation systems and the resulting transportation delay costs may be an important damage category in many urban settings. Care should be taken to adequately address transportation delay costs in both the without and with project condition.]

(e) Other Attributes. Other inherent attributes of floodplains may include soil fertility, reliability of water supply, waste disposal, and sand, mineral, and gravel deposits.

(2) Physical Characteristics. Describe pertinent physical characteristics, including slope, soil types, and water table.

(3) Available Services. Most activities require some or all of the following services: transportation (highway and rail), power, sewerage, water, labor, and access to markets. Indicate the availability of such services in or near the floodplain, including comparisons with similar services available in other portions of the affected area.

(4) Existing Activities. Include in the inventory of the floodplain a list of existing activity types, the number of acres, and the density, age, and the value of structure of each activity-type by flood hazard zone.

g. Step 3--Project Activities in Affected Areas. Base economic and demographic projections on the most recent available studies and include the following: population, personal income, recreation demand, and manufacturing, employment, and output. Additional projections may be necessary for any given area, depending on the potential uses of these projections. Base projections on assessment of trends in larger areas and appropriate data (e.g., OBERS) [Bureau of Economic Analysis]; the relationship of historical data for the affected area to trends projected for larger areas; and consultation with knowledgeable local officials, planners, and others. The basis for the projections should be clearly specified in the report. [Estimates of future growth benefits shall be based on current unbiased economic growth indices. Whenever possible the growth indices should be independent estimates. Paragraph E-19c. requires that for the without project condition, floodplain communities will be assumed to belong to the National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Agency. In order to participate in this program, the local community must preclude new development in the regulatory floodway as defined by the community, and require that new development in the NFIP regulatory floodplain outside of the floodway be constructed with first floor elevations at or above the .01 annual probability 100-year elevation. Therefore, future development will be assumed to be protected to the .01 probability 100-year discharge at the end of the period of analysis. The .01 probability discharge and elevation will be determined by the Corps consistent with levee certification guidance. If individual communities have floodplain restrictions more stringent than NFIP criteria, projections of future development should reflect the local criteria. However, under no circumstances, will future development be assumed in any area subject to flooding in the present and future median .01 probability flood.]

h. Step 4--Estimate Potential Land Use. Estimate potential land use within the affected area by converting demographic projections to acres. The conversion factors can normally be derived from published secondary sources, from agency studies of similar areas, or from empirical and secondary data available in the affected area. The categories of potential land use

need be only as detailed as necessary to reflect the incidence of the flood hazard and to establish the benefits derived from a plan.

i. Step 5--Project Land Use. Allocate land use demand to floodplain and non floodplain lands for the without project condition and for each alternative floodplain management plan.

(1) Basic Factors. Base the allocation on a comparison of the floodplain characteristics, the characteristics sought by potential occupants, and availability of sought-after characteristics in the non floodplain portions of the affected area.

(2) Criteria. The floodplain should not be used unless it has characteristics that give it a significant economic advantage to the potential user over all other available sites within the affected area. If such advantages exist, determine whether they overcome potential flood losses, potential flood proofing costs, and the costs of other related hazards. Flood losses and costs should be specific to the zone of the floodplain being considered.

j. Step 6--Determine Existing Flood Damages. Existing flood damages are the potential average annual dollar damages to activities affected by flooding at the time of the study. Existing damages are those expressed for a given magnitude of flooding or computed in the damage frequency process. No projection is involved. The basis for the determination of existing damages is losses actually sustained in historical floods; therefore, specify the year and month of all significant recorded discharges above zero point of damage and indicated the damages actually sustained by reach or zone and type of property and activity. Historical data are often incomplete; urbanization and other changes will have occurred over the years. Many streams and reaches do not have gaging stations. Therefore, data on historical flood losses should be carefully scrutinized and supplemented by appraisals, use of area depth-damage curves, and an inventory of capital investment within the floodplain. Further, estimates of damages under existing conditions should be computed for floods of magnitude that have not historically occurred. Estimate average annual losses by using standard damage-frequency integration techniques and computer programs that relate hydrologic flood variables such as discharge and stage to damages and to the probability of occurrence of such variables. Annual hydrologic data are normally sufficient for urban drainage estimates. Access flood damages by activity-type and by whether they are borne by the owner or by the public at large.

k. Step 7--Project Future Flood Damages. Future flood damages are the dollar damages to economic activities identified in step 3 that might use the floodplain in the future in the absence of a plan. Use this step in combination with step 5 (land use) to determine land use and associated damages for each future with project and without project condition. “Future” is any time period after the year in which the study is completed; in order to relate costs ultimately to benefits, however, future damages must be discounted to the base year. Determine future flood

damages on the basis of losses sustained both by the floodplain occupant and by others though insurance subsidies, tax deductions for casualty losses, disaster relief, etc.

(1) Hydrologic Changes. Changes in basin land use may result in major alteration of drainage characteristics, particularly surface runoff; project such hydrologic changes for the planning period. Average future hydrologic conditions should not be used, since they obscure situations in which the level of protection afforded by a project may be significantly different from average conditions by the end of the planning period.

(2) Economic Changes. Economic changes can be expected to result in a change in the level of future flood losses. A benefit-cost ratio for the existing condition should always be shown. If the ratio is greater than 1:1, the projection of future benefits may be accomplished in abbreviated form unless it would distort the comparison of alternative projects or the cost allocation and cost sharing in multipurpose projects. In the latter situation, the detail and accuracy of the estimates of flood control benefits should be comparable to the estimates of benefits for other water resources purposes.

(3) Projection of Physical Damages. Base measurement and projection of flood damages on the establishment of actual, observed relationships between damages, flood characteristics, and those indicators used for measurement and projection. These relationships should be modified as appropriate by consideration of constraints that change the historically derived relationship between flood damages and a given indicator. The relationships should be made explicit in the report and their accuracy and representativeness supported, to the extent possible, by empirical evidence. Use three steps in measuring flood damages for a future year: estimate the number and size of physical units; estimate the future value of units; and determine the damage susceptibility of units.

(a) Physical Units. The first step in measuring flood damages for a future year is to determine from step 2 (paragraph E-19f.) the number and size of physical units with potential to use the floodplain by hazard zones for each activity type. Care must be taken to determine whether existing structures will continue to occupy the floodplain over the period of analysis and, if not, the future land use and damage potential of new structures.

(b) Value per Physical Unit. This step involves estimating future unit value. Increases in the value of property in the floodplain may result from the expansion of existing facilities or the construction of new units. The following guidance applying to content value is derived from an empirical study of flood-prone property.

(1) Existing development. Use the OBERS [Bureau of Economic Analysis] regional growth rate for per capita income as the basis for increasing the real value of residential contents in the future.

(2) Future development. Project the value of contents within new residential structures from the year each unit is added.

(3) Translation to future flood damages. Use the projected rate of increase in the value of flood-susceptible household contents as the basis for increasing the future unit flood damage to household contents.

(4) Limit. The value of contents should not exceed 75 percent of the structural value of the residence unless an empirical study proves that a special case exists (e.g., trailer parks), nor should the increase in value of household contents be projected beyond project year 50. [Current guidance on content-to-structure ratios is provided in paragraph E-19q.]

(5) Commercial and industrial property. The procedure described for residential contents does not apply to commercial and industrial categories.

(c) Damage susceptibility. The third step in measuring future flood damages is to determine the damage susceptibility of units. Once the number of physical units and the value associated with each unit are known, examine possible future changes, if any, in damage susceptibility relationships as a function of the total value of each physical unit and the stream's flood characteristics, such as velocity, depth, duration, volume, debris load, and salinity. Some of the determinants of damage susceptibility are type of activity, vertical development, location within the floodplain, nature of flood proofing, construction material used, and individual response.

(1) Projection of Income Losses. Income losses may be projected to increase on the basis of projected land use. Increases in physical losses should not be used to project income losses.

(2) Projection of Emergency Costs. Emergency costs encompass a wide variety of programs. Some, such as emergency shelter and food, are primarily a function of occupancy of the floodplain but not of the value of development in the floodplain. Emergency costs should not be projected to increase as a direct function of physical losses.

(4) Use of Assessed Value Real Estate Appraisal and Market Value Data in Flood Damage Reduction Studies. Flooding causes physical damages to structures. In the past the Corps frequently estimated damages and cost of repair directly. The Corps now uses a risk-based procedure as defined by ER 1105-2-101. This procedure requires the use of depth-damage

curves, which express an average relationship between depth of flooding and damages. Damages are expressed as a percentage of structure value. When depth-damage curves are used, the correct measure of structure value, consistent with cost-benefit concepts, is replacement cost less depreciation to the existing (pre-flood) structure.

(a) Replacement cost is the cost of physically replacing (reconstructing) the structure (only). Depreciation accounts for deterioration occurring prior to flooding, and variation in remaining useful life of structures.

(b) Assessed value, real estate appraisal and market value data do not necessarily provide acceptable and directly useable estimates of replacement cost less depreciation, even when separate land and improvement values are reported. A variety of particular causes may make the data inappropriate, but the fundamental reason is that these data are produced for and primarily used for purposes other than estimation of flood damages, that is for other than NED benefit estimation purposes.

(c) Such data has some advantages for Corps planners as it is generally available and can be relatively inexpensive. Furthermore, in many cases such data may be useable, either directly or as modified. The appropriateness of the data must be verified however.

(d) When real estate appraisals are used as a source of basic data, the appraisal process shall be documented.

(e) Requirement. When structure value data is obtained from sources other than direct estimation of cost of physical replacement less depreciation, these data shall be verified as being reasonable estimates of replacement cost less depreciation. This can be done using a sampling procedure to select a relatively small number of structures for direct estimation of replacement cost less depreciation. The results can be used to compare to, and if appropriate, adjust the data obtained from other sources.

l. Step 8--Determine Other Costs of Using the Floodplain. The impact of flooding on existing and potential future occupants is not limited to flood losses. Some of the impacts are intangible but others can be translated into NED losses. These latter include the following:

(1) Flood Proofing Costs. High flood hazards lead to high flood costs. Therefore, compute the flood proofing costs of different activity-types and different flood hazard zones.

(2) National Flood Insurance Costs. A national cost of the flood insurance program is its administration. The cost of servicing flood insurance policies in effect at the time of the study is the average cost per policy, including agent commission, and the costs of servicing and claims adjusting. FIA should be contacted to obtain these costs.

(3) Modified Use. In some cases, the flood hazard has caused structures to be used less efficiently than they would be with a project. For example, the first floor of garden apartments may not be rented because of a flood hazard, or property may be configured in a different way with the plan compared to without a plan.

m. Step 9--Collect Land Market Value and Related Data. If land use is different with and without the project, compute the difference in income for the land. This is generally accomplished by using land market value data. Provide supporting data in the situations described in the paragraphs below.

(1) Land Use is Different With Project. If land use is different with compared to without the project, collect the following data as appropriate to complete step 10.

(a) Comparable Value. If the plan does not result in a major addition to the supply of land in the area, the value with protection is the market value of comparable flood-free land. If the plan results in a major addition to the supply of land, the effect on the price of land should be taken into account in estimating the value of floodplain lands with protection. The flood-free land should be comparable in terms of physical and infrastructural characteristics.

(b) Existing Value. Use the value of nearby floodplain sites or, as appropriate, the current value of the floodplain. In either case, report the current and, if available, past market values of the floodplain. Use actual market values, not capitalized income values. Therefore, it should not be assumed that the value of land being used for agriculture in an urban or urbanizing situation is the capitalized value of agricultural returns or that any value higher than this is due to speculation that a Federal project will be constructed or lack of knowledge. On the contrary, without project land values in excess of agricultural land values should be expected, reflecting the probability of future use as well as existing and anticipated infrastructural investments.

(c) Net Income Data. The net income (earned) with a project may be estimated directly based on an analysis of a specific land use with the project. This approach would be used, for example, for lands to be developed for recreation; the projected recreation benefits would constitute the gross income earned on the floodplain and would be shown as a project benefit.

(d) Encumbered Title Market Value. Estimate the market value of land with an encumbered title for inclusion as a benefit in step 10 in situations in which the floodplain is to be evacuated, no specific public use is planned, and the land could be resold with an encumbered title (which would ensure that future uses would be consistent with Executive Order 11988--Floodplain Management, May 24, 1977).

(2) Land Use is Same But More Intense With Project. If land use is the same but more intense, as when an activity's use of the floodplain is modified as a result of the project, base determination of the increase in income on increased land values or direct computation of costs and revenues.

(3) Evacuation Plan. In the case of an evacuation plan, changes in market value of properties adjacent to a restored floodplain may reflect recreation or open-space benefits to occupants of those properties. Document such an NED benefit by empirical evidence. Care must be taken to avoid double counting of benefits.

(4) Market Value is Lowered by Flood Hazard. If the market value of existing structures and land is lower because of the flood hazard, restoration of the market value represents a quantification of otherwise intangible benefits. In such cases, the benefit is the difference between increased market value and that portion of increased market value attributable to reductions in flood damages. Careful attention should be given to ensuring that factors not related to the flood hazard are not included as project benefits.[1]

(5) No Projected Increase in Market Value. Projected increase in the market value of land over the project life with and without a plan should not be used to measure flood hazard reduction benefits because the current market value of land theoretically captures the expected stream of income over time.

n. Step 10--Compute NED Benefits. At this point in the analysis, enough information is available to compute NED benefits for structural and nonstructural measures. Table E-15 displays the types of benefits claimable for three of the major flood hazard reduction measures and the steps in the procedure that provide the necessary data. The table applies generally; specific cases may vary. Discount and analyze all benefits at the appropriate discount rate to the beginning of the period of analysis. Benefits are categorized in the following way:

(1) Inundation Reduction Benefits. To the extent that step 5 indicates that land use is the same with and without the project, the benefit is the difference in flood damages with and without the project (step 7), plus the reduction in flood proofing costs (step 8), plus the reduction in insurance overhead (step 8), plus the restoration of land values in certain circumstances (step 9). To the extent that step 5

Table E- 15 Guide to Types of Benefits

Type of Benefit (and step)	Structural	Floodproofing	Evacuation
Inundation:			
Incidental Flood damages (step 6)	Claimable.....	Claimable.....	Claimable.....
Primary Flood damages (step 6)	Claimable.....	Claimable.....	Not Claimable..
Floodproofing cost reduced (step 7)	Claimable.....	Not Claimable.....	Not Claimable..
Reduction in Insurance overhead (step 7)	Claimable.....	Claimable.....	Claimable.....
Restoration of land value (step 9)	Claimable.....	Claimable.....	Not Claimable..
Intensification (steps 7 and 9)	Claimable.....	Claimable.....	Not Claimable..
Location:			
Difference in use (step 9)	Claimable.....	Claimable.....	Not Claimable..
New use (step 9)	Not Claimable.....	Not Claimable.....	Claimable.....
Encumbered title (step 9)	Not Claimable.....	Not Claimable.....	Claimable.....
Open space (step 9)	Not Claimable.....	Not Claimable.....	Claimable.....

indicates a difference in land use for an evacuation plan, the benefit is the reduction in externalized costs of floodplain occupancy that are typically borne by taxpayers or firms providing services to floodplain activities. Examples of such costs are subsidized flood insurance; casualty income tax deductions; flood emergency costs; and flood damages to utility, transportation, and communication systems. Reduction of costs not borne by the floodplain activities may be a major benefit of projects to evacuate or relocate floodplain activities. Reduction of flood damages borne by floodplain activities should not be claimed as a benefit of evacuation or relocation because they are already accounted for in the fair market value of floodplain properties.

(a) All damages avoided by flood mitigation measures are beneficial effects. Evacuation and relocation projects provide a special case for economic analysis because the effect of damage reductions are present in measures of both benefit and cost, therefore, double counting of this

benefit must be carefully avoided. IWR Research Report 85-R-1, Assessment of the Economic Benefits from Flood Damage Mitigation by Relocation and Evacuation, provides a comprehensive discussion of NED benefit evaluation procedures for relocation and evacuation projects. In planning for, and evaluation of, relocation and evacuation projects considerable attention should be paid to the with project use of land which is to be evacuated, as the benefit, associated with such use may be crucial to project feasibility.

(b) Benefit from Saving Insurance Costs. One category of costs that can be avoided by a removal plan is public compensation for private flood damages through the subsidized Federal Flood Insurance Program. Expressing savings in these externalized costs as project benefits is appropriate for properties in communities that participate in the Federal Flood Insurance Program or are expected to participate under the without project condition. This benefit is the reduction of insurable flood damages projected over the life of the project with careful attention to the projected without project condition.

(c) Insurable Flood Damages. Base the projection of insurable flood damages on traditional depth-damage-frequency relationships used in projecting total flood damages. Then reduce projected total damages by subtracting: Losses that are noninsurable either because they are in noninsurance loss categories or because they exceed the coverage limits of the subsidized program; the deductible portion of each expected flood damage event; and the annual cost of the insurance premium paid by the policyholders. For this benefit calculation, assume that all eligible parties purchase subsidized insurance. This assumption is appropriate because the market value of properties, which determines project costs, reflects the availability of the program, not the extent of its utilization by current floodplain occupants.

(2) Intensification Benefits. If step 5 indicates that land uses are the same with and without the project but activity is more intense with the project, measure the benefit as the increase in market value of land from step 9 or changes in direct income from step 6. Care must be taken to avoid double counting.

(3) Location Benefits. If step 5 indicates that land use is different with and without the project, measure the benefit by the change in the net income or market value of the floodplain land and certain adjacent land where, for example, the plan creates open space (step 9).

o. Evaluation Procedure: Problems in Application. There are six major problem areas in computing flood hazard reduction benefits:

(1) Income Losses. The loss of income by commercial, industrial, and other business firms is difficult to measure because of the complexity involved in determining whether the loss is recovered by the firm at another location or at a later time. Direct interview and empirical post-flood studies are the most appropriate data sources for analyzing whether a real resource

loss, such as the idle capital or decaying inventories, is involved. The loss of income because of idle labor may be measured from the point of view of the firm or the household, but care must be taken to avoid double-counting. Loss of income because of idle labor must be net of income to labor employed in cleanup and repair of damages; unemployment compensation and other transfer payments to idle labor are not income from an NED perspective.

(2) Intensification Benefits. This category of benefits is theoretically applicable to urban situations, but there are to date few documented case studies. This benefit cannot exceed the increased flood damage potential when the existing activity is compared to the intensified activity (without the proposed plan).

(3) Location Benefits. This benefit cannot exceed the increased potential damages with the changed land use but without the project, or the costs of fill/flood proofing, whichever is less. The limitation applies to floodplain but not floodway land. The prohibition of development in floodways reduces land value by more than can be attributed to flood risk alone. That is, land value would have been higher in the absence of development prohibition. Thus, the lessor of limitation is not an upper bound on the increase in land value due to a flood control project since the project removes both the flood risk and the development restrictions**.**

(4) Risk. The analysis of response to a flood hazard is based on a probability weighing of floods off various magnitude. This implies that floodplain occupants are risk-neutral, but many occupants, individually or as a group, either avert or accept risk. Therefore, responses to actual and potential flood damages should be viewed broadly in determining land use, mode of conducting business, and even benefits. Explain any significant deviations from expected behavior based on actual or potential flood damages computed on a risk-neutral basis.

(5) Sensitivity Analyses. The report should contain sensitivity analyses that present a range of benefit levels representing data and assumptions about which reasonable persons might differ. Report the benefit level that is most probable; present other levels for public information. If increases in damages are based on increases in value, conduct a sensitivity analysis of value per structure under the alternate assumption that there is no increase in the average value of structure of contents and that increases in damages are due solely to increases in the number of structures and/or shifts from one type of structure to another. If explicit risk-based analysis has been used in the report, sensitivity analysis are not required. Sensitivity analyses could be performed as necessary to describe the sensitivity of the formulation to inherent assumptions.

(6) Existing Levees that do not Meet Corps Criteria. Problems have often arisen in the benefit evaluation of flood damage reduction studies when there are existing levees of uncertain reliability. Specifically, the problem is one of engineering judgment but has implications for benefit evaluation: engineering opinion may differ or be uncertain on the ability of the levees to

contain flows with water surface elevations of given heights. This may lead to difficulty in arriving at a clear, reasonable and agreed upon without project condition.

(a) General. Investigations for flood damage prevention involving the evaluation of the physical effectiveness of existing levees and the related effect on the economic analysis shall use a systematic approach to resolving indeterminate, or arguable, degrees of reliability. Reasonable technical investigations shall be pursued to establish the minimum and, to the extent possible, the maximum estimated levels of physical effectiveness. Necessary information and summary of analyses shall be included in report presentations of plan formulation and shall be documented in appropriate supporting materials.

(b). Sources of Uncertainty. Studies involving existing levees will focus on the sources of uncertainty (likely causes of failure). Other than overtopping, levees principally fail due to one or a combination of four causes: surface erosion, internal erosion (piping), underseepage, and slides within the levee embankment or foundation soils. Reasonable investigations, commensurate with the level of detail suitable to the planning activity underway, shall determine the condition of existing levees with respect to the factors that can lead to failure, if this information does not already exist.

(c). Performance Record. Existing levees either have or have not failed during previous flood events or have shown evidence of distress such as various degrees of piping, underseepage and sloughing. Information regarding their performance is relevant and vitally important in forming judgments regarding future performance. However, it should not be assumed that because a levee has passed a flood of a given frequency it will always do so in the future or vice versa, assuming the levee has been repaired.

(d) Reliability.

(1). Reliability judgments should be based solely on physical phenomena. The question to be answered is: what percent of the time will a given levee withstand water at height x? This means that considerations such as meeting FIA regulatory requirements, induced damages, induced flood heights, potential for increased risk of loss of life due to false sense of security, etc., are not included. These considerations will be dealt with separately during the plan formulation process.

(2). The purpose of the reliability determination is to be able to estimate the without-project damages. Its purpose is not to make statements about the degree of protection afforded by the existing levees. The preferred procedure is to estimate the reliability from the levee base to its top. As a minimum, information shall be gathered to enable the identification of two points on the existing levees. The first point is the highest vertical elevation on the levee

such that it is highly likely that the levee would not fail if the water surface elevation were to reach this level. This point shall be referred to as the Probable Non-failure Point (PNP). The second point is the lowest vertical elevation on the levee such that it is highly likely that the levee would fail. This point shall be referred to as the Probable Failure Point (PFP). As used here, "highly likely" means 85+ percent confidence. As defined, the PNP will be at a lower elevation than the PFP. When there are unresolved uncertainties or differences of opinion, consideration should be given to having the range of uncertainty extend from the lower of arguable PNPs to the higher of arguable PFPs. Because of lack of information or other reasons, if the PFP cannot be determined then the PFP shall be the low point in the levee where the levee is first overtopped. When determining the low point in the levee, assume that closure actions have taken place.

(3) Further technical guidance on reliability determinations is available in Engineering Technical Letter 1110-2-556, Risk Based Analysis in Geotechnical Engineering for Support of Planning Studies, 28 May 1999.

(e). Benefit Evaluation Procedure. Even if no PNP is claimed for an existing levee, it does, most likely, provide some benefits. Assessment of these benefits must be in some degree arbitrary in the absence of illuminating engineering or statistical analyses. The function of identifying the probable failure and non-failure points is to create a range of water surface elevations on the levee over which it may be presumed that the probability of levee failure increases as water height increases. The requirement that as the water surface height increases the probability of failure increases, incorporates the reasonable assumption that as the levee becomes more and more stressed it is more and more likely to fail. If duration information is known, explicit incorporation of the information is encouraged. If the form of the probability distribution is not known, a linear relationship is an acceptable approach for calculating the benefits associated with the existing levees. For benefit evaluation, assume all flood damages will be prevented below the PNP; and no damages will be prevented above the PFP.

p. Data Sources. The following paragraphs summarize problems associated with two key data sources.

(1) Interviews. The primary use of personal interviews is to collect flood damage data, but interviews may also be used to collect other necessary data not available from secondary sources. Use only interview forms approved by the Office of Management and Budget. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in a way that protects the source of individual disclosures. Describe the errors and uncertainty inherent in the sampling methods and responses.

(2) Local Land Use Plans. Local land use plans and zoning ordinances are valuable guides to future land use in the floodplain, but caution must be exercised in the use of such plans

and ordinances. First, the demographic implications of local plans and ordinances must be consistent with, or convincingly distinguished from, trends in a larger area, e.g., OBERS [Bureau of Economic Analysis]. Second, a local plan is not an acceptable projection for the without project condition if it ignores the flood hazard. Third, the status, date, and likelihood of change of local plans vary. Finally, local plans may not contain sufficiently detailed information to be of direct use in benefit analysis.

(3) IWR Reports. Additional detailed support material for conducting NED evaluation for urban flood damage may be found in the following reference documents. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within these IWR reports.

(a) Urban Flood Damage (IWR Report 88-R-2, March 1988)--This manual provides an expanded description of urban flood damage reduction benefit procedures.

(b) Urban Flood Damage, Volume II, Primer for Surveying Flood Damage for Residential Structures and Contents (IWR Report 91-R-10, October, 1991)--This manual is a primer for conducting comprehensive flood damage and related surveys. It explains how basic principles of survey research can be applied to data collection for flood damage studies. Two prototype questionnaires (one in person and one mail with a preliminary telephone supplement) for collecting residential flood damage and related information are presented. Examples from previous applications of these questionnaires provide insight as to how they may be adapted and implemented for future flood damage studies.

q. Urban Flood Damage - Additional Procedures.

(1) Content Value.

(a) For feasibility studies, residential content-to-structure ratios should be based on either site-specific surveys or surveys of comparable floodplains. In areas where surveys of comparable floodplains are used, at a minimum, qualitative rationale will be provided to demonstrate comparability of the survey to the study floodplain. Districts may request deviation from this guidance if can reasonably demonstrate lack of site specific content surveys will not effect plan formulation. Rationale for deviation from this guidance should be submitted to HQUSACE (CECW-PD) with accompanying Project Management Plan.

(b) Commercial, industrial and public content-to-structure ratios should be based on either site-surveys or surveys of comparable business or structure types. In areas where surveys of comparable types are used, at a minimum, qualitative rationale will be provided to demonstrate comparability of the survey to the study floodplain. Districts may request deviation

from this guidance if it can reasonably demonstrate lack of site specific content surveys will not effect plan formulation. Rationale for deviation from this guidance should be submitted to HQUSACE (CECW-PD) with accompanying Project Study Plan.

(2) Depth-Damage Relationships. For feasibility studies, depth-damage relationships should be developed based on site-specific data or from comparable floodplain data. In areas where depth-damage relationships are based on comparable floodplain data, at a minimum, qualitative rationale will be provided to demonstrate the reasonableness of use of the depth-damage relationship in the study area. Districts may request deviation from this guidance if they can reasonably demonstrate lack of site-specific depth-damage relationships will not effect plan formulation. Rationale for deviation from this guidance should be submitted to HQUSACE (CECW-PD) with accompanying Project Study Plan.

(a) In FY 2000 the Corps began releasing generic depth-damage relationships developed through the Flood Damage Data Collection Program. In flood damage reduction studies where site-specific or comparable floodplain depth-damage information is not readily available these curves are approved for use. As these curves are intended for nation-wide use no rationale is required to demonstrate applicability in individual floodplains. The curves are developed for specific building types, i.e., residential one-story without basement, and cannot be substituted for other building types.

(b) These generic depth-damage curves relate content damages directly to structure values. When generic depth-damage curves are used no valuation of contents is required. Districts are therefore not required to collect or report content valuations for flood damages analyzed through the use of generic curves.

(3) Documentation Requirements for Location Benefits. A location benefit is the increase in aggregate net income (increases less decreases) due to efficiencies of a floodplain location compared to the best non floodplain location. The P&G says estimated change in floodplain land price is an acceptable benefit measure, but care must be taken that decreases in price elsewhere are accounted for. Alternatively, when change in net income to the occupying activities is directly estimated, accounting for compensating changes in land prices is not relevant.

(a) Provide the following documentation in addition to that required by paragraphs E-19e. to E-19n.

(1) Document alternative sites for activities that might occupy the floodplain. Include sites which are available or would likely be available for development over the planning horizon, but which may not typically be included in a real estate study that focuses on comparable sales. There is usually substantial industrial/commercial land available in a typical urban area.

(2) Document specific characteristics of the protected floodplain which make it attractive in comparison to alternative non floodplain locations, such as availability of services, etc. Some idea of the likely nature of the occupying activity is required. Compare floodplain and non floodplain alternative locations on a characteristic by characteristic basis.

(3) Based on economic projections for the overall area, and on the potential for land use change in the overall area, allocate land use to floodplain and non floodplain locations in without and with project conditions. The allocation must be explicitly based on the comparisons of subparagraph (2) above. Significant economic advantage of the floodplain location must be apparent as a basis for attributing predicted changes in land prices to locational advantage.

(4) If predicted changes in floodplain land values are to be the measure of benefits, the data and procedures by which the benefit estimate results from analysis of comparable sales must be documented.

(a) Choose comparable sales based on their similar characteristics to floodplain locations. These data are used in estimating NED benefits as discussed in paragraphs E-19m. and E-19n. Also, compare these sale prices to asking prices of non floodplain alternative locations identified in subparagraph (1) above. If alternative location asking prices are less, assess whether this means such sites would be preferable to floodplain sites. For example, if non floodplain asking prices are lower, it must be shown that floodplain site characteristics are sufficiently advantageous to outweigh the lower cost of non floodplain alternative sites.

(b) The spatial allocation and benefit estimates are supported when comparisons of both relative locational characteristics and relative land prices indicate floodplain locations are superior.

(5) If allocations are supportable by both comparisons of the locational characteristics and comparable sales data, it should be assumed that use of floodplain land is phased in as demand for additional land develops. Floodplain land should not be assumed to increase in value instantaneously.

(b) Required sensitivity on the reasonableness of benefits estimated by land value comparisons, and test of the non practicability of non floodplain locations.

(1) For representative activities estimate directly the change in net income that would accrue when a floodplain location is chosen over the best non floodplain location. Use these calculations to support benefits based on land value projections and for findings of non practicability of non floodplain locations.

(2) Estimate the increased damages which would accrue on the newly developable land in the floodplain if the development occurred in the without project condition.

(4) Documentation Requirements for Lost Net Income and Lost Wages. The P&G allow income loss as an NED benefit only when it can be demonstrated that postponement or transfer does not occur. This is exceedingly difficult to demonstrate. If lost net income or lost wages is to be claimed as a benefit, an estimating procedure must be developed and submitted to HQUSACE CECW-PD for approval prior to inclusion of the benefits in feasibility reports or other decision documents. The PSP is an appropriate vehicle for documenting proposed procedures when it is desired to include lost income or lost wages benefits in feasibility studies.

(5) Documentation Requirements for Savings in Floodproofing Costs on Alluvial Fans. Alluvial fans are triangular or fan shaped, gently sloping land forms which provide attractive development sites due to their commanding views. Alluvial fans primarily occur in the southwestern U.S. Active fans exhibit braided channels and erratic flowpaths that are typical of a young fan formation. These fans have severe flood hazards which exhibit unpredictable flow paths and high velocities that usually occur with little advance warning time. Flooding on the fan can cause considerable erosion in some areas and deposit large amounts of sediment and debris in other areas.

(a) The Federal Emergency Management Agency (FEMA) has provided guidance on techniques and strategies for minimizing losses from the flood hazards when building and developing on an alluvial fan (Alluvial Fans: Hazards and Management, May 1989) and additionally has placed restrictions on housing developments in Special Flood Hazard Areas (SFHA). The creation of an overall development master plan, drainage maintenance and floodplain management is encouraged by FEMA. The Federal Register dated March 7, 1989, 44 CFR states "topographic alterations alone, by fill or other means, will not serve as a basis for removing SFHA designations from alluvial fans." The procedures necessary for FEMA to recognize that a flood control measure is effective in removing or reducing the size of a SFHA on an alluvial fan have associated costs. To ensure that development projects are protected from alluvial fan flood hazards, FEMA's review criteria requires that the construction include elements which: do not cause the disturbance of natural flood processes on the fan; allow for safe collection, passage and disposal of flood related water, sediment and debris without negative impact to adjacent property; address erosion, scour, deposition, impact and hydrostatic forces; provide that the design and maintenance of project elements be coordinated with the local jurisdiction and/or agency responsible for flood control within the community.

(b) Cost associated with development compliance in accordance with FEMA alluvial fan regulations are NED costs where it can be demonstrated that these costs will occur in the without project condition. Removal of these costs through regional flood control solutions would therefore be an NED benefit. FOAs must, however, carefully document the without project

condition. It can reasonably be expected that without project development will not occur in some areas of an alluvial fan because of prohibitively high compliance costs. This is likely true in the high velocity areas approaching the apex of the fan. In studies where alluvial fan compliance cost benefits constitute a major portion of total benefits, districts are required to quantitatively demonstrate that development will occur in the without project condition. An example of an appropriate quantitative analysis would be a comparison of developer costs and expected profits in project alluvial fan and non-alluvial fan areas. Additionally, districts must document historic floodproofing costs and explain any deviation from those projected for the benefit analysis.

r. Report and Display Procedures. Include in the report enough data to enable the reviewer to follow the key steps above and, more important, the underlying rationale for the project.

(1) Report Procedures For Risk and Uncertainty. To assist reviewers in assessing response to risk, summarize the following separately and display the information in tabular form:

(a) Remaining Flood Damage Situations: Categorizations. The remaining damages are those expected to occur even with a floodplain management plan in operation. Remaining damages include:

(1) Damages to activities that would occupy the floodplain with as well as without the plan;

(2) Damages to activities that would occupy the floodplain only with the plan; and

(3) Increased damages to activities outside the protected area with and without the plan. This includes downstream flooding, if any, caused by the plan or project.

(b) Flood with two-tenths of 1 percent chance of occurrence. Fully describe the flood with two-tenths of 1 percent chance of occurrence (500-year frequency) with and without the plan. The report should contain, for example, two-tenths of 1 percent flood damages; the number of people and towns affected; the number of structures and acres by land-use type; disruption of essential services (e.g., water, power, fire protection, and sanitary services) and distance to unaffected essential services; anticipated warning time; flood depths, velocity, duration, debris content, etc.; and other indicators pertinent to catastrophic flooding. The .02 probability flood description will be based on the median probability discharge. If protection against the .02 probability event is recommended, the Standard Project Flood (SPF) shall also be analyzed and described, if it is larger than the .02 probability flood.

(2) Summary Tables. Tables E-16 through E-19 are suggested presentations for all reports that include flood hazard reduction as a purpose. The summary tables should include

pertinent land use data for computing not only NED benefits, but also environmental, social, and regional impacts. Also present other floodplain data pertinent to the evaluation on one or more maps: Flood limits and depths with and without the project; current and future land use; and 100-year [.01 annual probability] and other flood limits and depths.

E-20. NED Benefit Evaluation Procedures: Agriculture

a. Purpose. This section provides procedures for the evaluation of agricultural benefits from water resources plans. The benefits attributable to flood damage reduction, drainage, irrigation, erosion control and sediment reduction should be evaluated separately to the extent practical.

b. Conceptual Basis.

(1) NED Benefits. The NED benefits are the value of increases in the agricultural output of the Nation and the cost savings in maintaining a given level of output. The benefits include reductions in production costs and in associated costs; reduction in damage costs from floods, erosion, sedimentation, inadequate drainage, or inadequate water supply; the value of increased production of crops; and the economic efficiency of increasing the production of crops in the project area.

(2) Basic and Other Crops.

(a) Basic crops (rice, cotton, corn, soybeans, wheat, milo, barley, oats, hay, and pasture) are crops that are grown throughout the United States in quantities such that no water resources project would affect the price and thus cause transfers of crop production from one area to another. The production of basic crops is limited primarily by the availability of suitable land.

(b) On a national basis, production of crops other than basic crops is seldom limited by the availability of suitable land. Rather, production is generally limited by market demand, risk aversion, and supply factors other than suitable land. Thus, production from increased acreage of crops other than basic crops in the project area would be offset by a decrease in production elsewhere. In some parts of the Nation analysis of local conditions may indicate that the

Table E- 16 Summary of Annualized NED Benefits and Costs for Alternative Projects

(Applicable discount rate: _____)

Project benefits and costs	Alternatives			
	1	2	3	X

Flood hazard reduction benefits				
Inundation:				
Physical	.....	.....	.....	.....
Income.....	.....	.....	.....	.....
Emergency.....	.....	.....	.....	.....
Total	.....	.....	.....	.....
Intensification	.....	.....	.....	.....
Location:				
Floodplain	.....	.....	.....	.....
Off Floodplain.....	.....	.....	.....	.....
Total	.....	.....	.....	.....
Total flood benefits	.....	.....	.....	.....
Benefits from other purposes	.....	.....	.....	.....
Total project benefits	.....	.....	.....	.....
Project costs	.....	.....	.....	.....
Net benefits	.....	.....	.....	.....

Table E- 17 Flood Damages by Decade, Alternative Projects

(Applicable discount rate: ____)

Project	Time Period[1]			
	P0	P10	P20 etc	AAE [2]
No. 1.....	.....	.....	.....	.....
No. 2.....	.....	.....	.....	.....
No. 3.....	.....	.....	.....	.....

[1]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life
[2]Average annual equivalent

Table E- 18 Flood Damages by Decade Without Project

(Applicable discount rate: ____)

Property Type	Time Period[1]						
	P50	P40 etc	Existing	pn	P10	PN	AAE[2]
a (Subclassification of residential.....	.....	.....	.....	.....	.....	.....	.....
b.....	.....	.....	.....	.....	.....	.....	.....
c.....	.....	.....	.....	.....	.....	.....	.....
Commercial	.....	.....	.....	.....	.....	.....	.....
Industrial.....	.....	.....	.....	.....	.....	.....	.....
Other.....	.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	.....	.....

[1]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life, P50 is 1932, P40 is 1942, etc.
[2]Average annual equivalent

Table E- 19 Number of Acres (or Structures), Floodplain Without Project

Property Type	Existing	Time Period[1]						
		P0	P10	P20	P30	P40	P50	P100
a (Subclassification of residential units.....	.....	.....	.....	.....	.....	.....	.....	.....
b	.....	.....	.....	.....	.....	.....	.....	.....
c	.....	.....	.....	.....	.....	.....	.....	.....
Commercial.....	.....	.....	.....	.....	.....	.....	.....	.....
Industrial	.....	.....	.....	.....	.....	.....	.....	.....
Semipublic	.....	.....	.....	.....	.....	.....	.....	.....
Transportation	.....	.....	.....	.....	.....	.....	.....	.....

[1]Comparable tables may be made for all alternatives, if pertinent.
[2]The designations P10 and P20 identify the 10th and 20th years, respectively, of project life

production of other crops is limited by the availability of suitable land. (Suitable land is land on which crops can be grown profitably under prevailing market conditions.) In this case, crops other than basic crops listed above may also be treated as basic crops when measuring intensification benefits by farm budget analysis. (See paragraph E-20e(4) to determine when other crops may be treated as basic crops.)

(3) Benefit Categories. Agricultural benefits are divided into two mutually exclusive categories, depending on whether there is a change in cropping pattern:

(a) Damage reduction benefits, that is, benefits that accrue on lands where there is no change in cropping pattern between the with and without project conditions; and

(b) Intensification benefits, that is, benefits that accrue on lands where there is a change in cropping pattern. There is also a subcategory of intensification benefits called efficiency benefits, which accrue from reduced costs of production.

(4) Measurement of NED Benefits.

(a) Damage reduction benefits. Damage reduction benefits are the increases in net income due to the plan, as measured by farm budget analysis. These income increases may result from increased crop yields and decreased production costs. ER 1105-2-101 requires risk-based

analysis in all flood damage reduction studies. This includes studies where the primary damages occur to agricultural crops. The ER identifies key variables that will be specifically incorporated into the risk-based analysis. The identified hydrologic/hydraulic variables, discharge associated with exceedence frequency and conveyance roughness and cross-section geometry, apply to agricultural studies. However, the economic variables do not identify the key areas of uncertainty related to the stage-damage relationship in agricultural studies. The ER suggests that key variables in agricultural areas may be seasonality of flooding and cropping patterns. FOAs should incorporate the key variables that apply to their specific area in the risk-based analysis. Documentation of the key variables and the method of analysis should be incorporated in the PSP. Districts are under no requirement to use the economic variables identified in the ER (structure first floor elevation, content and structure values) for agricultural damages or to perform explicit risk-based analysis of agricultural structures if they do not affect the formulation of the project

(b) Intensification benefits. Intensification benefits are measured either by farm budget analysis or by land value analysis. Intensification benefits from increased acreage of basic crops and other crops that are constrained by the availability of suitable land in the WRC assessment subarea (ASA) are measured as the net value of the increased production. Intensification benefits from increased acreage of other crops (except for acreage of crops to be treated as basic crops because they are land constrained) result when there are production cost savings. These production cost savings are called efficiency benefits and are measured as the difference between production costs in the project area and production costs on land elsewhere in the ASA.

(1) Farm budget analysis. On land where the intensification benefit is solely from increased acreage of basic crops (and crops to be treated as basic crops), benefits are measured as the change in net income (see paragraphs E-20e.(3). through E-20e.(6).). On land where the intensification benefit is from increased acreage of other crops, use the efficiency procedure found in paragraph E-20e(8).

(2) Land value analysis. Intensification benefits alternatively may be measured as the difference in the value of benefiting lands with and without the plan. The market value of a parcel of land reflects the capitalized value of the expected net income that can be derived from the land. Therefore, the difference in market value of two parcels of land that are identical except for the provision of improved water conditions reflects the present value of the additional net income (i.e., the intensification benefit) that can be attributed to improved water management or supply. (See paragraph E-20e(9))

c. Evaluation Components. Evaluation of the impact of water management practices or control measures should consider the following components:

(1) Cropping Patterns. Project the most probable cropping patterns expected to exist with and without the project. If project measures are designed to reduce damage or associated cost problems without changing cropping patterns, project the current cropping pattern into the future for both with and without project conditions.

(2) Prices. Use normalized crop prices issued by the Department of Agriculture to evaluate NED agricultural benefits; adjustments may be made to reflect quality changes caused by floods or drought. The Department of Agriculture provides commodity prices, and indexes of prices paid by farmers for purchased inputs, to Federal water resource agency planners for estimating benefits from water projects. In the past, for each crop two prices and for each purchased input two price indexes were reported. One was market clearing prices with Government crop support programs, the other was market clearing prices without the programs. As a result of Section 632 of Public Law 100-460 market clearing prices without Government crop support programs will no longer be reported. Economic evaluation will therefore necessarily use only prices with the support programs**.** For crops not covered above, statewide average prices over the three previous years may be used.

(3) Production Costs.

(a) Analyze production costs that can be expected to vary between the with and without project conditions. These may include the costs of equipment ownership and operation; production materials; labor and management; system operation, maintenance, repair, rehabilitation and replacement (OMRR&R); and interest payments. If costs associated with project measures (e.g., on-farm drainage or water distribution costs) are included in the project cost analysis, exclude them from production costs.

(b) Value purchased inputs at current market prices. Compute interest at the project discount rate. Value all labor, whether operator, family, or hired, at prevailing farm labor rates. Estimate management cost on the basis of the type of farming operation. The estimate normally is expected to be at least six percent of the variable production cost (the cost of equipment ownership and operation, production materials and labor, but excluding the cost of land and added capital improvements).

(4) Crop Yields. Project current yields with average management in the project area to selected time periods. Adjust future yields to reflect relevant physical changes (e.g., erosion, drainage, water supply, and floodwater runoff) in soil and water management conditions. Increases in yields due to future improvements in technology may be included in the evaluation when realization of these benefits is dependent upon installation of the project. The costs associated with these improvements in technology should be accounted for in the analysis.

Changes in yields, both with and without the project, should be projected consistently with the water management and production practices accounted for in the production cost analysis.

(5) Livestock Production. In geographically isolated areas increased livestock production may depend on installation of the water resources project. Where this can be demonstrated, net income from additional livestock production may be included as a benefit. The test for dependency is whether the livestock feeds can economically be transported into or out of the area. Benefits cannot exceed the delivered cost of the livestock feed if it were purchased for use in the project area. Such purchase prices would automatically include the costs of transporting the feeds into the area.

(6) Comparable Lands. Comparable lands are lands that have climate, aspect, slope, soil properties and water conditions similar to those of a given category of lands benefitting from a plan.

(7) Land Values. The market value of lands method for estimating the economic benefits of alternative plans requires the involvement of qualified land appraisers with local experience. Use of this procedure is appropriate when:

(a) Lands to be affected by the proposed alternative plan are comparable to lands elsewhere which can be appraised;

(b) Water resources conditions on comparable lands are similar to those to be provided on lands affected by an alternative plan, and they can be identified and evaluated;

(c) Current market data are used to determine the value of capital improvements and other factors when making adjustments for these factors on comparable lands; and

(d) The estimated value of lands to be affected by the plan is not changed by speculation that Federal action is anticipated.

d. Planning Setting.

(1) The without project condition, including conservation measures, is the condition expected to exist in the absence of an alternative plan.

(2) The with project condition is the condition expected to exist with each alternative plan under consideration.

(3) Agricultural income and production costs should be determined for various conditions or levels of land and water quantity and/or quality use. (Include other resources

associated with changes in land and water quantity and/or quality.) The level of use to be evaluated initially is the without-plan condition. Other levels of use to be evaluated will depend on the number of alternative plans selected for analysis.

e. Evaluation Procedure: Crops. This procedure is for the evaluation of benefits to crop production that would accrue from an alternative plan. Steps in this procedure are summarized in Figure E-5.

(1) Step 1. Identify Land Use and Cropping Patterns With and Without a Plan. This information is generally developed for segments of the plan area with significantly different characteristics. Collect appropriate data about the current and historic cropping patterns and yields in the project area. When appropriate, collect similar data on other areas with comparable soils to determine conditions expected with alternative plans. Analyze trends and expected changes for without project conditions. Project future cropping patterns and yields under without plan conditions. Include the effects of conservation and structural and nonstructural measures expected under existing programs. Project future cropping patterns and yields for each alternative plan. For analytical purposes, separate land in the project area into two categories: lands on which the cropping pattern is the same with and without the plan; and lands on which there would be a change in cropping pattern with the plan. To estimate crop production benefits on lands where there would be a change in cropping pattern, go to Step 3. To estimate crop production benefits on lands where there would not be a change in cropping, proceed with Step 2.

(2). Step 2. Determine Damage Reduction Benefit. For land on which the cropping pattern would not change, determine the change in net income with and without a plan. This is the damage reduction benefit. Income increases may result from increased crop yields and decreased production costs. They are measured as reduced damage to crops from excessive soil moisture, water inundation, drought and erosion, and reduced costs associated with using water and land resources for the production of crops.

(a) Estimate reduced damage to crops from excessive soil moisture on the basis of the change in frequency and duration of excessive soil moisture. Estimate reduced damage to crops from water inundation on the basis of the change in frequency, depth, and duration of inundation. Estimate reduced damage from drought on the basis of the change in frequency and duration of inadequate soil moisture during the growing season. Estimate reduced damage from erosion on the basis of the change in land voiding from gully and streambank erosion and on the basis of the

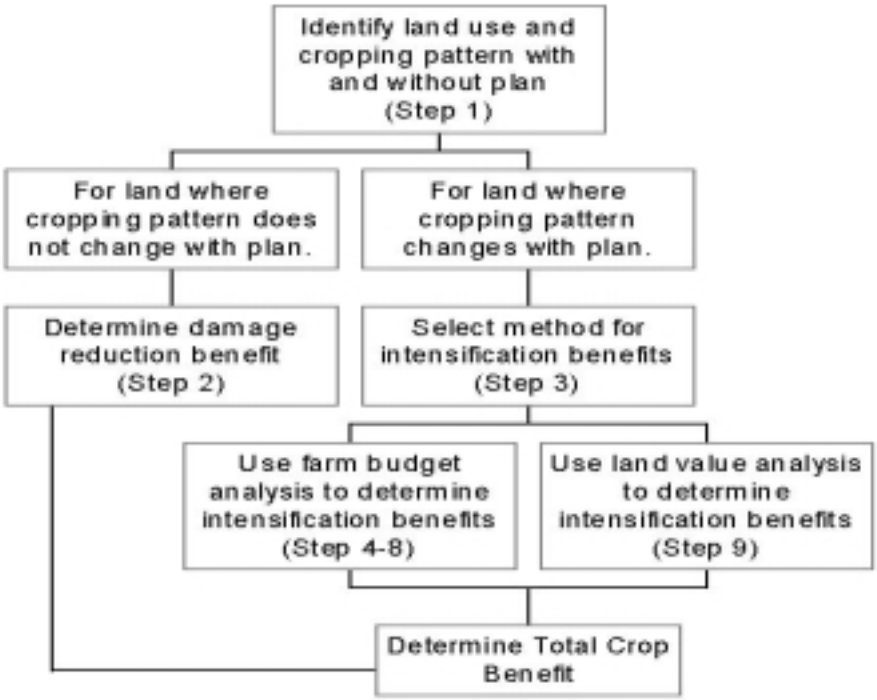


Figure E- 5 Agricultural Benefits Evaluation Procedure

change in productivity losses from floodplain scour, sheet erosion, overbank deposition, and swamping.

(b) Estimate reduced costs associated with using water and land resources for the production of crops on the basis of the changes in the costs of equipment ownership and operation; production materials; labor and management; and system operation, maintenance, and replacement.

(c) Use farm budget analysis to measure changes in net income from reduced damage to crops and reduced costs of production.

(3). Step 3. Select Evaluation Method for Estimating Intensification Benefits. For land on which the cropping pattern would change, select either farm budget analysis or land value analysis as the method for measuring intensification benefits. If land value analysis is selected, go to Step 9. If farm budget analysis is selected, proceed with Step 4.

(4) Step 4. Determine Whether Other Crops Are to be Treated as Basic Crops. If the change in cropping pattern increases the acreage in production of other crops and if it is believed that the production of other crops is constrained by the availability of suitable land, the following test may be applied to determine whether these crops should be treated as basic crops in the benefit analysis. If the test is not applied, go to Step 8.

(a) Select a representative sample of farm operations on lands comparable to lands benefitting from the project under with project conditions where there would not be a change in cropping pattern, proceed with Step 2.

(b) For each farm operation determine the respective acreage of basic and other crops.

(c) Use these data to compute the proportion of other crop acreage to total crop acreage for each farm.

(d) Use farm budget analysis to identify the top 25 percent of farms in the representative sample in terms of expected net income per acre.

(e) The average of the proportions of other crop acreage to total crop acreage for the top 25 percent of farm operations is defined as the “optimal proportion”. The optimal proportion for these farm operations will reflect risk and uncertainty, returns to management, and prevailing market conditions.

(f) If it can be demonstrated through standard statistical tests that the optimal proportion is not statistically different from the proportion computed as the average of individual farm operation proportions for the complete sample, then the production of other crops can be considered to be constrained by the availability of suitable land in the ASA and, therefore, treated as basic crops. Otherwise it can be inferred that production of other crops is not land constrained in the ASA. When the crops are not land constrained, go to Step 8; otherwise, proceed with Step 5.

(5) Step 5. Determine Limit on Acreage of Other Crops That May be Treated as Basic Crop Acreage. If the production of the other crops is found to be constrained by availability of suitable land in the ASA, then multiply the acreage of comparable land in the project area by the optimal proportion found in Step 4(a). This is the maximum acreage of other crops that may be analyzed using the steps that apply to basic crops (Steps 6 and 7). To analyze benefits for any acreage of other crops in excess of this maximum acreage, go to Step 8.

(6) Step 6. Project Net Value of Agricultural Production With and Without the Plan. Use information from farm budget analysis to estimate the net value of agricultural production under without plan conditions. Estimate the net value of agricultural production associated with each of the alternative plans. Account for variable costs related to production. Include non-project OM&R costs and associated costs for each alternative plan.

(7) Step 7. Compute Intensification Benefits for Acreage of Basic Crops and Other Crops to be Treated as Basic Crops. Compute intensification benefits as the change in net income between the without project condition and conditions with an alternative plan. Express these intensification benefits in average annual equivalent terms. This completes the analysis of benefits for lands with increased acreage of basic crops and other crops that are to be treated as basic crops.

(8) Step 8. Determine Efficiency Benefits. Compute efficiency benefits for acreage producing other crops not treated as basic crops as the sum of:

(a) The difference between the cost of producing the crops in the project area and the cost of producing them on other lands in the ASA; and

(b) The net income that would accrue from production of an appropriate mix of basic crops on those other lands. Express this efficiency benefit in average annual equivalent terms.

(9) Step 9. Land Value Analysis. When estimating intensification benefits on the basis of land value analysis, base appraisals on market values, not on capitalized income values.

(a) Obtain appraisals of the current market value of lands that would benefit from the plan. These lands should be divided into various categories where values differ significantly.

(b) Obtain and appropriately adjust appraisals of non-project lands in the ASA that are comparable to lands in each category of project lands and that have water conditions comparable to those that would result from each alternative plan.

(1) Adjust the value of these comparable lands for facilities and other capital improvements that are not present on project lands. For example, subtract the current market value of improvements such as investments in orchards.

(2) In the case of irrigation projects, add to the appraised value of comparable lands the present value of water costs incurred by the operator. These water costs include both payments to outside suppliers and the cost of self-supplied water. Use the project discount rate to calculate the present value of these costs.

(3) Control for other factors that may affect the value of land, such as kinds of crops grown, distance to urban areas, availability of transportation facilities, presence of utilities, zoning regulations, and special property tax rates. This control may be achieved by using totally comparable parcels of lands; by collecting a sample large enough so that differences will be averaged out; or by a statistical means such as regression analysis.

(c) Subtract the value in paragraph E-20e(9)(a) from the adjusted value in paragraph E-20e(9)(b). This is the intensification benefit.

(d) Annualize the intensification benefit found in the subparagraph (c) above at the project discount rate.

f. Damage Reduction For Other Agricultural Properties and Associated Agricultural Enterprises.

(1) Determine Damage Reduction for Other Agricultural Properties. The term "other agricultural properties" includes physical improvements associated with various farm enterprises and the agricultural community. Measure benefits to such properties as reduction in damages in the future with the project compared to without the project. The following discussion identifies key analytical steps in the evaluation. Benefits accrue through alterations in water conditions or in altering the susceptibility of the property to damage (e.g., flood proofing).

(a) Inventory Damageable Improvements. Identify the location, type, number, and value of other agricultural properties within the area that are subject to damage. This information is most easily obtained through interviews of farmers and field reconnaissance.

(b) Determine Damage to Improvements. Gather historical data on damages to other agricultural properties, such as equipment, improvements, and agricultural enterprises.

(c) Determine Average Annual Equivalent Damage to Improvements. Use appropriate data to determine average annual equivalent damage to improvements. For example, use depth-damage relationships for each reach, integrated with hydrologic data, to develop average annual flood damages with and without the plan. Include consideration of the frequency and duration of the damage.

(2) Determine Damage Reduction Benefits for Associated Agricultural Enterprises. Associated agricultural enterprises are economic activities that may be affected by changed water supply or water management conditions. Evaluate damages of this type as reduced net income under without project and with project conditions. An example of this type of damage is delay in spring planting on flood free lands because of flooding of access roads.

(3) Calculate Average Annual Equivalent Benefits. The damage reduction benefit is the difference between average annual equivalent damages with and without the plan.

g. Off-site Sediment Reduction. Determine average annual equivalent sediment damages by adding the costs in constant dollars of removing sediment from roads, culverts, channels, etc., over a representative period of time and dividing by the years of record. The difference in damages with and without the project is the benefit. Extending the useful life of an existing reservoir is another type of sediment reduction benefit. Discount the net value of the extension to present values, and amortize it over the project life. The increased cost of providing goods and services (e.g., additional treatment costs for removing sediment from municipal water) can also be used to evaluate damages. Reductions in the costs of sediment removal or water treatment provide the basis for assessing benefits with the plan.

h. Evaluation Procedures: Problems in Application.

(1) Damage Reduction Benefits. Damage reduction benefits are measured by farm budget analysis. Proper measurement of such benefits requires accurate estimates of with and without plan soil, water, and land use conditions. Changes in physical conditions take place at different rates and over different time periods. Analysis can be improved by projecting changes in physical conditions to selected time periods, analyzing net income for the time periods, and converting net income for the time periods to an average annual equivalent value. In farm budget analysis, double counting can be avoided by taking a holistic approach (including all soil, water and land use conditions in a single farm budget analysis).

(2) Determination of Land Constraint. Intensification benefits for other crops are measured either as a change in net income or as an efficiency gain depending on whether there is an adequate supply of suitable land in the region for growing crops other than basic crops (that is, whether production is land constrained). This determination requires a regional (ASA) analysis of comparable lands. In order to make this determination properly, care must be exercised to ensure that lands being evaluated are fully comparable. Care must also be exercised in order to obtain the proper determination of aggregate acreage of basic and other crops for the top 25 percent of the farms. (See paragraph E-20e(4))

(3) Benefit Attribution. In flatland watersheds, drainage and flood damage reduction benefits cannot be separated analytically. Therefore, they are arbitrarily allocated on a 50/50 basis. The value of benefits in other categories is determined on the basis of changes in physical conditions with and without the plan. The benefits are assigned according to the following: the proportion of the change in net income attributed to changes in soil moisture, water inundation, drought and erosion; the proportion of land use changes attributed to each of the above; and changes in production costs attributed to each of the above. Except for the problem with drainage and flood damage reduction in flatland watersheds, benefits can be measured independently if proper assumptions are made to avoid double counting. Double counting can be avoided by making sure that total benefits measured independently do not exceed total benefits from a holistic farm budget analysis.

(4) Residual Damages. In evaluating with plan conditions, care must be taken to consider residual damages, that is, damages that would still occur with implementation of the plan.

(5) Land Value Analysis. Because proper real estate value(s) analysis is dependent on accurate appraisals, the land analysis must be based on appraisals performed by qualified appraisers. Adjustment of comparable real estate to project lands requires detailed knowledge of local physical and financial conditions to account for capital improvements, costs of water supply, and other factors affecting the values.

(6) Agricultural intensification benefits cannot exceed the increased flood damage potential when the existing cropping pattern is compared to the intensified cropping pattern (without the proposed plan).

(7) Agriculture: Swampbuster. The Food Security Act of 1985 (Public Law 99-198) contains provisions known collectively as "Swampbuster". Their intent is to discourage conversion of farm wetlands. The Swampbuster provisions were implemented as a USDA final rule (7 CFR 12), effective 17 September 1987.

(a) Conversion of wetlands is discouraged by imposing penalties on farmers who plant commodity crops on lands that were converted from wetlands after 23 December 1985. The penalty is loss of a wide variety of Agriculture Department program benefits, including all types of price supports or payments; crop insurance; access to loans made, insured, or guaranteed by FMHA; and others. If imposed, the penalty applies to all holdings of the farmer, not just to the acres that were converted and cropped.

(b) More information about the purposes, policies, and procedures of the Swampbuster program are contained in the final rule cited above. Details about the program, and its management and administration, as well as determinations of its applicability to specific Corps projects can be obtained through the regional offices of the USDA Soil Conservation Service.

(c) Without and With Project Analysis. The effects of the Swampbuster program shall be explicitly considered in without and with project conditions.

(1) Benefit Evaluation. The effects of the program will operate through farm operator decisions to convert and cultivate on-farm wetlands. Particularly important for benefit evaluation is with project condition analysis, as a Corps project may by itself convert wetlands to non wetlands, or may make additional private conversion investments more profitable. The Swampbuster program, however, may modify incentives sufficiently to alter with project cropping plans, and may even affect support for particular projects.

(2) Incremental Cost of Mitigation Analysis. Swampbuster will have no effect procedurally on the analysis of the incremental cost of mitigation. It may affect the amount of wetland loss expected in the without project condition, the amount of any wetland preservation

credit due the project, and through these the total amount that will be considered for mitigation. (See Appendix C.)

i. Evaluation Procedure: Data Sources.

(1) Interviews. Interviews with farmers and other area residents are important for most of the categories of benefits to be evaluated. Interviews should not be confined to farmers in the project area. Data collected outside the project area serves as a comparative basis for estimating damages and yields in the project area. Use only interview forms approved by the Office of Management and Budget. In the project report, the questionnaire and a summary of responses should be compiled and displayed in such a way as to prevent the disclosure of individual sources.

(2) Physical Specialists. Agronomists and soil scientists can provide data to establish yield estimates by soil type and the effects on production of soil depletion or sediment deposition.

(3) Universities and Federal Agencies. Many universities and the Department of Agriculture have developed typical enterprise budgets that can be modified to reflect conditions in the area being studied.

(4) Land Appraisers. Market values of project lands and comparable lands should be provided by qualified real estate appraisers. The market values must be processed through the appropriate real estate division.

(5) IWR Report. Additional detailed support material for conducting NED evaluation may be found in Agricultural Flood Damage (IWR Report 87-R-10, October 1987). This manual provides an expanded description of agricultural benefit evaluation procedures. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within this IWR report.

j. Report and Display Procedures. A clear presentation of the study results will facilitate review. Tables E-20 and E-21 are suggested presentations.

E-21. Federal and Non-Federal Participation. As a general rule, a PCA must be executed between Federal and non-Federal participants prior to advertising and award of the contract.

a. Structural Measures. The 1986 and 1996 Water Resources Development Acts modified the basic requirements for non-Federal participation in flood control projects. The requirements for structural projects are essentially as follows:

(1) Provide a cash contribution equal to 5 percent of structural flood control features costs.

(2) Provide all lands, easements, rights-of-way, relocations (except existing railroad bridges and approaches thereto) and suitable borrow and dredged material disposal areas (referred to as LERRD).

(3) If the sum of the above two items is less than 35 percent of the costs assigned to flood control, non-Federal sponsors will pay the difference in cash. If it is greater than 35 percent, total non-Federal costs shall not exceed 50 percent of total project costs assigned to flood control. Contributions in excess of 50 percent will be reimbursed by the Federal Government to the non-Federal sponsor. Total contributions in excess of 30 percent may be reimbursed to the Federal government over a period not to exceed 15 years.

(4) Operate, maintain, repair, replace and rehabilitate the project after completion without cost to the United States in accordance with regulations prescribed by the Secretary of the Army.

(5) Hold and save the United States free from damages due to the construction or subsequent operation and maintenance of the project, except those damages due to the fault or negligence of the United States or its contractors.

(6) Prevent future encroachment or modifications, which might interfere with proper functioning of the project.

(7) Participate in the National Flood Insurance Program and other applicable Federal flood plain management programs.

(8) Provide guidance and leadership to prevent unwise future development in the flood plain.

b. Nonstructural Measures.

(1) Provide thirty-five percent of total project costs. A five percent cash contribution is not required.

(2) Provide all LERRDs, credited to sponsor's share. If credited LERRDs are less than thirty-five percent, sponsor will pay the difference in cash. Payments during construction are preferred, but an option exists for payment beginning upon construction completion. Deferred payments require ASA(CW) agreement. If LERRDs are more than thirty-five percent, the excess is reimbursed by the Federal Goverment.

(3) When LERRDs are more than thirty-five percent an agreement between the sponsor and the Federal Government on the most efficient and practical means for acquiring the excess LERRDs is required.

(4) Operate, maintain, repair, replace and rehabilitate completed project including, for a flood warning system, development and adoption of a detailed response plan. This plan must be acceptable to the Corps.

(5) Participate in the National Flood Insurance Program and other applicable Federal flood plain management programs.

(6) Nonstructural measures are always cost shared as nonstructural measures, even if they are mitigating for damages induced by structural measures of the same project.

(7) Other standard items included under structural measures will apply where appropriate.

Table E- 20 Summary of Crop Benefits (Farm Budget Analysis Method)

Item	Current	Base	Year[a]	Year[a]	Year[a]	Year[a]	Year[a]	Annualized Value[b]
Without Plan								
Acres:								
basic crops	.....	.....	.....	.....	.....	.....	.....	.....
other crops	.....	.....	.....	.....	.....	.....	.....	.....
Value of agricultural production	.....	.....	.....	.....	.....	.....	.....	.....
Agricultural production costs	.....	.....	.....	.....	.....	.....	.....	.....
With Plan								
Acres:								
basic crops	.....	.....	.....	.....	.....	.....	.....	.....
other crops	.....	.....	.....	.....	.....	.....	.....	.....
Value of agricultural production	.....	.....	.....	.....	.....	.....	.....	.....
Agricultural production costs	.....	.....	.....	.....	.....	.....	.....	.....
NED BENEFITS	.....	.....	.....	.....	.....	.....	.....	.....

[a]Annual value at the given year.
[b]Annualized at ____ percent discount rate.

Table E- 21 Intensification Benefits (Land Value Analysis Method)

Item	Current Year	Annualized[a]
Without Plan		
Value of agricultural land		
With plan		
Value of agricultural land		
INTENSIFICATION BENEFIT		

[a]Annualized at ____ percent discount rate

c. Cost Sharing - Special Cases.

(1) Betterments. Non-Federal interests normally pay the incremental cost for all desired betterments. Examples include the cost of flood control channel covering not needed for safety (ER 1165-2-118), and the costs of departures from the NED plan not part of an exception granted by ASA(CW).

(2) Highway Bridges. Alterations to highway bridges necessitated by a flood control project are considered part of LERRD and are a non-Federal responsibility. However, protection by reinforcement, underpinning, or construction to ensure the structural integrity of the bridge foundations, piers, or abutments, are considered construction costs, and are subject to standard cost-sharing rules. But, if new piers, foundations or abutments are required for additional spans in the bridge crossing, the work will be considered a relocation and a non-Federal responsibility. Highway bridges over channel cuts in fast lands are highway relocations and part of LERRD.

(3) Railroad Modifications. Existing railroad bridge (and approaches thereto) relocations and alterations, required as part of a flood control project, are considered construction costs and not relocations for cost-sharing purposes. This is in accordance with the intent of Section 3 of the 1946 Flood Control Act. Any required modification to the bridge approaches can also be evaluated as a construction cost. However, for railroad lines that are not bridges, relocation or alteration is considered a non-Federal responsibility. An example is a rail line passing through a reservoir site. New railroad bridges over a channel cut in fast lands that are included in feasibility reports are considered LERRD unless specifically authorized as a construction cost item.

(4) Abandoned Bridges/Buildings. Removal costs are considered construction costs.

(5) Covers for Flood Control Channels. If needed for safety the costs are considered construction costs. Otherwise the costs are non-Federal and are not credited towards total project costs.

(6) Utility Lines Under Proposed Levees. If the relocation is required as a matter of just compensation, these costs are considered LERRD. Otherwise, such costs are removals and are considered construction costs.

(7) Pedestrian Bridge Over Proposed Levee. A bridge provided because a levee interrupts pedestrian traffic is considered a relocation under LERRD.

(8) Relocation of Existing Recreation Facilities. If a proposed levee passes through an existing park and recreation facilities will be impacted, relocated facilities are a non-Federal responsibility under LERRD.

(9) Lands Needed for F&W Mitigation. There are no special rules for F&W mitigation costs. All land costs are LERRD and costs of plantings or other modifications are construction costs.

(10) Intercepted Interior Drainage. Interception and conveyance of drainage through or over a flood control work with measures such as intercepting ditches, ponding areas, pumping plants, gravity outlets, and pressurized conduits, are part of project construction, with the costs shared as construction costs. All lands associated with measures for interior drainage are part of LERRD. Any costs of increasing the size of the facilities to meet special local needs, as for betterments, are non-Federal costs.

(11) Stormwater/Sanitary Sewer Collection Systems and Interceptor Storm Sewers. Stormwater/Sanitary collection systems consisting of sewer pipes are utilities, and alterations of such systems are part of LERRD. Interceptor sewers and associated features may be more efficient than a number of separable sewer alterations, and such features are also LERRD. Efficient design may result in a single project feature to accommodate blocked interior drainage and the requirements for stormwater/sanitary sewers collected via interceptors. In such cases, the costs will be apportioned on a fair share basis between LERRD and construction costs. The fair share is to be based on the costs associated with separable facilities. The costs of measures that provide for positive flood control, such as gated sewers, outlets and gate well structures are project construction costs to be shared by non-Federal sponsors.

(12) Headwall Structures. Accommodation of pipes through the side slopes of channel projects may be accomplished along with project construction, but any identifiable added costs for end treatment of sewer pipes is part of LERRD.

(13) Levee Crossings. Where a levee or floodwall intersects a transportation facility, and a crossing structure is necessary, a closure structure or a ramp structure will be selected on the basis of efficiency and the appropriateness of a closure structure in view of the flood characteristics of the area. The closure structure or an appropriate section of the ramp structure along the line of protection (i.e., the volume of the ramp structure that would be a part of the flood control structure in the absence of a transportation feature) shall be classified as a construction item. Any additional work necessary to provide a ramp structure included in the selected plan shall be classified as a LERRD item.

(14) Credit for LERRD Specific guidance on crediting the value of LERRD toward the non-Federal share of project costs is contained in ER 1165-2-131.

(15) Windfall Benefits. Projects that provide land enhancement benefits of unconscionable magnitude to a few beneficiaries are subject to special cost sharing. Usually a

cash contribution is required, equal to 50 percent of the cost allocated to the windfall benefits. In those cases where windfall benefits are minor and incidental to implementation of the project, no special cost sharing is required. Potential windfall benefit situations should be surfaced as early as possible in the planning process and addressed by higher authority but no later than the FRC.

(16) Other Special Cost Sharing. Section 2 of the 1920 River and Harbor Act indicates that every report submitted to Congress should discuss special or local benefits which accrue to localities with a recommendation as to what local cooperation should be required, if any, on account of such benefits. This authority may be used to recommend special cost sharing for reasons of equity. The act predates the "a-b-c" requirements of the 1936 Flood Control Act and the landmark cost sharing requirements of the WRDA 1986. But, it remains relevant in that it signifies that Congress is concerned with, and directs the Corps to address, equity issues arising when identifiable localities or communities are beneficiaries to a far greater degree than they are cost sharers.

(17) General Credit for Flood Control. Section 104 of the 1986 WRDA establishes guidelines for crediting sponsors for constructing portions of a flood control project. ER 1165-2-29 outlines the procedures for crediting sponsor construction work. Sponsor work must receive ASA (CW) approval prior to initiation of construction to be eligible for credit. Work eligible for approved credit should be addressed in report recommendations, and recommendations must be supported by specific report documentation of compliance with the Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies (for example, documentation of economic justification).

SECTION IV – Hurricane and Storm Damage Prevention

E-22. Federal Interest. Congress has authorized Federal participation in shore protection projects to prevent or reduce damages caused by wind and tidal generated waves and currents along the Nation's ocean coasts and Great Lakes shores.

E-23. Types of Improvements. The improvements are usually structural measures including such features as beachfill, groins, seawalls, revetment, breakwaters, and bulkheads. Nonstructural measures, such as property acquisition, may also be appropriate.

E-24. Specific Policies. These policies are presented in more detail in ER 1165-2-130.

a. Geographic Applicability. The shore protection authority is applicable to the shores of the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, estuaries, and bays directly connected therewith of each of the States, the Commonwealths of Puerto Rico and the Northern Mariana Islands, and the possessions of the United States. The authority extends only that distance up streams where the dominant causes of damage are storms or ocean tidal action (or Great Lakes water motion) and wind-generated waves. The program does not address damages caused by streamflows or vessels.

b. Beach Restoration and Protection and Historic Shoreline. Existing authority provides for restoration and protection of beaches. It does not provide for extending a beach beyond its historic shoreline unless the extension is desirable for engineering reasons, is environmentally acceptable, and is an economically justified means to prevent or reduce storm damage behind the historic shoreline.

c. Formulation and Establishing Corps Participation. Shore protection projects are formulated to provide hurricane and storm damage reduction. Recreation is incidental. The Corps participates only in those projects formulated exclusively for hurricane and storm damage reduction, and justified (BCR $\geq$ 1.0) based solely on damage reduction benefits, or a combination of damage reduction benefits plus (at most) a like amount of incidental recreation benefits. In other words, recreation benefits useable to establish Corps participation may not be more than fifty percent of the total benefits required for justification, which in turn means they may not exceed an amount equal to fifty percent of costs. If the criterion for participation is met, then all recreation benefits are included in the BCR. Costs incurred for other than the damage reduction purpose, i.e. to satisfy recreation demand, are a 100% non-federal responsibility.

d. Public Use and its Relation to Federal Participation. Federal involvement in shore protection developed historically in a beach context, generally with efforts to stabilize, create or restore beaches. It was intended that beaches receiving public aid should not provide exclusively private benefits, and therefore, whenever a hurricane and storm damage reduction project involves beach improvements, real estate interest to insure public use of the Federal project is required. (See Table E-22.) Items related to public access are discussed below.

(1) User Fees. Reasonable beach recreation use fees used to offset the local share of project costs are allowable.

(2) Parking. Lack of sufficient parking facilities for the general public (including nonresident users) located reasonably near and accessible to the project beaches may constitute a restriction on public access and use, thereby precluding eligibility for Corps participation. Generally, parking on free or reasonable terms should be available within a reasonable walking distance of the beach. The amount of parking should be consistent with the attendance used in benefit evaluation. In some instances non-Federal plans may encourage or direct substitution of public transportation access for private automobile access. Reports considering public transportation must indicate how the public transportation system would be adequate for the needs of projected beach users.

(3) Access. Provision of reasonable public access rights of way, consistent with attendance used in benefit evaluation is a condition of Corps participation. Reasonable access is access approximately every one-half mile or less.

(4) Beach Use by Private Organizations. Federal aid to private shores owned by beach clubs and hotels which limit beach use to members or guests is contrary to the intent of Public Law 84-826.

(5) Public Shores with Limitations. Publicly owned beaches, which limit use to residents of the community or a group of communities, are not considered to be open to the general public and are treated as private beaches.

e. Shore Lines Owned by Federal Agencies.

(1) Work to provide shore protection to lands under the jurisdiction of another Federal agency is accomplished only on a reimbursable basis, upon request from the agency. In the event protection has not been requested and such lands are within the study area, Civil Works funds may be used if including them in a project is more cost effective than excluding them.

(2) Protection of (non Civil Works) Department of the Army lands is accomplished with military funds, not civil works funds. If the lands are a minor part within the study area, Civil Works funds may be used if including them in a project is more cost effective than excluding them.

f. Evaluation. This paragraph provides general principles for evaluation of benefits from hurricane and storm damage prevention projects.

Table E- 22 Shore Ownership and Levels of Federal Participation

Shore Ownership (4) and Project Purposes or Benefits	Maximum Level of Federal Participation Construction (2)	Operation Main,Repair,Replace Rehabilitation (OMRR&R)
I. Federally owned (1)		
HSDR on Developed Lands	100%	100%
HSDR to Undeveloped Lands	100%	100%
Recreation (Separable Costs) (7)	100%	100%
II. Publicly and privately owned (protection results in public benefits) (3)		
HSDR on Developed Lands	65% (8)	0%
HSDR to Undeveloped Lands		
Public lands (5) (6)	50% (8)	0%
Private lands	0%	0%
Recreation (Separable Costs) (7)	50% (8)	0%
III. Privately owned, use limited to private interests		
HSDR on Developed Lands (9)	0% (8)	0%
HSDR to Undeveloped Lands	0%	0%
Recreation (Separable Costs) (7)	0%	0%

(1) See paragraph E-24e on protecting other Federal agency shores.
(2) Periodic nourishment is considered "construction."
(3) Privately owned shores under public control, as through a sufficiently long-term lease assuring realization of public benefits throughout the economic life of the project.
(4) The status of Indian shores depends upon the particular treaty provisions pertaining to the lands in question and will need to be examined in each instance. Specific cases should be referred to CECW-P for guidance.
(5) Non-Federal public shores dedicated to recreation or fish and wildlife purpose.
(6) Adjusted by the ratio of public to total shore protection benefits along the protected shore.
(7) Department of Army Policy precludes civil works funding of separable recreation measures at shore protection projects.
(8) The fair market value of LERRD is included in these cost sharing percentages, unless the land has no value or special benefit situation considerations apply.
(9) Federal participation in construction could be 65 percent if project is only for inundation reduction or wave damage reduction and does not provide beach erosion control or shoreline protection. Note that no Federal participation in beach fill or restoration would be allowed due to the absence of public benefits.

(1) Systems Analysis. Because shoreline processes are dynamic, shore protection measures may generate both beneficial and adverse impacts beyond immediate project sites. Impacts elsewhere may occur as a consequence of the design and implementation of site specific hurricane and storm damage reduction projects, and navigation projects may impact or be impacted by such projects. These impacts must be evaluated, and this requires expansion of the study area to include reaches adjacent to the project site. Generally, the adjacent reaches are bounded by natural features that interrupt or substantially limit the natural littoral processes (e.g., bays, sounds, inlets, geomorphic features, etc.). For studies which may not require a full systems approach, the justification shall be documented in the feasibility report. A systems analysis approach will include the following components:

(a) Physical Processes. Develop a sediment budget for the segment of coast under investigation based on modeling of sediment movements, empirical data, and estimates of gross and net shoreline change rates over the past fifty year period, as well as rates of change during the most recent decade. Ascertain the effects and probability of occurrence of relevant storm events. Identify the magnitude of the average annual volumetric changes in beach area and volume.

(b) Coastal Alterations. Identify man-made alterations to the shore (jetties, sand-bypassing and recycling, dredging, seawalls, groins, breakwaters, beach nourishment, etc.) and estimate their contribution to the balance of littoral processes and shoreline changes. This information, and knowledge of the physical processes, establishes the historical and existing conditions.

(c) Forecast Shoreline Changes. Forecast shoreline changes (including changes in nourishment requirements, if appropriate) and navigation related dredging requirements for the economic life of the proposed measure. Forecast this for future without and with project conditions.

(d) Economic Benefits and Costs. Inventory potential damage centers and locations of other project induced benefits or costs. For without and with project conditions estimate the costs of maintaining shore protection and navigation projects. At the project site and other impacted sites assess the extent of damages to property through analysis of storm surge and wave damage; assess changes in recreation (if any); and evaluate project impacts to jetties, channels and other navigation features.

(2) Evaluation Procedure. The steps to evaluate benefits for hurricane and storm damage prevention projects are described in the following paragraphs. (See Figure E-6.) The level of effort expended on each step will depend on the scope and nature of the proposed improvement, the state of the art to accurately develop the estimates and the sensitivity of project formulation and evaluation to further refinement.

(a) Step 1 – Delineate the Study Area. The study area is that area affected by storms and erosion problems and by proposed alternatives. It includes areas indirectly affected by the

problems and projects such as downdrift areas and navigation and other projects outside the immediate project site.

(b) Step 2 – Define the Problem. In this step, existing storm damage and erosion problems are identified and described. The description of existing conditions should include a history of the economic and social effects of storm damage and erosion problems in the area, a history of storms and erosion trends and historical floods and wave attack problems. A determination of the degree of protection afforded by existing structures is also made as part of this step. This includes an assessment of the level of protection actually provided by the structure, its structural integrity, the remaining useful life and operation and maintenance requirements.

(c) Step 3 – Select Planning Shoreline Reaches. Reaches are the primary economic sub-unit of analysis. Geomorphic conditions, land uses and type or level of existing protection are criteria used in the designation of reaches.

(d) Step 4 – Establish Frequency Relationships. Two types of frequency relationship are developed for the analysis. These are elevation-frequency relationship and erosion-frequency relationship. The first one shows the relationship between wave and water level and frequency of occurrence and is used to derive expected annual inundation damages. The second one shows the relationship between periodic erosion (or accretion) and frequency of occurrence and is used to estimate erosion-induced damages.

(e) Step 5 – Inventory Existing Conditions. An inventory of affected properties, including land, is performed to estimate potential damages. The inventory is done by land use activities (i.e., residential, commercial, industrial, etc.) and includes variables such as value, use, ground elevation, distance from the water, construction materials, area, and number of stories. Areas likely to be developed in the future or where land use changes could occur are also identified.

(f) Step 6 – Develop Damage Relationships. Damage relationships describe the expected value of structural or contents damages caused by various factors, such as depth of flooding, duration of flooding, sediment load, wave heights, amount of shoreline recession and warning time. Generalized or site-specific damage relationships can be used depending on the scope of the study and the availability of applicable generalized relationships. Generalized damage relationships are those developed for other geographic areas with similar characteristics to the study area. Site-specific damage relationships are usually required to estimate wave attack and erosion damages. These damage relationships are developed using actual damage data from past storm events. Estimates of losses for buildings, roads, protective works, and other features are developed at current price levels for existing development. Damage relationships are developed for each land use

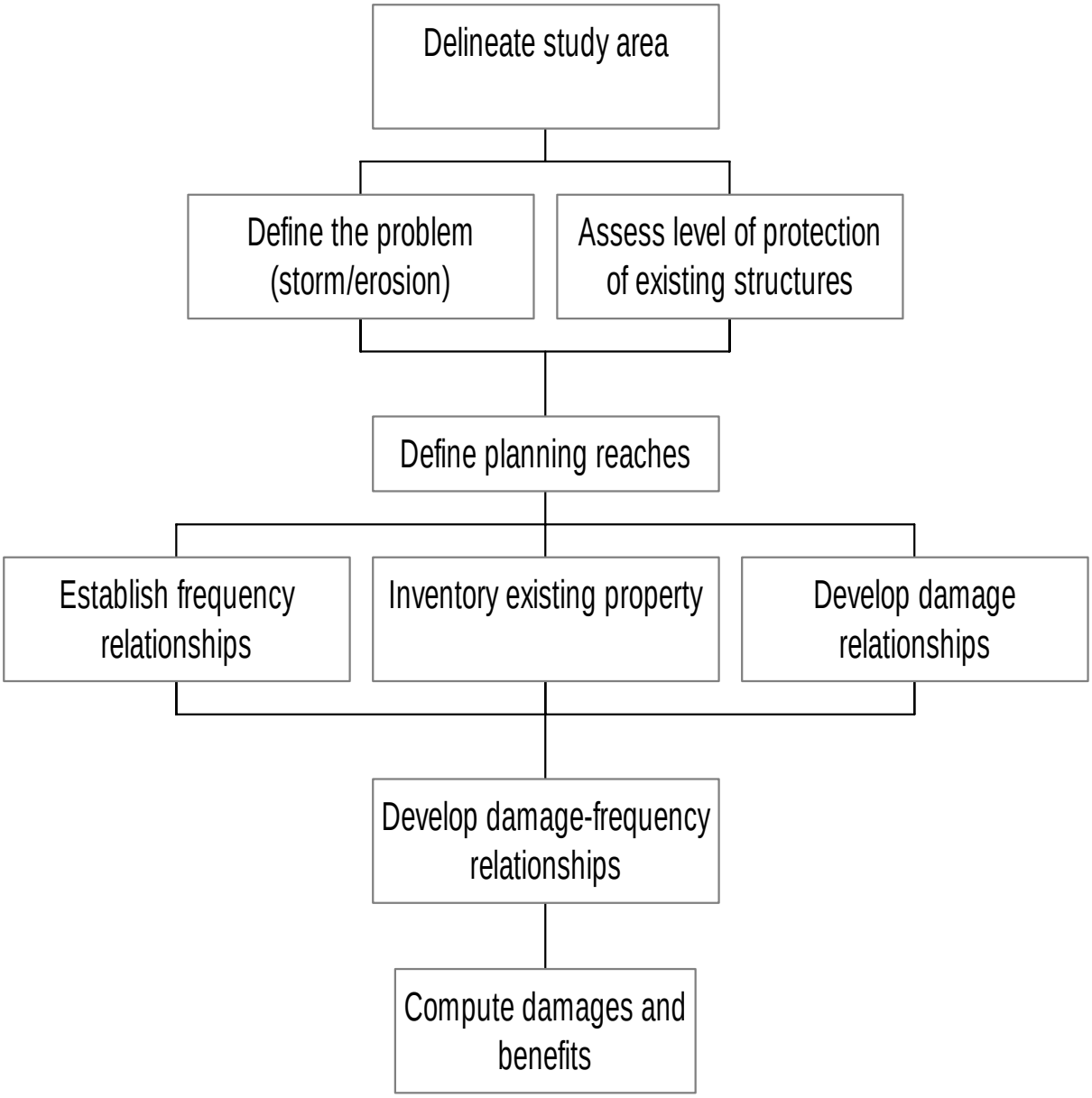


Figure E- 6 Hurricane and Storm Damage Prevention Benefits Evaluation

category. Anticipated damages from land loss due to erosion are computed as the market value of the average annual area expected to be lost. Nearshore land values are used to estimate the value of land lost. A risk-based analytical framework should be used to develop the damage relationships.

(g) Step 7 – Develop Damage-Frequency Relationships. The damage-frequency relationships represent how the damage associated with a given event (i.e., storm, wave, erosion)

is related to the frequency of that event (probability of occurrence). The damage relationships developed in step 7 are combined with the frequency curves (developed by the hydraulic and hydrologic engineers) to estimate the damage-frequency relationships. Damage-frequency relationships (curves) are developed for each of the applicable damage mechanisms, i.e., long-term erosion, recession, inundation and wave attack and for each land use category. These relationships should be developed using a risk-based analytical framework.

(h) Step 8 – Calculate Expected Annual Damages and Benefits. The expected annual damage is the expected value of erosion losses and storm damages in any given year. Expected annual damages are calculated by computing the area under the damage-frequency curve using a life-cycle approach. Expected annual damages are calculated for the with- and without-project conditions. The difference between the with- and without-project expected annual damages represents the benefit associated with the project.

(3) Other Data Source. Additional detailed support material for conducting benefit evaluation procedures for prevention of coastal storm damage and erosion is in IWR report 91-R-8, dated August 1991. Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained in the IWR report.

(4) Risk Analysis. Storm damage reduction studies should adopt a life cycle approach and probabilistic analysis (and display) of benefits and costs. Key considerations are listed below; at a minimum, those with the greatest effect on plan formulation should be explicitly incorporated in the analysis.

(a) The erosion damage function (with special emphasis on structure values and land values)

(b) The stage-damage function (with special emphasis on structure first floor elevation, content and structure values.

(c) The wave-damage function by structure class

(d) Storm-related parameters such as peak wave height and period storm duration, peak surge elevation, and timing with respect to tidal phasing

(e) Wave height above the dune

(f) Wave penetration

(g) The shoreline retreat or eroded volume

(h) The natural post-storm recovery

g. Periodic Nourishment. Public Law 84-826 provides that Federal participation in periodic beach nourishment may be appropriate when it comprises a more suitable and economical remedial measure for shore protection than retaining structures such as groins. Under such conditions periodic nourishment can be considered construction for cost sharing purposes. Retaining structures may be recommended, but then any required periodic nourishment is not considered construction and is not cost shared by the Federal government. Projects with structures included to maintain a shore alignment, but not to materially prevent littoral drift (which may nourish downdrift beaches), such as low-profile groins and offshore breakwaters, are eligible for periodic nourishment.

(1) New Projects. Federal participation in periodic nourishment may be recommended to continue for the shortest of: (a) project economic life; (b) physical life of cooperating structural features; (c) fifty years.

(2) Existing Projects.

(a) General. When the authorized period of Federal participation in periodic nourishment at existing projects expires, it may be extended without further Congressional action for a period not to exceed 50 years after the date of initial construction. (Section 934 of Public Law 99-662). Reevaluation is necessary using current evaluation guidelines and policies. Prior to the expiration of the existing periodic nourishment period the sponsor must request the extension and express a willingness to cost share in accordance with Public Law 99-662. This Section 934 authority does not apply to projects using sand bypassing plants.

(b) Section 934 Studies.

(1) The basic purpose of a Section 934 study is to determine if continued Federal participation in the authorized project is economically justified given current conditions. Justification is determined using current evaluation guidelines and policies. The cost of Section 934 studies will initially be financed by the Federal government using construction general funds. If extension of periodic nourishment is feasible, the cost of the study will be shared in accordance with PL 99-662 cost sharing for hurricane and storm damage reduction projects. The non-Federal sponsor will reimburse its share of study costs to the Federal government when the first re-nourishment occurs.

(2) Only an extension of periodic nourishment can be implemented under Section 934. Nevertheless, other alternatives should be evaluated as part of the Section 934 study. This alternatives analysis should be similar in scope to an initial appraisal under Section 216 of the 1970 FCA.

(3) If the analysis indicates that the NED plan formulated for hurricane and storm damage reduction differs from the authorized plan, additional studies should be considered. If additional studies are needed, the Section 934 study should place an appropriate time limit on the extension of Federal participation.

(4) The basic purpose of a Section 934 study is to determine if continued Federal participation in the authorized project is justified given current conditions. Thus, the without project beach profile should reflect the conditions that existed just prior to initial construction. The following is required: estimate current benefits (new surveys or updating of recently estimated benefits but no indexing of benefits) of the existing project to determine justification and consistency with current policy; develop alternatives (size and timing) for nourishment; and recommend the most cost effective nourishment scheme for the authorized project.

(5) Environmental documentation requirements are determined by the likely impact that Federal action would have on the environment. The extent and nature of environmental studies therefore depends on what is expected to occur without Federal participation. If nourishment would occur anyway, as is likely for well justified projects, incremental effects due to Federal participation would appear less consequential. If nourishment would not occur there may be more substantial environmental differences in the without Federal participation and with Federal participation conditions. This would in turn require more substantial analyses. In either case the environmental documentation must be coordinated with Federal and State agencies and others. This coordination provides the opportunity to identify environmental concerns. Comments from the Fish and Wildlife Service (at a level commensurate with a Planning Aid Report), Environmental Protection Agency, National Marine Fisheries Service, the state's coastal agency and the state's water quality agency should be included.

(c) Reporting. Section 934 reevaluation reports with the division commander's recommendation will be forwarded to HQUSACE (CECW-P) for preparation of a recommendation to the Assistant Secretary of the Army for Civil Works (ASA(CW)). If ASA (CW) concurs in continued participation, an amended draft project cooperation agreement (PCA) should be developed. Extension or modification of any Section 221 agreement will require approval by the Secretary of the Army and the signature level will be determined at the time of approval.

h. Mitigation of Shore Damage Due to Federal Navigation Projects. Shore protection measures undertaken using the authority of Section 111, Rivers and Harbors Act of 1968 shall generally follow the policies provided in Appendix F.

i. Placement of Dredged Materials on Beaches. See paragraph E-14h.

j. Outer Continental Shelf Mineral Resources. If mineral resources from the outer continental shelf are proposed for use in civil works projects, the Corps and Minerals Management Service (MMS), U.S. Department of Interior, must enter into a memorandum of agreement. The sponsor must also negotiate a noncompetitive lease with the MMS. Section 215 (b) of the WRDA of 1999 amended Section 8(k)(2)(B) of the Outer Continental Shelf Lands Act to exempt State and local government agencies, in addition to Federal agencies, from the assessment of fees for the use of Outer Continental Shelf sand, gravel and shell resources in a shore protection, beach restoration or coastal wetlands project or program, or in any other project

funded or authorized by the Federal Government. The MOA and lease must be executed prior to PCA approval and execution. This is addressed in more detail in ER 1165-2-131.

k. Sea Level Rise. The National Research Council (NRC) study on sea level change (Responding to Changes in Sea Level: Engineering Implications, 1987) is a practical and rational review of data on relative sea level changes and the resulting impact on engineering structures. The study should be used by the Corps for technical guidance until more definitive data are available. The NRC study recommended that feasibility studies for coastal projects should consider the high probability of accelerated sea level rise. Since precise estimates of future sea level rise are unknown, the risks associated with a substantial rise should be addressed. Feasibility studies should consider which designs are most appropriate for a range of possible future rates of rise. Strategies that would be appropriate for the entire range of uncertainty should receive preference over those that would be optimal for a particular rate of rise but unsuccessful for other possible outcomes.

(1) Potential relative sea level change should be considered in every coastal and estuarine (as far inland as the new head of tide) feasibility study that the Corps undertakes. The degree of consideration that the possible change receives will depend upon the historical record for the study site. Areas which are already experiencing relative sea level rise or where increases are predicted should undertake an analysis as part of the study. Plans should be formulated using currently accepted design criteria.

(2) For now, planning should consider what impact a higher relative sea level rises rate would have on the design based on the historical rate. A sensitivity analysis should be conducted to determine what effect (if any) changes in sea level would have on plan evaluation and selection. This analysis should be based, as a minimum, on the extrapolation of the local, historical record of relative sea level rise as the low level and Curve III from the NRC report as the high level.

(3) If the plan selection is sensitive to sea level rise, then design considerations could allow for future modification when the impacts of future sea level rise can be confirmed. It may be appropriate to consider plans that are designed for today's conditions but that incorporate features to facilitate future changes, or plans designed for future conditions. In these cases, an evaluation of the timing and the cost of potential changes should be conducted during the plan selection process.

E-25. Federal and Non-Federal Participation

a. General Requirements.

(1) The Federal approach to participation in shore protection is similar to that for participation in riverine flood damage reduction. Highest priority is for reducing damages to existing development. Reducing flooding on or erosion to undeveloped lands is not high priority. Federal participation in the protection of private undeveloped shores is prohibited by law.

(2) In the past, particularly prior to the WRDA of 1986, beach fill or beach restoration was frequently considered an erosion control measure, and erosion control was thought of, perhaps rather inexact, as a project output or project purpose. As a result of enactment of the law, however, erosion control has no separate status as a project purpose or as a project output. Thus, erosion control measures (beaches) are purely means to the ends of hurricane and storm damage reduction or recreation, just as breakwaters or revetments are.

(3) Beaches can be a factor complicating analysis and decision making, however, for in addition to reducing damages they also provide for recreation, and are in themselves highly desired amenities. Because of these characteristics, when hurricane and storm damage reduction plans include beach fill or restoration, Federal cost participation depends on shore ownership, use, and types and incidence of benefits.

(4) Construction costs are assigned, as appropriate, to the purposes of hurricane and storm damage reduction or recreation, and shared in the percentages designated in Section 103 of Public Law 99-662, with any adjustments required to reflect conditions of ownership as discussed below and summarized in Table E-22.

b. Project Purposes.

(1) Hurricane and Storm Damage Reduction. The Federal share is 65 percent of the costs assigned to hurricane and storm damage reduction. The non-Federal share is 35 percent. Participation in the National Flood Insurance Program and other applicable Federal floodplain management programs is required. Non-Federal interests must provide LERRDs; fair market value is credited to the non-Federal share. When the value of LERRD is less than 35 percent the difference must be provided in cash during construction. When the value is more than 35 percent the excess will be refunded.

(2) Recreation. Federal participation in separable recreation measures is not permitted by current budget policies. Recreation related access facilities such as bathhouses, roads, ramps, toilets, parking areas and so on are a non-Federal responsibility. Costs for the facilities are not included as project costs unless they are required for recreation benefits claimed by the project, and the costs are not being “offset” by user fees.

c. Shore Ownership.

(1) Private Shores. All costs for hurricane and storm damage protection on privately owned shores (where use of such shore is limited to private interests) are non-Federal; except that benefits to private shores beyond project limits, if trivial in amount, are considered incidental for cost-sharing purposes.

(2) Losses of Undeveloped Private Lands. All costs for hurricane and storm damage reduction measures of any kind assigned to the prevention of losses of undeveloped private lands are non-Federal.

(3) Federal Shores. All costs assigned to the protection of Federally owned shores are Federal.

(4) Non-Federal Public Shores (Park and Conservation Areas). Park and conservation areas produce recreation outputs, and cost sharing established in law is a maximum 50 percent Federal share. Policy precludes participation in projects not principally justified by hurricane and storm damage reduction however.

E-26. Recommendations in Feasibility Reports.

a. Cost Sharing. In a shore protection feasibility report, which includes measures for beach creation, restoration or preservation or for beach fill, recommendations on the percentage of construction costs to be borne by local interests or the Federal Government must be qualified as tentative. Final apportionment will be based on conditions of ownership and project purpose at the time of construction or subsequent nourishment.

b. Authorization Language. Authorization for shore protection projects that call for periodic beach fill will refer to an initial construction cost and an average annual cost for periodic nourishment as a part of construction. The recommendation wording should be as follows:

> "The project for shoreline protection, (project name), as described in the Report (report to be cited for authorization), at an initial total cost of ($100,000), with an estimated Federal cost of ($75,000) and an estimated non-Federal cost of ($25,000), and an average annual cost of ($600) for periodic beach nourishment over the (50) year life of the project, with an estimated annual Federal cost of ($450) and an estimated annual non-Federal cost of ($150)."

Projects thus authorized would be subject to two cost limits in accordance with Section 902 of the WRDA of 1986, as described in Appendix G.

SECTION V - Ecosystem Restoration

E-27. Federal Interest. Numerous Federal laws and executive orders establish National policy for and Federal interest in the protection, restoration, conservation and management of environmental resources. These provisions include compliance requirements and emphasize protecting environmental quality. They also endorse Federal efforts to advance environmental goals, and a number of these general statements declare it national policy that full consideration be given to the opportunities which projects afford to ecological resources. Recent water resources authorizations have enhanced opportunities for Corps involvement in studies and projects to specifically address objectives related to the restoration of ecological resources and ecosystem management. Specific authorities for new individual studies and projects to restore ecological resources have also been provided in legislation. Examples of legislation that broadly supports Federal involvement in the restoration and protection of ecological resources include:

- Federal Water Project Recreation Act of 1965, as amended
- Water Resource Development Acts of 1986, 1988, 1990, 1992, 1996 and 1999
- Coastal Wetlands Planning, Protection and Restoration Act of 1990 (Title III of P.L. 101-646)

a. The Corps ecosystem restoration policy is described in more detail in ER 1165-2-501 and EP 1165-2-502. This policy applies to all ecosystem studies and projects. The focus of projects implemented under this section of the guidance is the restoration of ecosystems and ecological resources and not restoration of cultural and historic resources, aesthetic resources, or clean up of hazardous and toxic wastes. Corps ecosystem restoration projects may not be able to address every functional and structural characteristic, nor may it be necessary where the nature and degree of impairment are limited to only one or a few of these parameters. Some restoration projects may only be able to address the symptoms of the disturbance or degradation, and not the cause(s).

b. The authorities through which the Corps can participate in ecosystem restoration and protection studies and project implementation are summarized below.

(1) Congressionally authorized studies, pursued under General Investigations (i.e., new start reconnaissance and feasibility studies) for single-purpose ecosystem restoration or multiple purpose projects which include ecosystem restoration as a purpose.

(2) Programmatic authorities for study, design and implementation of ecosystem restoration and protection projects: 1) Section 1135, Project Modifications for Improvement of the Environment Water Resources Development Act, WRDA of 1986, as amended; 2) Section 206, Aquatic Ecosystem Restoration WRDA of 1996, as amended; 3) Section 204, Beneficial Uses of Dredged Material, WRDA of 1992, as amended; 4) dredging of contaminated sediments under Section 312, WRDA of 1990, as amended; and 5) Flood Mitigation and Riverine Restoration Program Section 212 of WRDA of 1999. Sections 1135, 206 and 204 are discussed

in Appendix F. Section 312 of WRDA of 1990 is discussed in Section II of this appendix. Flood Mitigation and Riverine Restoration is discussed in Appendix G.

(3) Additional opportunities for ecosystem restoration and protection may also be pursued through existing project authorities for the management of operating projects; e.g., through water control changes, or as part of natural resources management.

E-28. Definitions.

a. Ecosystem. An ecosystem is the dynamic and interrelating complex of plant and animal communities and their associated nonliving environment, considered as an integrated unit. Implied within this definition is the concept of structure and function unified through life processes. An ecosystem may be characterized as a viable unit of community and interactive habitat. Ecosystem restoration can be directed at different sized ecosystems within the nested set, and may encompass multiple states, more localized watersheds, or a smaller complex of aquatic habitats.

b. Environmental Restoration. Care should be taken in the use of this term, which is often used interchangeably with “ecosystem restoration”. However, in the context of Corps of Engineers programs and missions, “environmental restoration” is more commonly associated with "cleanup" measures undertaken to achieve compliance with state and/or Federal laws or regulations to clean up hazardous, toxic and radioactive wastes. Environmental restoration generally refers to actions such as Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remedial actions, Resource Conservation and Recovery Act (RCRA) corrective actions, and cleanups related to underground storage tanks.

c. Mitigation. Mitigation consists of those measures taken to avoid, minimize or compensate for adverse environmental impacts. Mitigation measures are authorized by Congress or approved by HQUSACE or MSCs to compensate for ecological resources unavoidably affected by a Corps project or activity. Appendix C discusses natural resources mitigation in more detail, along with other environmental compliance requirements.

d. Enhancement. Historically the term “enhancement” has been used as an indication of a net habitat improvement over the without project condition. However, this term now implies making the habitat better for some species than it would have been naturally in the absence of human intervention. Since this goes beyond the goal of ecosystem restoration, the use of the term “enhancement” is rarely appropriate in Corps documents.

e. Net Ecosystem Restoration Benefits.

(1) The recommended plan should be the justified alternative and scale having the maximum excess of monetary and non-monetary beneficial effects over monetary and non-monetary costs. This plan occurs where the incremental beneficial effects just equal the incremental costs, or alternatively stated, where the extra environmental value is just worth the

extra costs. This plan should be called the NER plan. In making these value and cost comparisons it is assumed that each plan and scale is the minimum cost way of achieving that level of output; i.e., that an appropriate least cost or cost effectiveness algorithm was used in their development. Deviations from the NER Plan requires justification.

(2) For plans having both economic and restoration benefits, the plan with the greatest net sum of economic and restoration benefits is to be selected, consistent with protecting the Nation's environment, unless ASA(CW) grants an exception when there is some overriding reason for selecting another plan, based upon other Federal, State, local, and international concerns. (For plans having both NER and NED outputs, see Section IX of this appendix for policies and procedures related to multipurpose projects.)

E-29. Types of Improvements. Recommendations for ecosystem restoration projects will emphasize improving degraded ecosystem function and structure through the application of the Corps' engineering and other technical expertise related to solving water and related land resources problems, as opposed to projects that primarily rely on land acquisition to achieve the projected outputs. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement. The roles of various plant and animal populations and related habitats shall be considered in the larger context of community and ecosystem frameworks rather than maximizing habitat benefits for a single species or a resource commodity. A wide range of improvements is possible including, but not limited to, use of dredged material to restore wetlands, restoring floodplain function by reconnection of oxbows to the main channel, providing for more natural channel conditions including restoration of riparian vegetation, pools and riffles and adding structures, modification of obstructions to fish passage including dam removal, modifications to dams to improve dissolved oxygen levels or temperature downstream, removal of drainage structures and or levees to restore wetland hydrology, and restoring conditions conducive to native aquatic and riparian vegetation.

E-30. Policies. The policies specific to ecosystem restoration planning are summarized below.

a. The objective of Civil Works ecosystem restoration is to restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. However, partial restoration may be possible, with significant and valuable improvements made to degraded ecological resources. The needs for improving or re-establishing both the structural components and the functions of the natural area should be examined. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement.

b. Protection may be included as part of Civil Works ecosystem restoration initiatives, when such measures involve efforts to prevent future degradation of elements of an ecosystem's structure and functions. Protection consists of measures undertaken to protect and preserve elements of an ecosystem's structure and functions against future degradation. Such measures are most appropriate if they require the Corps' engineering expertise in accomplishing the protection measure.

c. Planning for Ecosystem Restoration. Restoration projects should be conceived in a systems context, considering aquatic (including marine, estuarine and riverine), wetland and terrestrial complexes, as appropriate, in order to improve the potential for long-term survival as self-regulating, functioning systems. This system view will be applied both in examination of the problems and the development of alternative means for their solution. Consideration should be given to the interconnectedness and dynamics of natural systems, along with human activities in the landscape, which may influence the results of restoration measures. Projects for restoring ecological resources may be recommended, based on the monetary and non-monetary benefits anticipated from the measures recommended. Ecosystem restoration can be included as part of multipurpose plans, which can produce both economic and environmental outputs. The planning for ecosystem restoration objectives is essentially the same as for other water resources development purposes. However, there are some special considerations because of limitations in understanding the complex interrelationships of the components of ecological resources and services which are the focus of these studies, and because the environmental outputs considered in the evaluation process are typically not monetized. The consideration of significant resources and significant effects is integral to plan formulation and evaluation for any type of water resources development project. In ecosystem restoration planning, the concept of significance of outputs plays an especially important role because of the challenge of addressing non-monetized benefits.

d. Mitigation. Ecosystem restoration projects should be designed to avoid the need for fish and wildlife mitigation. Projects implemented using restoration authorities may not be used as wetland banks or mitigation credit for the non-Federal sponsor.

e. Public Interest. For projects where the land on which the majority of the physical ecosystem restoration will occur is in the ownership of a single firm, individual, club, or association with restrictive membership requirements, it must be demonstrated clearly that the restoration benefits are in the overall public interests and that the benefits do not accrue primarily to the property owner.

f. Land Acquisition. Land acquisition in ecosystem restoration plans must be kept to a minimum. Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs. Projects with land costs exceeding this target level are not likely to be given a high priority for budgetary purposes.

g. Water Quality. Water quality is an important component of ecosystem structure, and good water quality is generally integral to healthy functioning ecosystems. An important Corps contribution in rehabilitating ecosystems, where water characteristics are a critical structural component of those ecosystems, may involve improvement of water quality characteristics using engineering solutions. Corps restoration and protection projects may involve cost effective solutions to improve aeration, temperature, turbidity, acidity, sedimentation and other water quality parameters. Consideration should be given to whether the water quality improvements will accomplish restoration of the system, because in many instances, other functional or structural ecosystem components may require attention as well. The Corps will not propose, for Civil Works implementation, any restoration projects or features that would result in treating or otherwise abating pollution problems caused by other parties where they have, or are likely to have, a legal responsibility for remediation or other compliance responsibility. (See EP 1165-2-502.)

h. Recreation. It is important that proposed recreation features are appropriate in scope and scale to the opportunity provided by ecosystem restoration projects, and that the recreation development and anticipated use be compatible with the ecosystem restoration purpose of the project. The recreation potential may be satisfied only to the extent that recreation does not significantly diminish the ecosystem outputs that justify the ecosystem restoration project. More detailed information on policy regarding recreation development at ecosystem restoration projects is provided in Section VII of this appendix and in Appendix B of EP 1165-2-502. A list of approved facilities for ecosystem restoration projects is provided in Exhibit E-3.

i. Monitoring and Adaptive Management.

(1) Monitoring may be necessary to determine if the predicted outputs are being achieved and to provide feed back for future projects. The information obtained from monitoring can be used to ascertain whether: 1) the project is functioning as per its objectives; 2) adjustments for unforeseen circumstances are needed; and , 3) changes to structures or their operation, or management techniques are required.

(2) Cost shared post-implementation monitoring will rarely be required. If cost shared post-implementation monitoring is being considered, it must be clearly defined, justified and shall be limited to no more than five years following completion of construction. The cost of monitoring included in the total project cost and cost shared with the non-Federal sponsor should normally not exceed one percent of the first cost of the ecosystem restoration feature(s).

(3) For complex specifically authorized projects that have high levels of risk and uncertainty of obtaining the proposed outputs, adaptive management may be recommend. The cost of the adaptive management action, if needed, will be limited to 3 percent of the total project cost excluding monitoring costs. Appendix F contains guidance for the CAP.

j. Real Estate Considerations. The analysis of the nature and extent of real estate requirements must be conducted in accordance with Chapter 12 of ER 405-1-12, including

consideration and identification of the specific interests, estates, and acreage required. After coordination and consultation with the non-Federal sponsor, the government will determine the lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRD) required for the implementation, operation, and maintenance of the project.

(1) Generally fee title is required for ecosystem restoration projects in accordance with ER 405-1-12. An easement estate may be appropriate based on the extent of the interest required for the implementation, operation and maintenance of the project. However, if an estate less than fee is recommended consideration should be given to the preservation of the physical integrity of the ecosystem restoration project and to risks associated with achieving benefits that serve to justify the project cost.

(2) A comprehensive Real Estate Plan (REP) prepared in accordance with the requirements of Chapter 12 of ER 405-1-12 must be included in the feasibility report or other decision document for the project. The level of detail required will vary depending on the scope and complexity of the project.

k. Operational Effectiveness. Because self-regulation is a key goal of ecosystem restoration, it is generally more desirable to pursue ecosystem restoration projects that have limited maintenance requirements. However, because of irreversible cultural modifications in the landscape, there will be instances where O&M measures may be essential to the functioning of the project. Operation and maintenance costs should be considered in evaluating the costs and benefits for alternatives for ecosystem restoration projects.

E-31. Federal and Non-Federal Participation.

a. Cost Sharing. For specifically authorized ecosystem restoration projects the costs of the Feasibility phase are shared equally with the non-Federal sponsor. The non-Federal share will be 35 percent of the project or separable element implementation costs (preconstruction, engineering and design, and construction), or total implementation costs of a multiple purpose project allocated to ecosystem restoration. Non-Federal sponsors shall provide 100 percent of LERRDs, and operation, maintenance, repair, rehabilitation, and replacement (OMRR&R). The value of LERRD shall be included in the non-Federal 35 percent share. Where the LERRD exceeds the non-Federal sponsor's 35 percent share, the sponsor will be reimbursed for the value of LERRD which exceeds their 35 percent share. For more detailed discussion of these requirements see ER 1165-2-501 and EP 1165-2-502. For information about cost sharing related to the Continuing Authorities Program see Appendix F.

b. In the identification of ecosystem restoration opportunities, Corps field offices shall seek the advice and cooperation of Federal, state, and tribal resource agencies, as well as input from interested non-governmental environmental organizations. The assistance of these agencies and other interests should be used in identifying the "boundaries" and parameters of the ecosystem, or portions thereof; prioritizing ecosystem restoration needs taking into account

national and regional priorities; identifying the existing and without project future conditions of selected ecosystem(s), or parts thereof; and in defining the restoration goals and objectives desired. See Appendix B for guidance on public involvement in planning studies.

E-32. Planning Process.

a. Consideration of ecosystems within (or encompassing) a watershed provides a useful organizing tool to approach ecosystem-based restoration planning. Ecosystem restoration projects that are conceived as part of a watershed planning initiative or other regional resources management strategy are likely to more effectively meet ecosystem management goals than those projects and decisions developed independently. Independently developed ecosystem restoration projects, especially those formulated without a system context, may only partially and temporarily address symptoms of a chronic systemic problem. Not all restoration studies will be "watershed studies", but all Corps studies should have a watershed perspective.

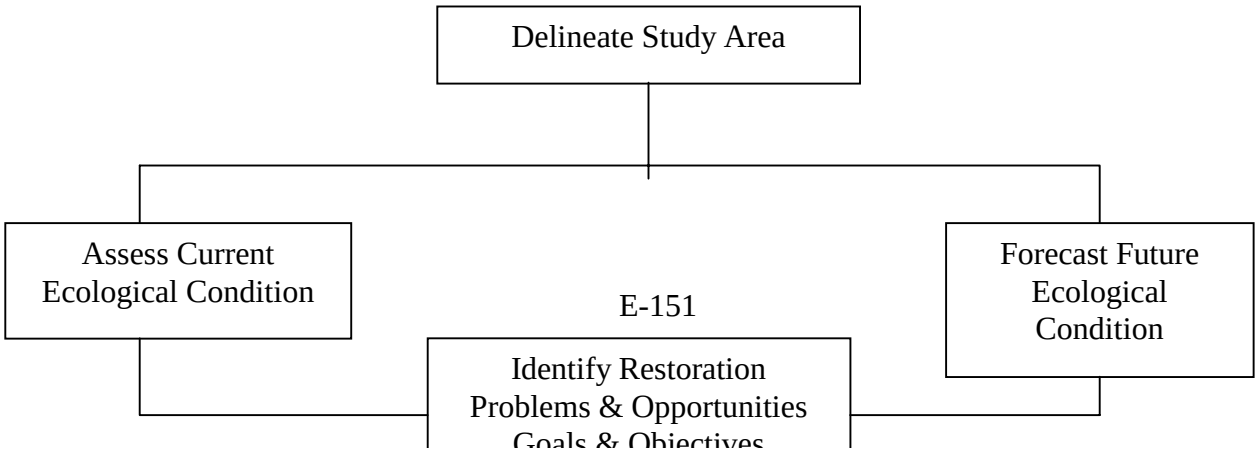
b. Six Steps. The six-step planning process as discussed in Chapter 2 of the main body of this ER and defined in the P&G applies to ecosystem restoration. These steps are summarized in the subsequent paragraphs. (See Figure E-7.)

E-33. Planning Steps 1 and 2.

a. Objective and Constraints. Problems and opportunities should be defined in terms of their nature, cause, location, dimensions, origin, time frame, and importance. The planning team develops objectives and constraints based on those problems and opportunities. Developing specific, flexible, measurable, realistic, attainable, and acceptable objectives and constraints is critical to the success of the entire planning process.

b. Inventory of Existing Conditions and Forecast of Future Conditions. Both existing conditions and future conditions expected to occur without a project must be characterized. The future without project condition forms the basis from which alternative plans are formulated and impacts are assessed.

(1) Selection of Assessment Methods. Many methods and models are available to measure existing ecosystem resource conditions and to estimate future conditions of those resources. Habitat models developed for individual species may have limitations when used to assess ecosystem restoration problems and objectives. They do not consider communities of organisms and typically consider habitat in isolation from its ecosystem context. Single species



habitat models may be limiting if used to optimize for a particular species, but they can be useful when carefully applied in the ecosystem context in which the habitat is situated. They can be helpful in identifying important influential functions or structural components for ecosystem projects to address. The assessment methodology chosen for a study should be governed by how well the technique meets the needs of the study goals and objectives and level of detail for a given study. The assessment methodology may include habitat models, or information derived from community or ecosystem assessments using other scientifically based methods that are generally accepted by state or Federal resource agencies.

(2) Gathering information about historic and existing resources requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in environmental conditions are likely to impact problems and opportunities. Forecasting future conditions in an ecosystem may be subjective and can be very difficult, but is essential in order to formulate restoration projects. It should be done in an iterative manner, seeking input from State and Federal resource agencies and the environmental community, in order to help build consensus about future without project conditions and what outputs the restoration project will produce. Forecasting may be especially critical to a case for protection where an argument must be made that there will be a decline or degradation of the resource unless protection is provided.

E-34. Planning Step 3 – Formulation of Alternative Plans. Plan formulation consists of three phases: 1) identifying management measures; 2) formulating alternatives from mixing and matching the management measure building blocks; and 3) iterative reformulation, during which alternative plans previously formulated are changed for one or more reasons. Measures may be added, dropped, re-scaled, or otherwise modified such that the reformulated plan will better achieve a planning objective or stay within the limits of a constraint.

E-35. Planning Step 4 - Evaluation of Alternative Plans. The inability to quantify ecosystem benefits in the familiar metric of dollars probably makes the evaluation of plan effects (planning step 4) the single biggest challenge in ecosystem planning.

a. The evaluation of effects is a comparison of the with-plan and without-plan conditions for each alternative. At a minimum, two categories of effects will be evaluated: costs and outputs. Environmental outputs are the desired or anticipated measurable products or results of restoration measures and plans. The term “outputs” is often used interchangeably with “benefits.” Ecosystem restoration proposals may possess multiple output categories, as well as other effects that may need to be considered, but the evaluation must at least address cost and an output category that has been determined to reasonably represent ecosystem restoration benefits. The evaluation is conducted by assessing or measuring the differences between each with- and without plan condition and by appraising or weighting those differences. Evaluation consists of four general tasks: (1) forecast the most likely with-project conditions expected under each alternative; (2) compare each with-project conditions to the without-project conditions and document differences between the two; (3) characterize the beneficial and adverse effects by magnitude, location, timing, and duration; and (4) qualify plans for further consideration.

b. All Corps water resources development projects be evaluated in terms of acceptability; completeness; effectiveness; efficiency. Ecosystem restoration alternatives are also evaluated on the basis of cost effectiveness and incremental cost analyses of the possible restoration alternatives and significance of ecosystem outputs. How each of these criteria is used to evaluate alternatives is explained in the following paragraphs.

E-36. Cost Effectiveness and Incremental Cost Analyses (CE/ICA). CE/ICA are two distinct analyses that must be conducted to evaluate the effects of alternative plans. First, it must be shown through cost effectiveness analysis that an alternative restoration plan's output cannot be produced more cost effectively by another alternative. "Cost effective" means that, for a given level of non-monetary output, no other plan costs less, and no other plan yields more output for less money. Subsequently, through incremental cost analysis, a variety of implementable alternatives and various-sized alternatives are evaluated to arrive at a "best" level of output within the limits of both the sponsor's and the Corps' capabilities. The subset of cost effective plans are examined sequentially (by increasing scale and increment of output) to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called "Best Buys". They provide the greatest increase in output for the least increases in cost. They have the lowest incremental costs per unit of output. In most analyses, there will be a series of Best Buy plans, in which the relationship between the quantity of outputs and the unit cost is evident. As the scale of Best Buy plans increases (in terms of output produced), average costs per unit of output and incremental costs per unit of output will increase as well. Usually, the incremental analysis by itself will not point to the selection of any single plan. The results of the incremental analysis must be synthesized with other decision-making criteria (for example, significance of outputs, acceptability, completeness, effectiveness, risk and uncertainty, reasonableness of costs) to help the planning team select and recommend a particular plan.

a. There are a number of ways of conducting CE/ICA, thereby determining which plans are cost effective, and, from the set of cost effective plans, identifying those plans which are most efficient in production (i.e., "Best Buys"). In relatively uncomplicated cases, these analyses may simply be performed by hand with pencil and paper. In slightly larger or more complex situations, user-built and generated spreadsheet models may suffice. In still larger and more involved calculations, planners may need to use more sophisticated software applications specifically designed for CE/ICA.

b. The Corps' Institute for Water Resources (IWR) has developed procedures and software to assist in conducting CE/ICA. Please refer to the following IWR reports for detailed discussion of CE/ICA: IWR Report 94-PS-2, *Cost Effectiveness Analysis for Environmental Planning: Nine EASY Steps*; IWR Report 95-R-1, *Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses*; and IWR Report 98-R-1, *Making More Informed Decisions in Your Watershed When Dollars Aren't Enough.* Two software packages are also available to assist in performing CE/ICA: *ECO-EASY*, a DOS-based software application, and Windows-based *IWR-PLAN* Decision Support Software. These

reports and the *IWR-PLAN* software package are available from the IWR web site at http://www.wrsc.usace.army.mil/iwr.

c. CE/ICA Procedures:

(1) Step 1. Before starting CE/ICA, the planning team should have already identified potentially implementable solutions for achieving the desired ecosystem outputs. The solutions must be described in terms of their effects on costs and outputs. That is, an estimate of the cost of each management measure/scale combination and an estimate of the environmental output it will produce must be developed. All costs should be calculated in terms of present worth using the appropriate discount rate and annualized (see Appendix D on Economic and Social Considerations for more detailed information). Ecosystem restoration outputs are not discounted, but should be computed on an average annual basis, taking into consideration that the outputs achieved are likely to vary over time. For example, if one of the outputs is a mature oak forest, the full benefits may not be realized for 30 years. Note that the output values listed are the differences between with- and without-project conditions, not total values before and after the project is implemented. The management measures, scales, costs, and outputs should then be listed.

(2) Step 2. After estimating the costs and outputs of each solution, the next step is to formulate all possible combinations of management measures and scales. Each possible combination may be considered an alternative plan.

(a) By definition, scales within a management measure are mutually exclusive; they represent the application or implementation of different amounts of a given management measure. Formulating all possible combinations requires choosing one scale from each of the management measures to combine in turn with one scale from each of the other management measures, until all possible permutations have been combined. The “No action” possibility for each management measure should also be included in the permutations.

(b) When measures and scales are combined, the cost and output of each constituent part of the combination is summed. Each combination thus has an associated total cost and total output.

(3) Step 3. The next step is to sort all possible combinations of management measures and scales (which are, in effect, all possible alternative plans) in terms of increasing output. This is done as a prelude to cost effectiveness analysis. All possible plan combinations are listed and sorted in terms of increasing output. Costs and outputs of combined solutions may be additive or synergistic. It is important to document the rationale for determining which of these cases applies.

(4) Step 4. Once all possible plans have been formulated and sorted by increasing output, the next step is conducting cost effectiveness analysis. Cost effective means that, for a

particular level of output, no other plan costs less. Furthermore, no plan yields more output for the same or less cost.

(a) Graphing cost effective plans in terms of their respective costs and outputs can help visually display the relationship between the increasing financial investment required for increasing environmental outputs.

(b). Each of the cost effective plans produces its associated level of output at the least cost; no other plan can provide as much output for the same level of investment. This is an important point to make in ecosystem restoration evaluations, and an important criterion in qualifying plans for further evaluation.

(5) Step 5.

(a) The next step is to examine the efficiency of each of the cost effective plans, which is accomplished through incremental cost analysis. In incremental analysis those cost effective plans that are most efficient in production are identified. These plans, known as “Best Buy” plans, provide the greatest increase in output for the least increase in cost. They have the lowest incremental costs per unit of output. The concept of incremental changes in costs and outputs is analogous to the concept of marginal changes, i.e., the differences in cost or output between one plan or alternative and the next one in succession.

(b) The decision rule in incremental analysis is to select the plan with the lowest cost per unit (i.e., the first “Best Buy” from a production perspective, producing output at the lowest unit cost) and then remove from consideration (in this analytical process) any plans that provide a smaller output level than the selected plan (they are less efficient in production, producing a lower level of output at a higher unit cost).

(c) To conduct incremental cost analysis, start with the subset of cost effective plans ranked by increasing output. Beginning with the “No Action” alternative, compute the incremental cost, incremental output, and incremental cost per unit of incremental output advancing from the No Action alternative to each successive alternative. The incremental cost is the additional cost incurred in selecting one plan over another, or in this case the difference in cost between each alternative and No Action. Similarly, the incremental output is the additional output gained in selecting one plan over another, or in this case the difference in output between each alternative and No Action. The incremental cost per unit of incremental output is the incremental cost divided by the incremental output. It shows the change in cost from No Action to each other alternative plan in a per unit basis.

(6) Step 6. The next step is to recalculate the incremental cost per unit of incremental output of implementing each remaining plan instead of the last selected plan

(a) The same decision rule still applies: of the remaining plans (all larger than the first Best Buy plan), select the plan with the lowest incremental cost per unit of incremental output,

then remove from consideration (in this analytical process) any plans that provide a smaller output level than the selected plan.

(b) This process of recalculating incremental cost per incremental unit for each remaining plan over the last selected Best Buy plan is reiterated until the incremental unit cost for the last remaining plan has been recalculated. The number of iterations is dependent upon the number of plans and on the respective cost and output data of each.

(c) It should be noted that the iterative process of selecting successively larger Best Buy plans is an arbitrary, but rational, decision process based on production efficiency. Situations could arise where the most efficient plan produces such a large quantity of output that its total cost makes it infeasible due to cost constraints. However, because the plan is the most efficient in production, all plans that produce smaller output levels (possibly at lower and acceptable cost levels) would be eliminated from consideration in the iterative process. In such situations, it may useful to remove such a large scale plan from consideration and repeat the Best Buy iterative process. The purpose of the iterative process is not to eliminate plans from the possibility of being selected, but rather to identify those plans (and their corresponding level of output) where there is a marked increase in production costs. By identifying where significant increases in production costs occur as output levels are increased, better information is provided to assist in determining desirable project scale.

(7) Step 7. The final step in the CE/ICA process is to tabulate and graph the incremental costs.

(a) It is not necessary to display all such iterations in ecosystem restoration report documentation. What should be provided, however, is a table that summarizes the pertinent incremental cost and output information associated with the increasing size (in terms of output) of the Best Buy plans.

(b) Graphing the Best Buy plans can help visually display the relationship between the increasing financial investment required for increasing environmental outputs. Figure E-8 shows the incremental costs of alternative plans (in $1000) on the y-axis and the average annual environmental benefits (in habitat units) on the x-axis. A similar one should be provided in ecosystem restoration report documentation.

d. CE/ICA as Evaluation Criteria. Neither cost effectiveness analysis nor incremental cost analysis include a “one plan” selection rule similar to the “NED plan” selection rule for NED evaluations. In the absence of such a decision-making rule, neither analysis dictates what choice to make. However, the information developed by both analyses can inform decision-making by progressively proceeding through the available levels of output to ask whether the

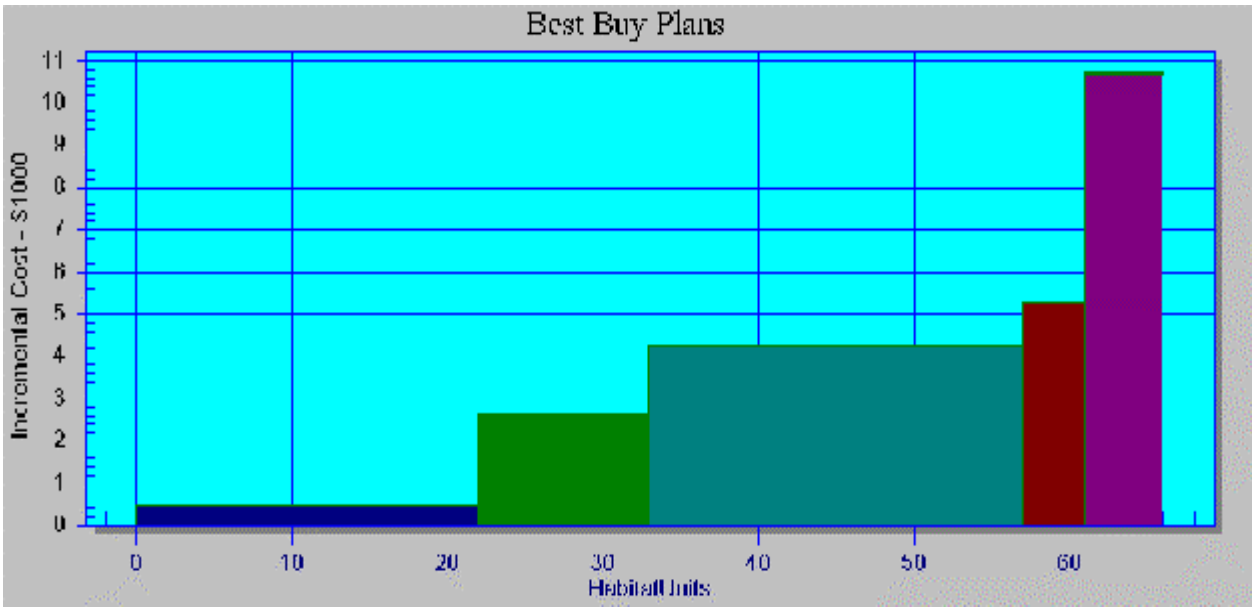


Figure E- 8 Best Buy Plans

next level is "worth it"; that is, whether the environmental benefit of the additional output in the next level is worth its additional cost. In the example shown in the graph, Figure E- 6, the question is whether the first increment of 22 habitat units are worth $440 each, as opposed to No Action of 0 habitat units at $0 each. If it is judged that 22 habitat units are worth $440 each, then proceed to the next level of output and repeat the questioning. At the next level there is a total of 33 habitat units, or 11 additional habitat units over the last level at a cost of $2,600 for each additional habitat unit. Again, if the case can be made that the additional 11 habitat units are worth $2,600 each, then proceed to the next increment.

(1) Often this questioning process will tend to continue to conclude that successive levels of output are "worth it" until an unusual increase in incremental costs, beyond the general range of preceding costs, is encountered. In the CE/ICA graph, Figure E-8, the last increase represents a jump in incremental costs of $10,700 per habitat unit for each of the last five habitat units. This doubling of unit cost for additional output (from the preceding increment) most likely presents a situation where the value of increasing outputs to this level should be explained, supported, or otherwise considered in more detail than previous increases.

(2) The following general decision-making guidelines related to outputs, costs, and the display curves should be applied to the results of cost effectiveness and incremental cost analyses to assist in making "Is it worth it?" arguments:

(a) Curve anomalies (abrupt breakpoints, spikes, peaks, jumps, inflection points, or changes in cost effectiveness and incremental cost curves) identify potential points that provide decision-makers with reasons to question the causes of the changes, and whether additional incremental costs are worth it.

(b) Output Target. If a study has established a specific resource output target to be met, then a decision rule can be developed to meet some portion of that target. For example, a habitat unit target could be marked on an incremental cost bar graph to provide a picture of the relationship between the target and possible solutions. The display may be useful in focusing on whether the incremental costs of the solutions leading to the target are worth it.

(c) Output Thresholds. In some cases it may be necessary to first produce a minimum base amount of output, and any lesser amount would not be successful. Similarly, there may also be a "maximum threshold" level of output where production beyond that output would no longer contribute to the achievement of planning objectives. If minimum or maximum output thresholds exist, they can be used to bound the range of acceptable solutions.

(d) Cost Affordability. If implementation funds are a constraint, either from the perspective of the Corps' or the local sponsor's funding limitations, then decision makers can review both the cost effectiveness curve and the incremental cost curve for information to help them judge the best investment for the funds available.

(e) Unintended Effects. Decisions to recommend a particular cost effective or best buy plan are not made in isolation. Other factors that matter in terms of selecting one alternative over another could include, for example, land ownership, effects on other outputs, and effects on nearby stakeholders. It is possible that the unintended consequences could be just as important as the primary project purpose of ecosystem restoration. The importance and magnitude of these unintended effects will of course vary from study to study.

(3) The results of cost effectiveness and incremental cost analyses are intended to help decision makers make better informed decisions. In all but the most unusual cases, the NER Plan should be derived from the final set of Best Buy solutions. Other solutions, identified as non-cost effective in cost effectiveness analysis; as well as cost effective plans identified as relatively less efficient in production ("non-Best Buys") in incremental analysis, may continue to be considered for selection. In some cases, the economic and environmental models used to estimate the effects of ecosystem restoration plans are not capable of capturing the full range of such effects, or considerable uncertainty may accompany the estimates of such effects. Other evaluation criteria, such as environmental significance, acceptability, completeness, and effectiveness also impact the decision process. For example, concerns about endangered species, support by a local sponsor or other interest group, unintended effects on other economic and ecological resources, and other factors may lead to the continuing consideration and selection of solutions that may not be the most cost effective, or that may incur substantial incremental costs

E-37. Significance of Ecosystem Outputs. Because of the challenge of dealing with non-monetized benefits, the concept of significance of outputs plays an important role in ecosystem restoration evaluation. Along with information from cost effectiveness and incremental cost analyses, as well as information about acceptability, completeness, and effectiveness, information on the significance of ecosystem outputs will help determine whether the proposed environmental investment is worth its cost and whether a particular alternative should be recommended. Statements of significance provide qualitative information to help decision-makers evaluate whether the value of the resources of any given restoration alternative are worth the costs incurred to produce them. The significance of restoration outputs should be recognized in terms of institutional, public, and/or technical importance. This basically means that someone, some entity, some law/policy/regulation, or scientific evidence indicates that a particular resource is important. How to determine and characterize institutional, public, and/or technical significance is an important point and explained in greater detail in the paragraphs below. Detailed procedures for determining and describing the significance of environmental resource(s), including a hypothetical restoration study example as well as sample significance statements, is found in IWR Report 97-R-4, *Resource Significance Protocol for Environmental Project Planning*.

a. Institutional Recognition. Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include: (1) public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal government; (2) plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; (3) laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and (4) charters, bylaws, and other policy statements of private groups.

(1) Examples of sources of information that can assist in identifying and describing significant resources at the Federal level include the threatened and endangered plant and animal species listed by the Endangered Species Act of 1973, as amended; the species lists of the U.S. Fish and Wildlife Service, Office of Migratory Bird Management; species listed in the Anadromous Fish Conservation Act of 1965; species protected by the Marine Mammal Protection Act of 1972; the waterfowl habitat areas and habitat joint ventures of the North American Waterfowl Management Plan; the wetlands designated in the National Wetlands Priority Conservation Plan; the rivers identified by the National Wild and Scenic Rivers Act of 1968 - Nationwide Rivers Inventory; and the estuaries designated under the National Estuary Program.

(2) Examples of sources of regional level information include the wetlands designated under the Coastal Wetlands Planning, Protection, and Restoration Act of 1990 -- Annual Coastal Wetlands Restoration Plan and Priority Project List; the rivers identified in the Northwest Power Act of 1980 - Protected Areas Program; the aquatic habitats identified through the Water Resources Development Act of 1986 (Section 1103) -- Upper Mississippi River System Environmental Management Program; the marine habitats designated by the Coastal America

Partnership; the aquatic resources identified through the Chesapeake Bay Program; and marine resources identified in the Gulf of Mexico Program.

(3) On the state level, examples of sources of information may include the species and habitats identified in state natural heritage programs; species listed under state endangered species programs; habitats designated in state wetlands priority plans; marine resources identified in state coastal zone management programs; and habitats identified by state chapters of the Nature Conservancy.

(4) Local level sources may include zoning ordinances; wetlands regulations; master plans; shoreline regulations; and habitat conservation plans.

b. Public Recognition. Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, providing volunteer labor, and correspondence regarding the importance of the resource.

(1) The public expresses its recognition of resource significance through membership in many local, regional, state, national and international organizations (e.g., Arlingtonians for a Clean Environment, Ducks Unlimited, local chapters of the Nature Conservancy, the National Audubon Society, World Wildlife Fund); and through participation in many activities, whether they be resource-specific (e.g., focusing on a river, a type of fish, a watershed), user-based (e.g., fishing, bird-watching, hiking, camping), or conservation- or management-based (e.g., wetlands restoration projects, posting signs for no-wake zones, planting seedlings).

(2) Another form of public recognition is the role of the resource in the public's customs and traditions. For example, some communities may hold annual festivals, fairs and seasonal celebrations in association with a resource that reflects its importance to the community. In the Pacific Northwest, many tribal ceremonies revolve around salmon runs, indicating the importance of salmon to the culture and traditions of these Native American Indian tribes.

(3) Public and agency records (e.g., newspaper articles, letters written to the Corps) and scoping meetings with the general public as well as non-profit organizations with an interest in the resource may help Corps planners identify sources of public recognition of resource significance.

c. Technical Recognition. Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgement of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. While technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g., ecosystem, landscape, or ecoregion) context should be considered. Corps planners should describe technical significance in terms of one or

more of the following criteria or concepts: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity.

(1) Scarcity. This is a measure of a resource's relative abundance within a specified geographic range. Generally, scientists consider a habitat or ecosystem to be rare if it occupies a narrow geographic range (i.e., limited to a few locations) or occurs in small groupings. Unique resources, unlike any others found within a specified range, may also be considered significant, as well as resources that are threatened by interference from both human and natural causes.

(2) Representativeness. This is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The presence of a large number and percentage of native species, and the absence of exotic species, implies representativeness, as does the presence of undisturbed habitat.

(3) Status and Trends. This concept involves evaluating the occurrence and extent of the resource over time, how it has changed, and why. Documenting the status, or health, of the resource, includes describing its physical attributes, the extent of degradation, and human alterations of the resource. The trends associated with the degradation of the resource should indicate whether the resource is declining, recovering, or maintaining a steady status, as well as how quickly the resource is changing. Different variables may be used to describe the status of the resource and include: the presence of pollution; biodiversity; abundance of distress-loving and exotic species; extent of man-made barriers and other disturbances; and degree and immediacy of threats. In general, Corps planners can consider a potential restoration site that has declining trends and an imperiled status to be more significant than one that is recovering. Planners should also consider the "recoverability" (i.e., the ability of human intervention to restore the natural productivity or condition of the ecosystem) of a degraded resource in examining a resource's status and trends.

(4) Connectivity. This is a measure of the potential for movement and dispersal of species throughout a given area or ecosystem, and should be considered in the context of an entire landscape or watershed. The variation and quality of links between habitats in a landscape or watershed determine the level of connectivity. Landscape spatial patterns that effect the level of connectivity include the existence and suitability of habitat corridors, the degree and pattern of habitat fragmentation, and the presence of natural and man-made barriers. Often, rivers, waterways, and riparian forests serve as highly functional habitat corridors, and aquatic ecosystems inherently serve a connective function to other waterways and terrestrial landscapes. Corps planners may recognize as technically significant those restoration alternatives that serve to improve connectivity by creating or re-establishing habitat corridors; eliminating or addressing the pattern of fragmentation; or removing barriers, such as dams and other water blockages, that disrupt otherwise contiguous habitats.

(5) Limiting Habitat. This is habitat that is essential for the conservation, survival, or recovery of one or more species. Limiting habitat may serve as a criterion for both institutional and technical significance. Under the Endangered Species Act, the Secretary of the Interior has

designated critical habitat for a portion, but not all, of the species listed as threatened or endangered. In that context, critical habitat is an example of limiting habitat with both institutional and technical significance. Since the term "critical habitat" has specific legal and regulatory ramifications, it should only be used in relation to Federally listed threatened or endangered species. The protection or restoration of limiting habitat for non-designated or non Federally listed species may be technically significant.

(6) Biodiversity. Most simply defined, biodiversity is a measure of the variety of distinct species and the genetic variability within them. It can be measured at the individual level (genetic variation), population level (species variation), and the community level (variation of biological communities and interaction of ecosystem functions). In measuring diversity, biologists usually attempt to describe species richness (i.e., the number of species found in a community) as well as the distribution of individuals among species (i.e., how evenly the total number of individuals is divided among species). Diversity is greater if individuals are more evenly distributed. Corps planners may recognize as technically significant those restoration alternatives that serve to improve biodiversity within a specified area.

(7) In summary, the case can be made that environmental resources are significant based on technical recognition when, within a specified geographic range, those resources are either scarce; are representative of their respective ecosystems; will improve connectivity or reduce fragmentation of habitat; represent limiting habitat for important species; will improve or increase biodiversity; or trends indicate that the health of the resource is imperiled and declining, but can be recovered through human intervention.

E-38. Acceptability, Completeness, Effectiveness, and Efficiency. Acceptability, completeness, effectiveness, and efficiency are the four evaluation criteria specified in the P&G (Paragraph 1.6.2(c)) in the screening of alternative plans. Alternatives considered in any planning study, not just ecosystem restoration studies, should meet minimum subjective standards of these criteria in order to qualify for further consideration and comparison with other plans. These concepts are discussed in more detail in Section I of this appendix.

a. Acceptability. An ecosystem restoration plan should be acceptable to State and Federal resource agencies, and local government. There should be evidence of broad based public consensus and support for the plan. A recommended plan must be acceptable to the non-Federal cost-sharing partner. However, this does not mean that the recommended plan must be the locally preferred plan.

b. Completeness. A plan must provide and account for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. Real estate, O&M, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features and an adaptive management plan has been proposed it must be accounted for in the plan.

c. Efficiency. An ecosystem restoration plan must represent a cost effective means of addressing the restoration problem or opportunity. It must be determined that the plan's restoration outputs cannot be produced more cost effectively by another agency or institution.

d. Effectiveness. An ecosystem restoration plan must make a significant contribution to addressing the specified restoration problems or opportunities (i.e., restore important ecosystem structure or function to some meaningful degree).

E-39. Risk and Uncertainty Considerations. When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved, which may often be the case, the selection of a recommended alternative becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the course of planning analyses. Restoration of some types of ecosystems may have relatively low risk. For example, removal of drainage tiles to restore hydrology to a wetland area. Other activities may have higher associated risks such as restoration of coastal marsh in a area subject to hurricanes. When identifying the NER plan the associated risk and uncertainty of achieving the proposed level of outputs must be considered. For example, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it might be possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan will actually produce greater ecological output than originally estimated, in effect qualifying it as a cost effective plan. But without taking into account the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration. This topic is discussed in more detail in Section I of this appendix.

E-40. Planning Step 5 - Plan Comparison. Alternative plans that qualified for further consideration will be compared against each other in order to identify the plan to be recommended for implementation. A comparison of the effects of various plans must be made and tradeoffs among the differences observed and documented to support the final recommendation. The effects include a measure of how well the plans do with respect to planning objectives including NED and NER benefits and costs. Effects required by law or policy and those important to the stakeholders and public are to be considered. Previously, in the evaluation process, the effects of each plan were considered individually and compared to the without-project condition. In this step, plans are compared against each other, with emphasis on the important effects or those that influence the decision-making process. The comparison step concludes with a ranking of plans.

E-41. Planning Step 6 - Selection of Ecosystem Restoration Plan. When selecting a single alternative plan for recommendation from all those that have been considered, the criteria used to select the National Ecosystem Restoration (NER) plan include all the evaluation criteria discussed above. Selecting the NER plan requires careful consideration of the plan that meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of cost effectiveness and incremental cost analyses, significance of outputs,

acceptability, completeness, efficiency, and effectiveness. Additional factors to consider include the following items.

a. Partnership Context. Restoration projects that were planned in cooperation with other Federal resource agencies, and where those agencies also have a significant role in implementing the project, using their authorities and funding, should receive higher priority than those that do not, assuming they also satisfy the other criteria. Similarly, restoration projects that make a significant contribution to regional or national interagency programs (e.g., North American Waterfowl Management Plan, Coastal America, Marine Fish Habitat Creation and Restoration Program, Chesapeake Bay Program, etc.) should also receive priority.

b. Reasonableness of Costs. All costs associated with a plan should be considered. Even after tests of cost effectiveness and incremental cost analysis have been satisfied, the decision-maker must ascertain that the benefits to be realized are really worth the costs. This will almost always be a subjective decision and ultimately must rely on experience, reasonableness and common sense.

c. Rarely will the NER plan not be among the best buy plans identified during the cost effectiveness and incremental cost analyses. If the recommend plan is not the NER plan its selection must be justified. The reasons for such a selection should be clearly explained in the supporting documentation as well as the potential implications for cost sharing.

SECTION VI - Hydroelectric Power

E-42. Federal Interest. Hydroelectric power development may be included in formulation of water resources projects when certain criteria are met.

E-43. Types of Improvements.

a. New Federal Projects. Hydroelectric power development may be considered during planning for multipurpose projects involving dams and lakes and may be recommended if non-Federal development would be impractical. The Corps does not construct single purpose hydroelectric power projects. No single purpose hydropower studies may be initiated for new sites unless specifically directed and funded by the Congress. Non-Federal sponsors must agree to share the cost of the feasibility study with the explicit understanding that any resultant project will be financed by non-Federal funds.

b. Additions to Existing Projects. Existing Corps projects without hydroelectric power facilities may have them added, either through Congressionally authorized Federal development, or preferably through Federal Energy Regulatory Commission (FERC) licensed non-Federal development.

c. Pumped Storage. Pumped storage may be investigated where non-Federal development would be impractical. Pumped storage facilities are either integral or adjoining. Integral facilities frequently consist of a conventional powerhouse with reversible units (the same turbines alternately generate power and pump water). Adjoining facilities usually consist of an upper or lower reservoir and powerhouse and intake separate from the multipurpose project dam (and conventional powerhouse, if any). Adjoining facilities may be the only practical way to add pumped storage to an existing project.

d. Minimum Facilities for Future Power Installations. To support future hydropower development, penstocks and some other features, classified as minimum facilities, may be included in initial project construction, while installation of full facilities is postponed. This authority applies even to projects where hydropower is not an authorized purpose (Flood Control Act of 1938 and subsequent authorizing acts). It requires approval by the Secretary of the Army, on recommendation of the Chief of Engineers and the Federal Energy Regulatory Commission (FERC). Recommendations for minimum facilities should be based on estimates of future economic and financial viability of power, and the expected willingness of non-Federal interests to finance the facilities (or repay). The rationale for this authority is the greater dam modification costs, and the potentially foregone project outputs while modification takes place, compared to the cost of initial provision of minimum facilities. Procedures for report processing and approval are contained in ER 1110-2-1.

e. Transmission Facilities. Transmission lines and substations must be considered with other project effects. Transmission investment plus operation and maintenance costs may be included as project costs, or accounted for in benefit estimates (i.e., through the effect of

differences in transmission requirements between hydropower and other (typically thermal) alternatives).

f. Hydroelectric Development at Non-Corps Sites. The Corps of Engineers has no general authority to participate in hydroelectric development at non-Corps sites.

g. Major Rehabilitation Projects. Construction of infrequent, costly structural rehabilitation or major replacement works that will improve reliability or efficiency of a hydropower generating plant or a principal feature thereof are implemented under the Major Rehabilitation Program. Major rehabilitation projects are budgeted under the Construction General account. Rehabilitation is a major project feature restoration consisting of structural work on a Corps operated and maintained facility intended to improve reliability of an existing structure, the result of which will be a deferral of capital expenditures to replace the structure. Rehabilitation is considered as an alternative when it can significantly extend the physical life of the feature and can be economically justified by benefit-cost-analysis. ER 1130-2-500 and EP 1130-2-500 document the requirements and procedures for major rehabilitation studies and projects. A summary of the procedures to evaluate this type of projects is provided in Section X of this appendix.

E-44. Specific Policies

a. Non-Federal Development Encouraged. Corps policy is to encourage non-Federal development where feasible, and thus development should ordinarily proceed under FERC procedures. Pursue Federal action only when non-Federal development is impractical.

b. Practicability. A hydropower project is impractical for non-Federal development if there are compelling physical, operational, legal, competing use, institutional, environmental or economic reasons preventing development or operation, or if non-Federal development would be significantly less productive than Federal development (i.e., produce significantly fewer net NED benefits considering all project outputs).

c. Economic Justification Requirements. Before hydropower can be included in a multiple purpose project, the project must be economically justified based on other outputs (flood damage reduction or navigation). If included, however, hydropower scale is not limited by policy.

d. Conditions of Non-Federal Payment or Repayment.

(1) The cost of Federal hydropower development is a non-Federal responsibility. The Corps of Engineers determines the development costs, including cost allocations, if any. The Separable Cost-Remaining Benefit method (SCRB) is the preferred cost allocation procedure (Corps, Interior, FERC interagency agreement).

(2) Payment via reimbursement is permissible in law, but Corps policy is to seek payment concurrent with construction. Under non-Federal sponsor financing, all or some of the vendible power outputs may be ceded to the sponsor, or, the law permitting, the sponsor may

receive revenue from the Federal power marketing agency selling the power. Traditional reimbursement by Federal power marketing agencies is unlikely because of budget restraints.

(3) Although the Corps constructs and operates power facilities, the power itself is either sold by a Federal power marketing agency or conveyed to a sponsor. Thus, plan formulation, financing and other implementation requirements should be coordinated with the power marketing agency or sponsor, if any.

E-45. NED Benefit Evaluation Procedure

a. Purpose. This section describes procedures for the evaluation of national economic development (NED) benefits of hydropower features of water resources projects and plans. These features include single-purpose hydropower (when Congressionally authorized), the inclusion of hydropower as a function in new multipurpose projects, addition of hydropower power-generating facilities to existing water resource projects, and expansion of existing power plants

b. Conceptual Basis.

(1) The conceptual basis for evaluating the benefits from energy produced by hydroelectric power plants is society's willingness to pay for these outputs. If this is not possible or cost effective, benefit information may sometimes be obtained through examination of market prices. Although utility pricing of electricity is complex and usually based on average cost rather than marginal cost, in cases where it can be determined that market price to the final consumer is based on marginal production costs, this may be used as a measure of benefits. When using market price as a measure of benefits the increment in supply should ordinarily be relatively small compared to the total (i.e., little change would be expected in market price due to the incremental supply). Continued movement of retail electricity pricing towards marginal cost approximations (e.g., seasonal rates, time of day rates, etc.) may make market prices more relevant for benefit evaluation in the future. In the absence of such direct measures of marginal willingness to pay, the benefit from energy produced by hydroelectric powerplants is measured by the resource cost of the most likely alternative to be implemented in the absence of the alternatives under consideration. Non-Federal investment analysis generally does not provide an adequate basis for evaluation of potential investments of Federal resources in hydroelectric power. This is because non-Federal investments reflect financial conditions, insurance, and tax incentives that differ from those applying to Federal investments. The procedure that follows allows the planner to construct an NED benefit estimate based on real resource cost of the most likely non-Federal alternative. Simplifications are encouraged for small-scale hydropower projects. An alternative hydropower benefit evaluation procedure is provided for single-purpose projects that are to be 100 percent non-federally financed, provided that there are no significant incidental costs.

(2) The real resource cost of the most likely alternative can also be used to compute benefits from nonstructural measures. However, the net benefits of certain nonstructural

measures that alter the electric power load cannot be measured effectively by the alternative cost procedures for the following reasons:

(a) Structural measures and many nonstructural measures (except those that alter the load) result in similar plan outputs, whereas load-altering measures (e.g., revised rate structures) may change levels of output; and,

(b) Load-altering measures may have fewer direct resource costs than measures based on higher levels of output. Because of this lack of comparability, the benefits from such load-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the benefits of load-altering nonstructural measures on the basis of direct willingness to pay are encouraged.

c. Planning Setting.

(1) Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of a project, including any known changes in law or public policy. The without project condition includes the following specific assumptions:

(a) Existing Resources. Existing generating resources are part of the without project condition. Make adjustments to account for anticipated plant retirements and changes in plant output due to age or environmental restrictions associated with existing policy and regulations.

(b) Existing Institutional Arrangements. Existing and reasonably expected future power system and water management contracts, treaties, and non-power river operating criteria are part of the without project condition. If revision of these arrangements is part of an alternative plan, the new arrangement (revised contract, criteria, etc.) would be considered in the with project condition.

(c) Alternative Actions Anticipated or Under Way. The without project condition includes those generating resources that can reasonable be expected to be available in the forecast period.

(d) Nonstructural Measures and Conservation. The without project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures.

(2) With Project Condition.

(a) The with project condition is the most likely condition expected to exist in the future with the plan under consideration. Examples of alternative plans include: alternative combinations of projects in a basin study; alternative sites in a reach study; alternative plant sizes at a specific site; alternative reservoir sizes at a reservoir site; use of reregulation and/or pumpback to increase firm capacity; and reallocation of storage to increase firm energy output.

(b) Nonstructural alternatives to hydropower may be used alone or in combination with structural measures. Nonstructural measures include but are not limited to reducing the level and/or time pattern of demand by time-of-day pricing; utility-sponsored loans for insulation; appliance efficiency standards; education programs; inter-regional power transfers; and increased transmission efficiency.

d. Evaluation Procedure

(1) Follow the steps shown in Figure E - 9 and described in the following paragraphs to estimate NED benefits that would accrue whenever the plan would be cost shared. When single-purpose hydropower alternatives being studied would be 100 percent non-federally financed, the market-based procedure specified in paragraph E-45 may be used. Non-federally financed means that all construction and operating costs would be financed entirely from sources other than federally appropriated funds. The level of effort expended on each step depends upon the nature of the proposed development, the state of the art for accurately refining the estimate, and the likely effect of further refinement on project formulation and justification. For the purpose of ensuring efficiency in the use of planning resources, simplifications of the procedures set forth in this section are encouraged in the case of single-purpose, small scale hydropower projects (25 MW or less), if these simplifications lead to reasonable approximations of NED benefits and costs. In addition, an analysis of marketability may be substituted for determination of need for future generation for hydropower projects up to 80 MW at existing Federal facilities.

(a) Step 1 - Identify System For Analysis. Because of the trend toward interconnection and coordination among utilities and power systems, it is most appropriate to evaluate NED benefits for hydropower on a system basis, rather than on the needs of an individual utility or local area. The size of the system would depend on the situation but could consist of a power pool, a National Electric Reliability Council (NERC) regional area, the marketing area of a Federal Power Marketing Administration, or other geographic region. In some cases, physical or institutional constraints may limit the analysis to a smaller area, but care must be taken to ensure that benefits are not misstated by such analysis.

(b) Step 2 - Estimate Future Demand For Electric Power. Forecast electric power loads in terms of the annual peak demand period. When a high proportion of the generation is from hydropower, a forecast of annual energy demand should be made. Also forecast weekly load shapes to represent a minimum of three periods in the year (e.g., typical summer, winter, and spring/fall days) to assist in determining the type of load that a hydropower project could carry. Load forecasts should reflect the effects of all load management and conservation measures that, on the basis of present and future public and private programs, can reasonably be expected to be

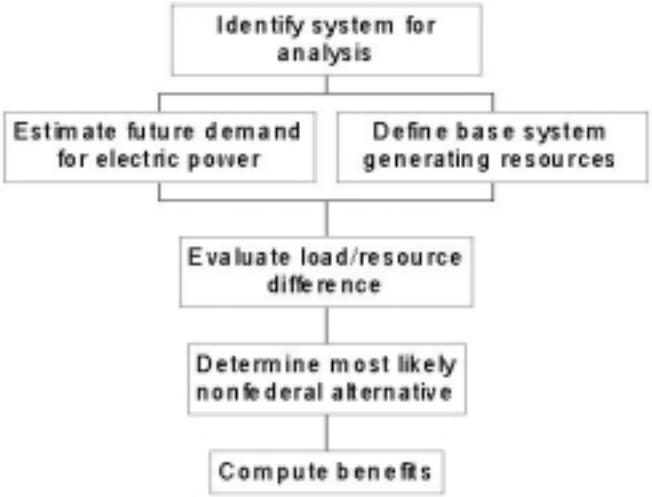


Figure E- 9 Flowchart of Hydropower Benefit Evaluation Procedures

implemented during the forecast period. Load forecasts should be made and analyzed by sectoral use (e.g., residential, commercial, industrial). Estimate loads at increments of no more than 10 years from the present to a time when the proposed plant will be operating in a state representative of the majority of its project life. In the case of staged hydropower development or where generation system resource mixes may change markedly, load forecasts may be appropriate for 20 years or more beyond the initial operation date. Account for system exports and reserve requirements.

(c) Step 3 - Define Base System Generating Resources. Project future generating resources and imports at various points in time without the proposed plan or any alternative plan. Estimate resources for the time periods stated in step 2. Provide information on peak capacity and on average annual energy production where a high proportion of the systems generation is hydropower. Data are readily available on projected system resources for about 10 years. Base projected resource additions beyond that time on system studies. Account for retirement of older plants as well as the reduction of output of some plants due to age or environmental constraints.

(d) Step 4 - Evaluate Load/Resource Difference. Compare the loads identified in step 2 with the resources identified in step 3 to determine: (1) when generating resource deficits will occur, (2) the magnitude of these deficits, and (3) what portion of these deficits could be met by the hydropower project. If nonstructural measures are components of an alternative plan and these measures reduce system loads, the amount of such reduction lessens system deficits. Hydropower sites can be developed to provide either a base load, mid-range, or peaking service. Evaluate the system demand for each class of hydropower generation. Simple tabulation of annual peak and energy loads and resources is generally adequate for preliminary studies. Use

system load-resource models that account for load characteristics and generating plant operating capabilities, if available, to evaluate accurately the usability of specific projects.

(e) Step 5 - Determine the Most Likely Non-federal Alternative.

(1) General. Select the one alternative most likely to be implemented in the absence of the proposed Federal project. Begin identification of the most likely alternative to the plan being considered with the least costly alternative. If an alternative with a lesser cost is passed over for a more expensive one, justify not selecting the lower cost plan.

(2) Screen Alternatives. The alternatives to a specific hydropower project must be viable in terms of engineering, environmental quality, and other national policy considerations. Engineering viability limits thermal alternatives to commercially available electric powerplants. Environmental viability implies that plant costs include all equipment required to meet environmental quality criteria. National policy considerations include factors such as legal limitations on the use of oil, natural gas, and other “scarce” fuels for electric power generation. Each alternative need not in itself deliver service similar in kind to the hydropower project, but the total power system with the alternative must deliver service similar in kind to the system with the hydropower project. If nonstructural measures or conservation are components of an alternative plan and these measures reduce the need for additional capacity or for additional power, the amount of such reduction constitutes provision of service similar in kind; this ensures that evaluation procedures will not be biased against the selection of an alternative that utilizes nonstructural measures.

(3) Identify the Most Likely Alternative. Compare the system with the hydropower project under consideration to alternatives capable of meeting system loads within established criteria of system reliability. Base the comparison on the basis of cost and other factors to determine the most likely alternative, i.e., the structural and/or nonstructural measures that will be implemented if the project under consideration is not implemented. If institutional obstacles to implementation are noted, an alternative plan should still be considered the most likely if the barriers are substantially within the power of the affected users to correct. A detailed description of the institutional obstacles should be included, with a discussion of the basis for the conclusion that the obstacles cannot be overcome. If the most likely alternative includes new thermal plants, use those plants’ capacity costs (including amortized investment costs, transmission costs and fixed operating and maintenance (O&M) costs) as the measure of the value of the hydropower project’s generating capacity, and use the thermal plants’ energy costs (primary variable O&M costs and fuel costs) as the measure of the value of the hydropower project’s energy production.

(f) Step 6 - Compute Benefits.

(1) Compute Hydropower Plant Annual Benefits. Compute annualized benefits based on the costs of the most likely alternative for each hydropower development and installation component. Base the calculation of alternative costs to be used as a measure of NED benefits on the following: (i) calculate all interest and amortization costs charged to the alternative on the basis of the Federal discount rate; (ii) charge no costs for taxes or insurance to the alternative; and (iii) in calculating costs of the most likely alternative, use assumptions and procedures that parallel those used to calculate the costs of the plan being evaluated. In many cases, benefits may vary over the life of a project. This may be due to such factors as staged development of the hydropower project, changes in operating of the hydropower project resulting from changes in the resource mix in the total generating system, and real escalation in fuel costs (if the most likely alternative system includes a thermal plant). Compute project benefits by time intervals and discount these values to derive annualized power benefits. When applicable, the evaluation shall reflect differences in the cost of transmission, distribution, and other facilities compared to the most likely alternative. Occasionally, the initial output of a hydropower project is large compared to annual growth in system load; two or more years may be required to fully absorb its output into the load. In these cases adjust the credit (benefit) to reflect the generating capacity and energy actually used in the load in the early years of project life.

(2) Energy Value Adjustment. Account for the effect on the system production expenses when computing the value of hydroelectric power. Adding structural or nonstructural measures of a plan to a system instead of adding an alternative power source may result in greater or lesser system production expenses than if a particular thermal capacity were added; the effect on production expenses can be determined by performing a system analysis. If there is a difference in system production expenses, adjust the energy value in the economic analysis of the plan. If the alternative plan would increase system production expenses, the adjustment would be positive. Consider system production expenses in determining the most likely alternative.

(3) Capacity Value Adjustment. The physical operating characteristics of hydropower projects differ significantly from alternative thermal plants. Appropriate credit may be given to hydropower projects to reflect their greater reliability and operating flexibility. When the value of these characteristics cannot otherwise be quantified, an adjustment can be made to the alternative plant capacity costs. Typically, the adjustment per kilowatt of capacity ranges from 5 to 10 percent of the cost per kilowatt of thermal capacity, depending on the operating characteristics of the hydropower project and alternatives that include thermal capacity. The adjustment may be applied by increasing the capacity cost of the most likely alternative by the appropriate percentage determined by the Federal Energy Regulatory Commission (FERC).

(4) Intermittent Capacity Adjustment. The dependable capacity of hydropower project is based on the load-carrying capacity of the project under the most adverse combination of system

loads, hydrologic conditions, and plant capabilities. This very conservative approach is unrelated to the dependable capacity of a hydropower project's alternative if thermal capacity is included and given no credit for the value of capacity that is available a substantial amount of the time. When power system operation studies show that there is an intermittent capacity value to the system, a capacity adjustment should be made.

(5) Price Relationships. Assume relative price relationships and the general level of prices prevailing during the planning study to hold generally for the future, unless specified studies and considerations indicate otherwise. Examples of the latter include escalation of relative fuel cost (e.g., due to increasing scarcity) or increased capital costs expected to result from changed environmental or safety criteria. Fuel costs used in the analysis should reflect economic prices (market clearing) rather than regulated prices.

e. Data Sources. Data on existing and planned resources, loads, marketability criteria, and alternative costs are available from various agencies and groups, including the Department of Energy, NERC regional councils, FERC regional offices, Federal power marketing administrations, State energy agencies, utility companies, and regional planning groups. If specific operating characteristics of individual plants are not available, generalized data can be obtained from other sources, including the Electric Power Research Institute. Load-resources models based on simulated system operation may be used if available. Some of these models are available from various sources, including FERC, Federal power marketing administrations, and a number of consulting services.

f. Alternative Procedure: Financial Evaluation.

(1) General. This section provides an alternative hydropower benefit evaluation procedure that may be used for evaluating single-purpose projects that are to be 100 percent nonfederally financed, provided that there are no significant incidental costs. This approach employs market data based on long-run (10 or more years) utility wholesale prices as an estimate of the cost of producing equivalent power from the most likely alternative. These prices may be used to evaluate and compare the financial feasibility of alternative plans, provided that they are consistently applied to all of the alternatives. Through this process, the most financially attractive alternative is identified. Because the benefits and costs of all alternative plans are evaluated in a consistent way, the most financially attractive plan can be identified as the NED plan.

(2) Industry Long-run Wholesale Prices. The market approach must be carefully applied to ensure that the long-term (10 or more years) contract prices reflect the energy and capacity characteristics of the proposed hydropower project. In screening contracts for applicability, a number of factors should be examined, including: term of contract, power and energy availability (daily, weekly, seasonally), geographic relationship, delivery voltage, power factor, point(s) of delivery (busbar, high voltage grid, load center), interconnecting facilities, reliability

standards and emergency backup. Information on long-term wholesale power contracts may be obtained from FERC, State public service commissions, the Federal power marketing administrations, and electric generating and distribution utilities.

g. Report and Display Procedures.

(1) Tables E-23 through E-25 are suggested for presentation for reports that include federally financed hydropower measures. Table E-23 summarizes the output of all plans by peaking capacity and system load factor, and presents the costs of each alternative plan. Tables E-24 and E-25 summarize the output of the structural component of each alternative, the benefits of the structural components, and the resource costs of all structural and nonstructural components of each alternative plan. The number of benefit categories included will carry from project to project. Not all projects will have intermittent capacity, for example, and in some cases it will be appropriate to account separately for firm and secondary energy. System energy costs are sometimes included in the unit energy values; in those cases such costs would not have to be accounted for separately.

(2) Table E-25 is suggested if the nature or magnitude of hydropower benefits changes substantially over time. Examples are: staged construction of the hydropower project; change in the role of hydropower in the system over time; and situations in which several years are required to absorb a large project into the system. When the alternative financial evaluation procedure is used to evaluate financial feasibility of plans that are to be 100 percent non-Federally financed (see paragraph E-45f), physical data similar to that found in Tables E-23 through E-25 should be displayed. Capacity and energy values, as developed through the financial analysis, should also be displayed in a manner facilitating comparison among alternatives. These displays are in lieu of the standard presentation of hydropower benefits and project costs in the NED account. Also display any incidental benefits and costs of the alternatives. However, no benefit-cost ratio can be presented, because the analysis of the hydropower project's financial feasibility is not comparable to economic analysis.

h. Major Rehabilitation Projects Evaluation Procedures. Benefits associated with major rehabilitation projects are increases in reliability and efficiency improvements. Procedures to estimate these benefits are found in ER 1130-2-500 and EP 1130-2-500.

E-46. Special Considerations. Upon request, districts may provide reimbursable technical services to states or State subdivisions on hydropower development at sites where hydropower is not an authorized purpose (Intergovernmental Cooperation Act of 1968; see ER 1140-1-211). Assistance is limited to technical services; separate authority to construct or operate and maintain hydropower facilities is required. The Corps Center of Expertise for hydropower projects is located in Northwestern Division (NWD).

b. Coordination Initiatives.

(1) FERC Coordination-Costs of Alternatives. Ordinarily the Corps collaborates with FERC in estimating costs of alternatives to Corps hydropower projects, and frequently has adopted FERC values as benefits. The Corps is under no requirement to use FERC values however; if a district can perform superior analysis, it should do so.

(2) Marketing Agencies. The Corps does not market the power it produces; marketing is done by the Federal power marketing agencies (Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration, Bonneville Power Administration, Alaska Power Administration) through the Secretary of Energy. The rates are set by the marketing agency to: (a) recover costs (producing and transmitting) over a reasonable period of years (50 years usually); and (b) encourage widespread use at the lowest possible rates to consumers, consistent with sound business principles. The law requires that preference for sale be given to public bodies and cooperatives. Rates are determined by the marketing agency and approved by FERC (Section 5 Flood Control Act 1944, Public Law 78-534; see ER 1130-2-324). In compliance with Section 103(c)(1) of the Water Resources Development Act of 1986 (Public Law 99-662), any proposal to Congress for hydroelectric power authorization must contain statements of the appropriate power marketing agency regarding its marketing of the power to recover all costs allocated to power and any other costs assigned for power cost recovery pursuant to law.

Table E- 23 Electric Power Supply Alternatives

[Period of analysis, price level, discount rate]

	Annualized cost[1] ($1,000)	Peak power supplied conserved, and system load factor (MW)[2] by time period[3]			
		P_1	P_2	P_3	P_N
Most likely alternative	.....	.....	.....	.....	.....
Recommended plan.....	.....	.....	.....	.....	.....
Other plans analyzed.....	.....	.....	.....	.....	.....

[1]Annual equivalent cost includes system costs.
[2]For example, for the summer season, an entry "90 10 .6" would represent the 100 MW deficit in the summer peak use identified in the without-project condition by supplying 90 MW and reducing the quantity used by 10 MW; the system load factor for the entire system for the summer would be .6.
[3]Show by time period and season where there are seasonal variations

Table E- 24 Summary of Annualized NED Benefits for Structural Measures and NED Costs for Structural and Nonstructural Measures[1]

[(Thousands of month, year dollars) Applicable discount rate: ____]

	Alternative			
	1	2	3	X
Plant data:				
Installed capacity, MW	.....	.....	.....	.....
Dependable capacity, MW.....	.....	.....	.....	.....
Intermittent capacity, MW	.....	.....	.....	.....
Average annual energy, gWh.	.....	.....	.....	.....
Average annual capacity factor (percent).....	.....	.....	.....	.....
Benefits:	(.....)	(.....)	(.....)	(.....)
Unit capacity.....	.....	.....	.....	.....
Dependable capacity benefits.	.....	.....	.....	.....
Intermittent capacity benefits.				
Unit energy value (mills/kWh).....	(.....)	(.....)	(.....)	.....
Energy benefits				(.....)
Unit system energy adjustment (mills/kWh).....	(.....)	(.....)	(.....)	..... (.....)
System energy cost adjustment.....	(.....)	(.....)	(.....)	(.....)
Real fuel cost escalation rate (percent).....	(.....)	(.....)	(.....)	.....
Period of real fuel cost adjustment (yrs)				
Real fuel cost adjustment.....				
Total hydro benefits.....	.....	.....	.....	.....
Other purpose benefits (list).....	.....	.....	.....	.....
Annualized cost.....	.....	.....	.....	.....
Structural measures	.....	.....	.....	.....
Nonstructural measures.....	.....	.....	.....	.....
Net annualized benefits	.....	.....	.....	.....

[1]Note that benefits from load-altering nonstructural measures are excluded. This table may be used for displaying the benefits of nonstructural measures that do not alter the load (see 2.5.2(b)).

Table E- 25 Time Distribution of NED Electric Power Benefits

for Structural Measures of Alternatives[1](Applicable discount rate: ____)

	Alternative				
	P_1	P_2	P_3	P_X	AAE[3]
Plant data:					
Installed capacity, MW	.....	.....	.....	.....	.....
Dependable capacity, MW..	.....	.....	.....	.....	.....
Intermittent capacity, MW..	.....	.....	.....	.....	.....
Average annual energy, gWh	.....	.....	.....	.....	.....
Average annual capacity factor (percent).....	.....	.....	.....	.....	.....
Benefits:					
Unit capacity.....	(.....)	(.....)	(.....)	(.....)	(.....)
Dependable capacity benefits	.....	.....	.....	.....	.....
Intermittent capacity benefits	.....	.....	.....	.....	.....
Unit energy value (mills/kWh)	(.....)	(.....)	(.....)	(.....)	(.....)
Energy benefits	.....	.....	.....	.....	.....
Unit system energy adjustment (mills/kWh)	(.....)	(.....)	(.....)	(.....)	(.....)
System energy cost adjustment	.....	.....	.....	.....	.....
Real fuel cost escalation rate (percent)	(.....)	(.....)	(.....)	(.....)	(.....)
Period of real fuel cost adjustment (yrs).....	(.....)	(.....)	(.....)	(.....)	(.....)
Real fuel cost adjustment....	.....	.....	.....	.....	.....
Annualized benefits.....	.....	.....	.....	.....	.....

SECTION VII – Recreation

E-47. Federal Interest. The legislative basis for Federal participation in recreation development is found in the Flood Control Act of 1944, as amended, the Federal Water Project Recreation Act of 1965 (Public Law 89-72), and the Water Resources Development Act of 1986 (Public Law 99-662). These give broad authority to include recreation as a project purpose. Policy limits exercise of these authorities however. Recreation is a low priority output and thus the Corps will not plan for (formulate for) single purpose recreation unless a sponsor is willing to pay one hundred percent of the associated implementation costs. For projects with other purposes to which separable recreation is added, the statutory cost sharing requirement is just fifty percent. The Corps will plan for and implement projects serving other purposes (hurricane and storm damage reduction for example) and these may have incidental recreation benefits. Benefits are incidental when: (1) a project is formulated for other primary purposes and recreation benefits are less than 50% of total benefits, or (2) a project is formulated for other primary purposes and average annual recreation benefits are less than 50% of the average annual benefits required for justification. This is equivalent to saying the recreation benefits, which are required for justification, must be less than an amount equal to 50% of project costs. There may be additional recreation benefits if they are not required for justification. In addition, for multiple purpose projects recreation may be included as a primary purpose if there is a non-Federal sponsor. For cases 1 and 2, recreation benefits are considered incidental; cost sharing (and cost allocation, if any) is based on the formula for the primary purpose only.

E-48. Types of Improvements

a. Vendible Outputs and Services and Non-Federal Facilities. Improvements providing outputs or services generally considered vendible are non-Federal responsibilities. Marina facilities and telephone services are examples. Any improvement or service not closely and directly related to enjoyment of the natural resource itself (or created resource itself) is a non-Federal responsibility, even if it is not generally considered vendible. Examples are tennis courts and accommodations for viewing sporting or cultural events taking place on or near a lake.

b. Federal Participation, Joint Facilities and Cost Sharing. If there is no non-Federal recreation sponsor, facilities or project modifications may not be recommended unless justified by other project purposes, in which case recreation benefits are considered incidental. Minimum facilities needed to maintain public health or safety, are permissible. These are limited to road end turnarounds, guardrails, barricades, warning signs, public safety fencing and vault toilets (unless upgrades are required by Federal or state regulations). Boat ramps and trailer parking justified by project operations requirements may be provided. Costs are joint costs and allocated to project purposes.

c. Facilities Justification and Cost Sharing. When there is a recreation sponsor economically justified facilities are cost shared 50 percent Federal and 50 percent non-Federal.

d. Check List of Facilities. Exhibit E-2 contains a list of recreational facilities which may be provided in recreation developments at Corps water resources projects with requirements for funding each as either: (1) joint facilities cost-shared jointly with other project features; (2) separable recreation features dependent upon the water resource project that may be cost-shared at 50 percent Federal and 50 percent non-Federal with the recreation sponsor; and/or, (3) separable recreation facilities for which there will be no Federal cost-sharing and which must be provided at 100% non-Federal cost.

E-49. Specific Policies

a. Lakes (man-made).

(1) Lakes, or reservoirs, are impoundments created behind dams, or behind navigation locks and dams if lands not subject to navigation servitude are needed for water storage. Recreation policies applicable to lakes are not applicable to dry dams, that is those dams not providing permanently impounded water. The Federal government may participate in basic recreation facilities on project lands or separable recreation lands if a non-Federal sponsor will participate and cost share as outlined in paragraph E-51. The same conditions apply to separable lands acquired for future recreation development.

(2) Recreation costs may not exceed one-half of total costs.

(3) If recreation is a project purpose, several scales of development must be formulated and evaluated.

(4) Reallocation of Storage. Storage reallocations for recreation which significantly affect other authorized purposes, or involve major structural or operational changes, require Congressional approval. Costs reallocated to recreation and subject to cost sharing will be set to the highest of: benefits foregone; revenues foregone; replacement costs; updated cost of storage. Cost sharing of facilities is 50/50.

b. Other Types of Projects. These include works or improvements for commercial and recreational navigation, hurricane and storm damage prevention, non-lake projects for flood damage prevention and ecosystem restoration. The benefits and costs of recreation are considered incremental. Specific policies and exceptions are provided in the following paragraphs.

(1) Non- lake Projects.

(a) At non lake projects basic recreation facilities exploiting project created opportunities may be provided, but only on lands acquired for non recreation purposes.

(b) The Federal government will not participate in acquiring lands for recreation purposes. A special case may exist when the real estate interest required for other project purposes is insufficient for recreation development. The sponsor may obtain real estate interest sufficient for recreation and receive a credit for the incremental cost. For example, if an easement is adequate for other project purposes, but fee acquisition is necessary for recreation development, the sponsor may receive credit for the incremental cost of fee acquisition. This real estate upgrade policy does not apply to temporary construction easements, nor to disposal or borrow areas.

(c) If there is to be recreation development, then beyond real estate interest upgrades the only other Federal participation in land acquisition is for providing access to project lands, parking, potable water, sanitation and related developments for public control and for health and safety.

(d) Unlike lake projects, at non lake projects there is no routine Federal interest in provision of minimum facilities for public health and safety. That is, if no recreation development is sponsored by a non-Federal entity, there is no Federal participation in minimum facilities.

(e) The Federal cost of a project including recreation may not exceed the Federal cost of the project excluding recreation by more than ten percent without prior approval by the Secretary of the Army.

(2) Shore Protection Project. Except for Federal shores the Corps will not participate in the cost of beach use recreation developments. Local cooperation requirements shall include the provision and maintenance of roads, parking, sanitary facilities and any other on-shore recreation development necessary to accommodate anticipated beach users needed to realize recreational benefits claimed. Also, Army policy precludes the addition of sand to a beach solely to increase its potential for recreation.

(3) Nonstructural Flood Damage Reduction Projects. The formulation of nonstructural flood damage reduction projects is not constrained by the limitation of increased Federal cost for recreation development described above. This is because such projects are justified mainly by creating new uses for floodplains, and the most important new use is frequently recreation.

(4) Recreation at Ecosystem Restoration Projects. Recreation at ecosystem restoration projects should be compatible with these types of projects and enhance the visitation experience

by taking advantage of natural values. The social, cultural, scientific, and educational values should be considered within the framework of the ecosystem restoration project purpose. Recreation development at an ecosystem restoration project shall be totally ancillary to the primary purpose, appropriate in scope and scale, and shall not diminish the ecosystem restoration outputs used to justify the project. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem restoration project but the project shall not be formulated for recreation. The recreation potential may be satisfied only to the extent that recreation does not adversely impact the ecosystem restoration purpose, and the recreation facilities are justified. The recreational experience shall build upon the ecosystem restoration objective and take advantage of the restored resources rather than detract from them. Ecosystem restoration projects should not encourage public use if there is no non-Federal sponsor to cost share recreation. Federal participation in recreation development at ecosystem restoration projects will be limited to the facilities shown in Exhibit E-3 of this appendix. Specific policies stated in paragraph E-49b also apply to recreation development at single purpose ecosystem restoration projects.

(5) Multipurpose Projects. For multipurpose projects that include nonstructural flood damage reduction, ecosystem restoration and recreation, the cost of recreation associated with the non-structural flood damage reduction features may not exceed one-half of the total cost for flood damage reduction plus recreation; and, for recreation associated with ecosystem restoration, the Federal cost of ecosystem restoration plus the Federal cost of recreation may not exceed by more than 10 percent the Federal cost of the ecosystem restoration project without prior approval of the ASA(CW). For example, a multipurpose project with a total cost of $8 million for nonstructural flood damage prevention and Federal cost of $2 million for ecosystem restoration, may include recreational facilities associated with the nonstructural flood damage prevention project with a cost not to exceed $8 million and recreational facilities associated with the ecosystem restoration projects with a Federal cost not to exceed $200,000.

(6) Continuing Authorities. Flood control, navigation and shore protection continuing authorities are subject to the same recreation policies and conditions of participation as specifically authorized projects. Additionally, all costs in excess of the statutory limitation of Federal expenditures for these projects are entirely a local responsibility.

E-50. NED Benefit Evaluation Procedure

a. Purpose. This section provides the procedures for evaluating the beneficial and adverse effects of water project recreation on national economic development (NED). The Federal Water Project Recreation Act of 1965 requires that full consideration is given to the opportunities that Federal multipurpose and other water projects afford for outdoor recreation and associated fish and wildlife enhancement.

b. Conceptual Basis.

(1) General.

(a) Benefits arising from recreation opportunities created by a project are measured in terms of willingness to pay. Benefits for projects (or project features) that increase supply are measured as the willingness to pay for each increment of supply. Benefits for projects (or project features) that alter willingness to pay (e.g., through quality changes) are measured as the difference between the without and with project willingness to pay. Willingness to pay includes entry and use fees actually paid for site use plus any unpaid value (surplus) enjoyed by consumers. (Payment for equipment, food, transportation costs, or lodging associated with recreation activity cannot be used as direct estimates of willingness to pay, because these payments are not specifically for site use.) The total willingness to pay is represented as the area under the demand curve between the old and new supply. Because most recreation is publicly provided, it is usually not possible to estimate demand directly from observed price-consumption data. This section describes procedures for estimating use and willingness to pay by means of travel behavior, user surveys, and other quantifiable measures.

(b) Many proposed projects subject to NED benefit-cost analysis involve both recreation gains and recreation losses. Section 928 of the Water Resources Development Act of 1986 requires, for projects having recreation benefits, analysis of the effects of the proposed project on existing recreation resources. For example, stream and land-based recreation may be lost because of the project, or recreation may be transferred to the proposed site from a more distant site. Net recreation benefits are the value of the gains minus the value of the losses; benefits may be positive or negative. Since reliable empirical methods for estimating willingness to accept compensation for losses have not been developed, measures of willingness to pay are used to value both gains and losses. Evaluation procedures should be based on sound economic rationale and have an empirical basis that permits an objective and reproducible analysis of benefits and costs. Reports shall include:

(1) A description of the alternative or competing facilities and their existing and future use, with and without the proposed project. Describe alternative resource use at a level of detail

roughly similar to that used to describe use of the proposed project. For example, if peak and non-peak attendance, types of facilities and categories of use, etc., are used to characterize the proposed project, a similar level of detail shall also be used to describe the competing resources.

(2) Analysis of the proposed project which takes into account use of the alternative resources. Estimate benefits of the proposed project net of benefits of the alternative facilities. For example, beach recreation benefits for a proposed project are net of benefits from use of an alternative beach in the without project condition.

(2) Criteria for an Acceptable Evaluation Procedure. An acceptable evaluation procedure has the following characteristics:

(a) Evaluation is based on an empirical estimate of demand applied to the particular project.

(b) Estimates of demand reflect the socioeconomic characteristics of market area populations, qualitative characteristics of the recreation resources under study, and characteristics of alternative existing recreation opportunities.

(c) Evaluation accounts for the value of losses or gains to existing sites in the study area affected by the project (without project condition).

(d) Willingness to pay projections over time is based on projected changes in underlying determinants of demand.

(e) Development of recreation facilities for non-reservoir projects must be on the land required for the basic project with the exception that additional recreation land may be acquired if needed for access, parking, potable water, sanitation, and related development for health, safety and public access.

(3) Description of Evaluation Methods. The procedures described in this section incorporate three evaluation methods. They are the travel cost method (TCM), contingent valuation method (CVM), and unit day value (UDV) method. The use of any other method should be justified as conforming to the characteristics listed in paragraph E-50b and the selection process described in paragraph E-50b(4).

(a) Travel Cost Method. The basic premise of the travel cost method is that per capita use of a recreation site will decrease as out-of-pocket and time costs of traveling to the site increase, other variables being constant. TCM consists of deriving a demand curve by using the variable

costs of travel and the value of time as proxies for price. This method may be applied to a site-specific study or a regional model.

(b) Contingent Valuation Method. The contingent valuation method estimates NED benefits by directly asking individual households their willingness to pay for changes in recreation opportunities at a given site. Individual values may be aggregated by summing willingness to pay for all users in the study area. This method may be applied to a site-specific study or a regional model. Contingent value techniques shall not be used to estimate existence, "option", bequest or other such non-use values, due to several factors including the conjectural nature of estimated values and the high difficulty in controlling bias.

(c) Unit Day Value. The unit day value method relies on expert or informed opinion and judgment to estimate the average willingness to pay of recreational users. By applying a carefully thought-out and adjusted unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits.

(4) Selection of Evaluation Procedure. Select a procedure for evaluating each of the following two categories of project-related use: (1) total or gross expected use of project facilities, including transfers of use from other sites; (2) and existing site use displaced or destroyed by project facilities. The criteria for selecting the appropriate procedure for each category are set out in Figure E-10. Application of the criteria may result in selection of different procedures for the two categories. The criteria given in Figure E-10 consider several dimensions of project evaluation situations: Three measures of the absolute and relative size of the recreation benefit created, displaced, or transferred by the proposed project, and the nature of the recreation activities affected. If either use category specified above involves more than 750,000 annual visits, use either a regional model or site-specific study to evaluate benefits or benefits foregone. If recreation in an important project component relative to other outputs and costs, or if specialized activities (those for which opportunities in general are limited, intensity of use is low, and users' skill, knowledge, and appreciation is great) are affected, the criteria also require greater accuracy in benefit estimates. If both specialized activities and general recreation are affected by the project, the choice between a regional model and a more limited site-specific study is at the discretion of the agency, based on consideration of the relative importance of the specialized activity, the advantages of the respective methods, and cost considerations.

(a) Restrictions on UDV Use. The general principle for the recreational analysis is, the more important recreation benefits are in plan formulation and/or plan selection and the more costly recreation components are, the more important is economically sound and empirically defensible analysis. The arguments for employing the user day approach can be based on two foundations: (1) Infeasibility for technical reasons or due to study cost considerations; or, (2) formulation or plan selection not materially affected by willingness to pay value or by expected

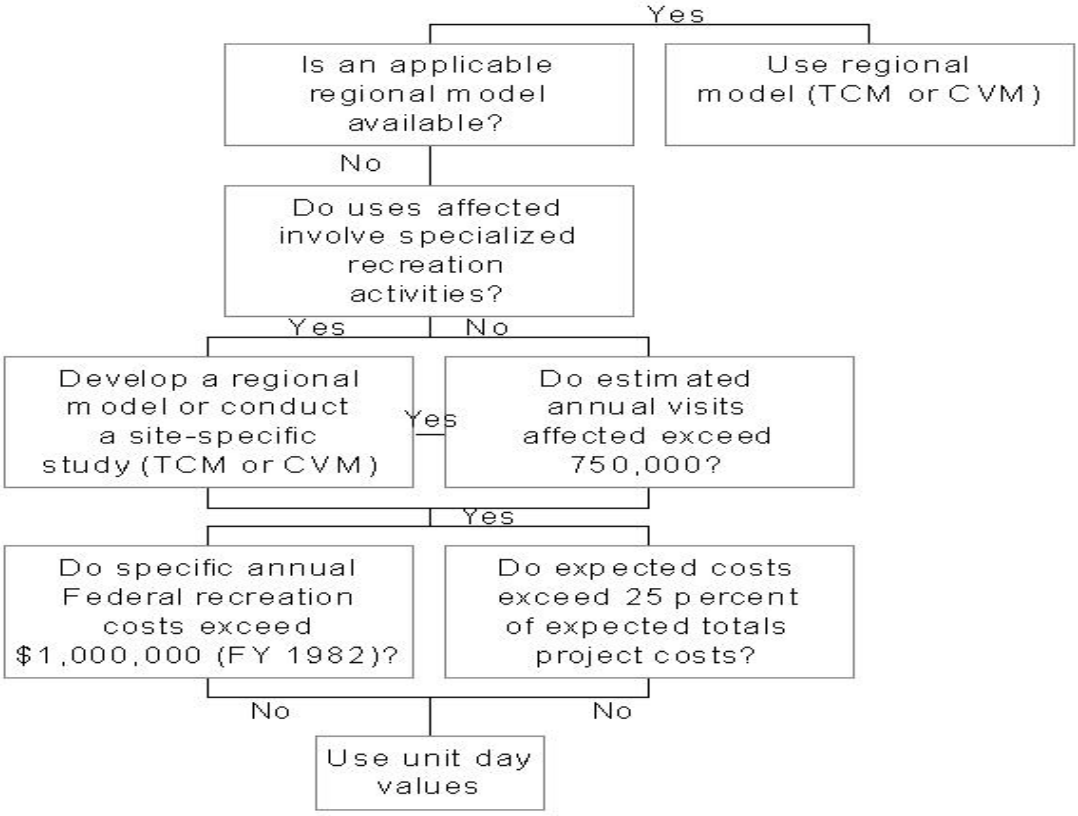


Figure E- 10 Criteria for Selecting Procedures for Evaluating Recreation Benefits

visitation. Study cost considerations do not simply mean the least study cost method is chosen; quality of analysis and results must be considered. The reasons for choosing a particular benefit evaluation method must be documented in the planning reports.

(b) Required Visitation Documentation. The UDV approach in recreation benefit analysis consists of two parts: estimating visitation and determining value per visit. Both must be documented in planning reports. Of the two parts, the determination of UDV is subjective; the visitation is not. Projected visitation must be based on data, either at the existing project or by comparisons with other similar resources. Historic and existing visitation and the capacity of the proposed project and its substitutes should be displayed. Expected visitation at the proposed project, in the without project and with project conditions, should be analyzed taking into account transfers from substitute recreation resources. Reasonableness of visitation should be established. This can sometimes be done via comparisons to other verifiable data (e.g. visitation at other similar resources, comparison to statewide participation data, references to other credible modeling studies, smaller scale surveys than would be required in CVM, etc). The key elements are reasonableness and documentation.

(c) Required Procedure for Determining Willingness to Pay Surrogate. Unit day values are to be developed using a point rating scale. Use of a particular point rating scale is not limited to the one presented at the end of this section. Additional or substitute rating criteria are allowed and encouraged. Resource and socioeconomic characteristics similar to those that would form the independent variables in a willingness-to-pay model are candidates for additional/substitute rating criteria. Similar recreation resources in the region should be surveyed for comparison to the proposed project. The main constraint is the range of monetary values. Point ratings are developed in a systematic, consistent and documented process; public participation in assigning point values lends credibility to this essentially subjective process. Changes in the quantity and quality of a recreation experience must be directly related to the nature of the Federal project. For example, changes in the ease of use or convenience of a small boat harbor have no effect on the environmental quality of the primary resource (ocean, bay, etc). Note that unit day value does include entry and use fees actually paid for the site. Therefore, entry and use fees should not be added to the unit day value to determine total willingness to pay.

(5) Additional Reference Material. Additional detailed support material for conducting NED evaluation may be found in a series of documents prepared by the Institute of Water Resources (add net site). Policy statements in this regulation take precedence in any apparent contradiction suggested by information contained within these IWR reports.

c. Planning Setting.

(1) General. Determine changes in recreation use and value resulting from alternative plans through analysis or without project and with project conditions in the study area over the prescribed period of analysis.

(2) Without Project Condition. The without project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis in the absence of the recreation project or plan. The without project condition includes existing water and related land recreation resources, and projects and additional recreation resources currently being developed or both authorized and likely to be developed during this period.

(3) With Project Condition. The with project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis with a recreation plan or project. Recreation resources included in the without project condition provide the basis for the with project condition. Analysis of the with project condition considers recreation opportunities that will be diminished in quality or quantity because of project development and operation. This will be accomplished in assessing the use of the proposed recreation development.

d. Evaluation Procedure. Use the following procedure to determine the benefit from recreation resource use with a plan or project. (See Figure E-11). The benefit is based on the gross value of recreation use of the resource for the with project condition less the gross loss in recreation use caused by the project or plan. The recreation benefit is measured in nine steps. The level of effort expended on each step depends on the nature of the proposed improvement, the state of the art for accurately refining the estimate, and the sensitivity or project formulation and justification to further refinement.

e. Step 1 - Define the Study Area. Determine changes in recreation use and value resulting from alternative plans through the analysis of without project and with project conditions in the study area over the prescribed period of analysis. The impacts should relate to the geographical recreation “market” defined by the location of actual and potential user populations. Definition of the study area should be justified with respect to the particular characteristics and quality of the site and the availability of similar alternative recreation opportunities. Reference to statistical evidence regarding the spatial distribution of trip generation is encouraged.

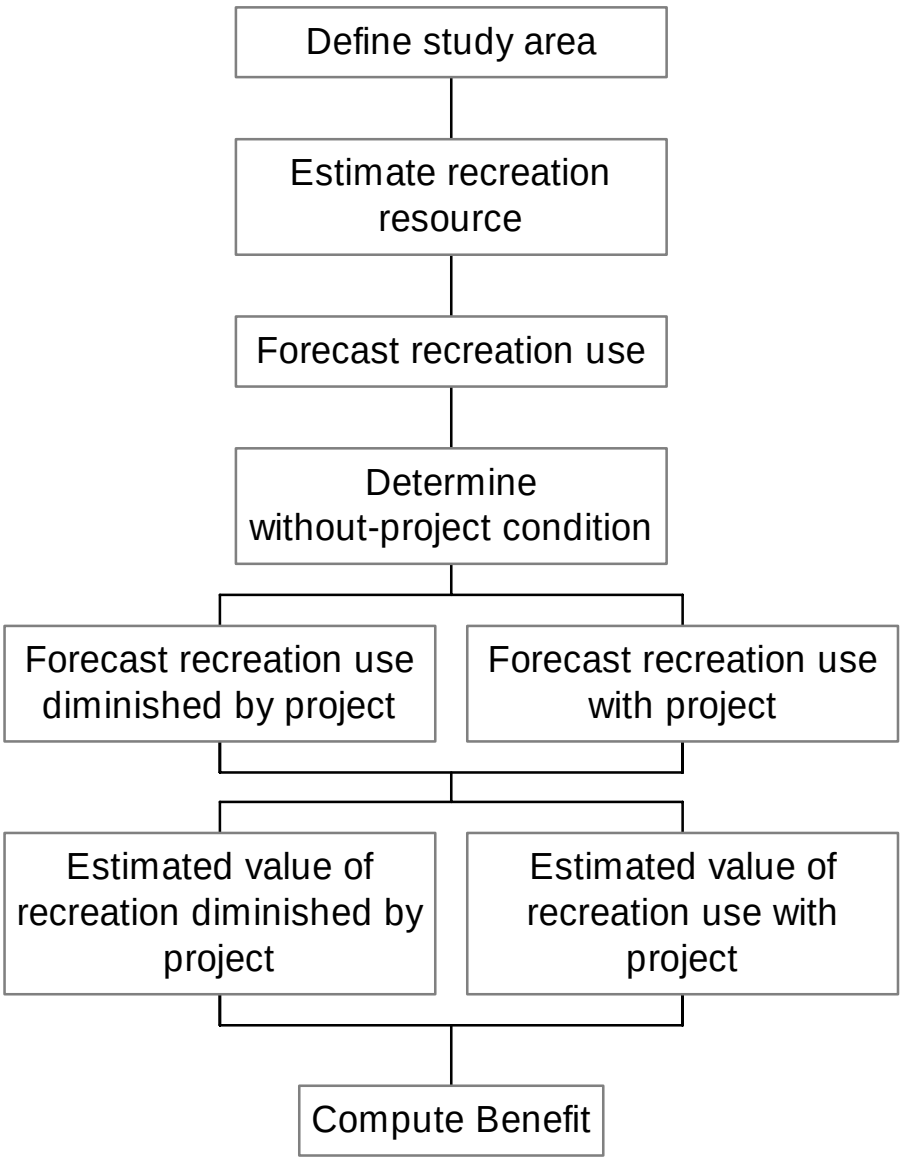


Figure E- 11 Recreation Benefit Evaluation Procedures

f. Step 2 - Estimate Recreation Resource.

(1) Include in estimates of the recreation resource capacity for the study area all sites that provide recreation activities similar to those displaced or provided by the project. The recreation resource in the study area is the system of water and related land recreation sites that influence the demand for the proposed project and are influenced in turn by the demand at the existing site.

(2) Include in the inventory of water and related land recreation sites in this study area those Federal, State, county, local, and private sites that are in varying stages of development or that are authorized and likely to be developed in the forecast period.

(3) Identify the ability of recreation alternatives to provide different recreation activities and assess the quality of the alternative recreation experiences.

g. Step 3 - Forecast Potential Recreation Use in the Study Area. Potential use is the expected visitation at prevailing prices unconstrained by supply. Forecast of total recreation use in the study area should be made for each activity currently provided at the project site and for each activity proposed in the plan or project. The potential use for a specified outdoor water and related land recreation activity will depend on the size and characteristics of the study area population and the availability of the specified recreation activity and other types of recreation in the study area.

(1) The recreation use of the site's resources will depend not only on the attributes of the site and its proximity to population centers, but also on its location in relation to the location of other water and related land resources providing similar or complementary types of recreation with the study area.

(2) Forecasting potential future participation in recreation activities for the study area involves four steps: (1) Collect data on explanatory variables that influence the demand for recreation activities; (2) Relate potential use to these variables by means of some use estimating techniques as described in paragraph E-50i; (3) Forecast values of the explanatory variables over the period of analysis. Justify projections and explain any simplifying assumptions. Reference to statistical evidence on trends in encouraged; (4) Calculate expected use for the study area using the values obtained in Step (3) and the relationships determined in Step (2).

h. Step 4-Determine the Without Project Condition. Determine the without project condition for the study area on the basis of a comparison of the available recreation resources as specified in step 2 and the recreation resource use as specified in step 3 for each activity currently

provided at the project site and each activity proposed in the plan or project. Compare the capacities of all sites, including the site without the proposed project, to produce recreation activities with the expected demand for each activity.

i. Step 5 - Forecast Recreation Use With Project.

(1) General. Forecast recreation use with the project as a basis for estimating project recreation values. Project use over time by calculating the change in use induced by anticipated changes in the variables that determine use. Explain values employed for projecting future demand and any simplifying assumptions. For the capacity method , use is constant over time as determined by the capacity constraint. Explain use projections and any simplifying assumptions. Reference to statistical projections of recreation participation is encouraged.

(2) Use Estimating Techniques. Use one or more of the following approaches for estimating recreation use for the with project and/or without project conditions. The use of any other method should be justified as conforming to the characteristics listed in paragraph E-50b. References to statistical estimates are encouraged.

(a) Regional Use Estimating Models. Regional use estimating models are statistical models that relate use to the relevant determinants based on data from existing recreation sites in the study area. The use of regional models can economize on resources required for site-specific studies. In the absence of a regional model, estimate use by one of the site-specific methods described below. If a use-estimating model has already been developed for the region in which a proposed project is to be located, use estimates should be obtained by the following procedure:

(1) Delimit the areas of origin for the proposed project (use of counties or parts of counties as origin areas will facilitate gathering of data in subsequent steps).

(2) Compute measures of the explanatory variables in the use equation for each origin area and for each year for which an estimate is required.

(3) Calculate use from each area for each year.

(4) Aggregate use from each area to get estimated annual use.

(b) Site-specific use estimating models. The preferred site-specific method of estimating use is a use estimating model (UEM) that relates use per 1,000 of origin population to distance traveled, socioeconomic factors, and characteristics of the site and alternative recreation opportunities. Use estimating models yield regression coefficients estimated from data gathered at a comparable existing site or cross section of existing sites. The coefficients are used to estimate visitation at a proposed site in the same way as described for regional models. Factors that influence demand for recreation, such as characteristics of user populations and availability of alternative opportunities, are explicitly taken into account by variables in the model. Because of the influence of congestion during heavy use periods, it is desirable to distinguish use during summer weekends and holidays. If data limitations do not permit disaggregation, explain treatment of seasonal use variation and any simplifying assumptions.

(c) Application of information from a similar project.

(1) If a UEM is not available and cannot be estimated because of data limitations, use may be estimated by the similar project method. This method assumes that recreation demand for a proposed project can be estimated from observations of visitation patterns at one or more existing projects with similar resource, operations, and use characteristics. The alternatives under study are compared with water resource projects and recreation resource areas for which trip generation and other statistics are known. It is important to obtain as close a match as possible in type, size, and quality of project; market area demographic and socioeconomic characteristics; existence and location of competing recreation opportunities; and other variables that influence demand.

(2) The most efficient and technically sound similar project procedure is based on per capita use curves (i.e., regression curves relating per capita rate of use to travel distance) from which use estimates are derived. The similar project method involves the following steps:

(a) Evaluate the characteristics of a proposed project or other area under study.

(b) Select a similar project or area by comparing characteristics of the proposed project with available information for existing sites; include evaluation and comparison of the respective recreation market areas.

(c) Adjust the per capita use curve to account for the differences between the similar project and the proposed project.

(d) Determine the county populations within the market area for the years in question, and derive per capita use rates for each county population by measuring road mile distance from the

project to the center of the most populated city within the county (proxy for centroid of county population).

(e) Multiply each county per capita rate by county population and sum to get total use.

(f) Determine the percentage of total use that the foregoing estimate represents; if 100 percent, use as is; if less, adjust accordingly.

(3) Justify assumptions used to adjust or modify per capita use curves.

(4) Capacity method of determining use. If data on use determining variables are unavailable and are not cost effective to obtain, and if it can be demonstrated that sufficient excess demand exists in the market area to accommodate the additional capacity supplied by a proposed project, use may be assumed to be equal to capacity. Since this method provides no information on trip generation, willingness to pay cannot be evaluated by the travel cost method.

j. Step 6 - Estimate Value of Use With the Project. As noted in E-52b, three alternative methods can be used to estimate recreation benefits:

(1) Travel Cost Estimate of Willingness To Pay Based on Use Estimating Model or Per Capita Use Curves.

(a) Conditions under which TCM may not be used are discussed in the following paragraphs.

(1) Use was not estimated by a technique relating trip-generation to distance to the site;

(2) There is insufficient variation in travel distances to allow parameter estimation (for example, urban sites); or

(3)The project site is typically only one of several destinations visited on a single trip.

(b) Construction of a TCM demand curve. The area under a demand curve based on travel costs to a site approximates the willingness to pay for access to the recreation opportunities there. This estimate involves the following calculations:

(1) Convert round-trip distance from each origin into monetary values by suing the most recent U.S. Department of Transportation average variable costs in cents per mile to operate an automobile, plus the opportunity cost of leisure time spent in travel and on the site. Time costs vary according to the alternative uses of time available to visitors and are correlated with income,

age, education, occupation, time of year, and day of week. Explain values assigned to time and any simplifying assumptions.

(2) Construct a demand curve that relates "prices" to total visits. Given a relationship between travel costs and annual visitation from a use estimating model or a per capita use curve, construct a demand curve by gradually increasing travel cost and calculating the total visitation associated with each increase, until visitation falls to zero for all origins.

(3) Compute the area under the demand curve plus any user charges or entrance fees. This value measures the annual total willingness to pay for recreation activities available at the site.

(2) Contingent Valuation (Survey) Estimate of Willingness To Pay.

(a) Use of Contingent Valuation Method for Daily or Annual Values. CVM may obtain either daily or annual estimates of willingness to pay. Multiply daily estimates by annual use obtained previously. Annual estimates do not require use estimation except to demonstrate the net increase in recreation use in the market area.

(b) Five steps are involved in designing and using simulated markets to identify the value of recreational resources as if actual markets existed as discussed in the following paragraphs.

(1) Establish a market to the respondent.

(2) Permit the respondent to use the market to make trades and establish prices or values reflecting the respondent's individual evaluation of the recreation opportunities bought or sold.

(3) Treat the values reported by the respondent of individual values for recreation, contingent upon the existence of the market.

(4) Given willingness to pay bids from an unbiased sample of users in the market area, the socioeconomic characteristics of respondents, distance to the site, and available alternative recreation opportunities for each origin, obtain multiple regression estimates of average household value for the proposed change in recreation opportunities for households in each group.

(5) Multiply this value by the number of households in the group and sum the group values to estimate the aggregate willingness to pay if the average values are annual; multiply this value by estimated annual use if average values are daily.

(c) Obtaining Individual Bids from Personal Interviews or Mail Surveys. The preferred format is one in which the respondent is required to answer “yes” or “no” to questions if he or she is willing to pay a stated amount of money to obtain a stated increment in annual recreation opportunities. The value is increased gradually until the highest amount that the respondent is willing to pay is identified.

(d) Developing Regional Contingent Valuation Models. Regional models may be developed with CVM as well as use estimating models. All survey forms are subject to the clearance procedures of the Office of Management and Budget.

(3) Unit Day Value Approximation of Willingness to Pay.

(a) Application of Unit Day Values. See paragraph E-50b.

(b) Selection of Value. If the UDV method is used for economic evaluations, select a specific value from the range of values agreed to by Federal water resource agencies. The product of the selected value times the difference in estimated annual use over the project life relative to the without project condition provides the estimate of recreation benefits.

(1) If evidence indicates that a value outside the agreed-to range is more accurate, a regional model or site-specific study should be conducted. Explain the selection of any particular value within the published range.

(2) To explain the selection of a specific value, a point rating method may be used to reflect quality, relative scarcity, ease of access, and esthetic features. Appropriate use should be made of studies of preferences, user satisfaction, and willingness to pay for different characteristics; particular efforts should be made to use estimates derived elsewhere from applications of the TCM and CVM techniques.

(c) Account for site transfers in choosing unit day values.

k. Step 7 - Forecast Recreation Use Diminished With Project. Using the appropriate method described in E-52i, forecast the recreation resource sues that would be diminished due to physical displacement expected because of the plan or project.

l. Step 8 - Estimate Value of Recreation Use Diminished With Project. Using the appropriate methods described in paragraph E-50j and selected by the appropriate criteria described in paragraph E-50b, estimate the value of the recreation uses that would be diminished by the physical displacement expected to occur as a result of the plan or project. In determining project net benefits, account for changes in recreation use of an existing resource and/or project as a result of transfers to the plan or project under study.

m. Step 9 - Compute Net Project Benefits. Compute the project benefit as the difference between the gross value of recreation use as estimated in paragraph E-50j and the value of recreation use diminished as estimated in paragraph E-50l. However, if excess capacity for any activity exists in the study area, benefits are the user cost savings plus the value of any qualitative differences in recreation.

n. Report and Display Procedures. Tables E-26 and E-27 are suggested presentations for reports that include recreation as a purpose.

o. Recreation Evaluation Techniques in Detail. More detail on recreation benefit estimation techniques is in (add web site).

Table E- 26 Recreation Capacity and Use (19__)[1]

	Without project			With project		
	Capacity	Use	Surplus or Deficit	Capacity	Gross use	Displaced use
Plan 1	.....	.....	.....	.....	.....	.....
Plan 2	.....	.....	.....	.....	.....	.....
Plan 3	.....	.....	.....	.....	.....	.....
Plan 4	.....	.....	.....	.....	.....	.....

[1]Prepare for representative project years.

Table E- 27 Annualized Recreation Benefits, Recommended Plan

	Value of gross use	Value of displaced use	Net value
Specialized.....	.....	.....	.....
General.....	.....	.....	.....

E-51. Federal and Non-Federal Participation. Costs allocated to recreation shall be apportioned to Federal and non-Federal interests as below:

a. Recreational Developments at Lakes.

(1) Federal. The Federal Government will assume not more than one-half of the separable first costs of construction of initial and future recreation facilities, including one-half of the cost of lands acquired specifically for recreation and access. All joint construction costs allocated to recreation shall be assumed by the Federal government.

(2) Non-Federal. The non-Federal entity must assume at least one-half of the separable first costs of construction of recreation facilities, including project lands acquired specifically for recreation and access, and all cost and full responsibility for the operation, maintenance, replacement, and management of recreation lands, areas, and facilities. Costs of revenue-producing facilities to be provided by private enterprise under Federal or third party agreements are not eligible for cost sharing.

b. Recreational Developments at Other Types of Projects. Agreements to participate with a non-Federal entity in the development of basic recreational facilities will require the non-Federal entity to:

(1) Acquire in its name in fee title, and dedicate to public outdoor recreation use, lands on which cost shared recreation facilities and improvements for access, parking, potable water, sanitary facilities and related developments for health and safety are provided, with credit as specified below.

(2) Make an additional contribution sufficient to raise the non-Federal share to at least 50 percent of the total first cost of adding recreation to the project if the appraised value of the creditable lands amount to less than that percentage.

(3) Operate, maintain and replace without cost to the Federal Government, for the economic life of the project, the recreation areas and all facilities installed pursuant to the agreement.

SECTION VIII - Water Supply

E-52. Federal Interest. The Flood Control Act of 1944 and the Water Supply Act of 1958, as amended, among other pieces of legislation, define the Federal interest in water supply. The current policy was defined by Congress in Section 932 of the WRDA of 1986. This policy is based on a recognition that states and non-Federal entities have the primary responsibility in the development and management of their water supplies. The policy also recognizes a significant but declining Federal interest in the long range management of water supplies and assigns the financial burden of supply to users. The Corps may, however, participate in developing water supplies in connection with water resource improvements for construction, operation, maintenance, and modification of Federal navigation, flood control, or multiple purpose projects when certain conditions of non-Federal participation are met. Existing legislation give the Corps authority to use its reservoirs for surplus water, for municipal and industrial (M&I) water supply and for agricultural water supply . The Corps is also authorized to provide emergency water and assist states and local interest in their water supply planning process.

E-53. Types of Improvement

a. Multiple Purpose Project. In order to include M&I as a project purpose in a multiple purpose project, benefits from water supply can not exceed the following limits depending on the type of project:

(1) The project has justified, separable storage for flood control or navigation or agricultural water supply. In this case the sum of benefits for these purposes must be at least ten percent of total NED benefits. If M&I water supply exceeds 90% of total benefits the project is considered single purpose water supply and thus not eligible for Federal participation.

(2) The project has no separable storage for flood control or navigation or agricultural water supply. In this case the sum of benefits for these purposes must be at least twenty percent of total NED benefits. If M&I water supply exceeds 80% of total benefits the project is considered single purpose water supply and thus not eligible for Federal participation.

b. Single-Purpose Project. The Corps will not conduct single purpose water supply studies, except for analysis of existing data under Section 22 of the Water Resources Development Act of 1974. This constraint does not apply to single purpose water supply modifications to previously constructed projects having flood damage reduction or navigation purposes. Also, the Corps may conduct reimbursable single purpose water supply studies for non-Federal interests under provisions of the Intergovernmental Cooperation Act of 1968.

E-54. Specific Policies

a. Municipal and Industrial Water Supply. Section 301 (a) of the Water Supply Act of 1958, as amended, established a policy of cooperation in development of water supplies for domestic, municipal, industrial, and other purposes. Section 301(b) is the authority for the Corps to include municipal and industrial water storage in reservoir projects. The terms "municipal and industrial," while not defined in the legislative history of the Water Supply Act, have been defined by the Corps as supply for uses customarily found in the operation of municipal water systems and in industrial processes. Irrigation is not ordinarily found among customers of a municipal system and, therefore, is not eligible to be included in a project under the M&I authority unless specifically authorized by Congress. Other policies applicable to this category of water supply are as follows:

(1) Storage. Corps provided water supply service normally means reservoir space for storing water, and where necessary, facilities in the project structure for releasing or withdrawing the stored water for water supply purposes. The non-Federal sponsor must repay all costs allocated to water supply storage space.

(2) Water Conduits. Conduits for release or withdrawal of stored water may be designed as an integral part of the dam structure. Cost of water conduits are specific water supply costs and the users must repay 100 percent of investment and annual costs. A non-Federal sponsor must contract for the costs if the features are to be included in construction. For existing projects with conduits, any remaining unpaid conduit cost shall be prorated just as storage costs are prorated unless one or more entities agree to repay the entire cost.

(3) Seasonal Operations for Water Supply. Congress has not provided general authority for including storage space in Corps projects for seasonal M&I use, either as withdrawals or to improve groundwater supplies. The Corps may consider seasonal operations for water supply when specifically authorized by Congress. In addition, project operations may be modified to enhance ground water replenishment, to increase downstream flows, or to otherwise enhance usage of projects for M&I purposes. These modifications must be consistent with authorized project purposes and law. Pricing policy for M&I water supply driven changes in project operations require the non-Federal sponsor be responsible for:

(a) 100 percent of new construction costs and new operations costs;

(b) A share of joint use operation maintenance and replacement cost based on use-of-facilities cost allocation;

(c) Benefits foregone;

(d) Compensation to others for losses in their operations (may be same as (c) above); and,

(e) Payment of an amount equal to one-half the savings to non-Federal interests (least cost alternative minus the specific cost of the modifications). In any case, the cost to the non-Federal sponsor should not exceed the costs derived for permanent reallocation of storage (see paragraph E-57d(2)).

(4) Limits on Future Use Storage. The Water Supply Act of 1958, as amended, states that no more than 30 percent of total construction costs can be allocated to water supply for future use. In addition, Corp policy is to obtain full payment of allocated capital costs from water supply sponsors prior to or during construction, or failing this to negotiate a repayment agreement, payments to begin immediately after construction completion. Thus, formulation of water supply storage without a current sponsor willing to participate is an exception requiring prior approval. Forward requests for exception to HQUSACE CECW-P.

(5) Water Rights. Potential encroachment on the water rights of lawful downstream water users by the operation of water supply storage must be carefully considered and coordinated with responsible state and local interests. The Corps will not acquire water rights necessary for use of stored water. This is a responsibility of the water users. Nor should the Corps become involved in resolving conflicts among water users concerning rights to use stored water, but will look to responsible state agencies to resolve such conflicts. Where there is more than one water user, it is recommended to arrange for payment for the entire water supply storage from a single agency, if this is practical.

(6) Permanent Rights to Storage. Under the authority of the Permanent Right to Storage Act of 1963, the non-Federal sponsor acquires a permanent right to the use of storage as long as the space is physically available. The sponsor must have completed or be making payments pursuant to its agreement with the government. It must also agree to continue to pay its share of annual allocated operation and maintenance costs, together with its share of costs allocated to necessary reconstruction, rehabilitation, or replacement of project features. Equitable reallocations of storage space may be necessitated by sedimentation.

(7) Water Quality. The Federal Government makes no representation and assumes no responsibility with respect to the quality or the treatment of the water.

b. Irrigation (Agricultural Water Supply). Water storage for agricultural irrigation, to meet entire needs or as a supplement to natural supplies, may be considered in plan formulation.

(1) Western States. Section 8 of the Flood Control Act of 1944 provides that Corps lakes may include irrigation as a project purpose upon recommendation of the Secretary of the Interior

(DoI). Section 8 also states that the DoI may provide the irrigation works needed to make use of the irrigation storage. The DoI is responsible for constructing, operating and maintaining the additional irrigation works, as well as to contract for the storage space. If allocated irrigation costs exceed the amount that can be repaid by water users, the excess amount will be stated. Specific Congressional authorization is required for projects where irrigation costs exceed water users' repayment ability. Section 8 applies only to the 17 Western States defined as those 17 contiguous states lying west of the 98th meridian .

(2) Areas Outside the Western States. The Corps may include irrigation storage in reservoirs in areas outside the 17 Western States provided the non-Federal sponsor assumes thirty five (35) percent of the costs of the reservoir allocated to irrigation.

E-55. NED Benefit Evaluation Procedure

a. Purpose. This section provides procedures for the evaluation of NED benefits of municipal and industrial (M&I) water supply features of water resource plans. The procedures presented apply to both structural and nonstructural elements of such plans. Risk-analysis techniques are required in all formulation, evaluation and investment decision studies. No specific risk-based procedures have been developed for municipal and industrial water supply analysis. For studies and projects where water supply benefits constitute a substantial portion of total benefits, analysts are expected to perform, at a minimum, sensitivity analysis of key variables such as least cost alternative cost, future demand for water and future availability of water supplies.

b. Conceptual Basis.

(1) The conceptual basis for evaluating the benefits from municipal and industrial water supply is society's willingness to pay for the increase in the value of goods and services attributable to the water supply. Where the price of water reflects its marginal cost, that price is used to calculate willingness to pay for additional water supply. In the absence of such direct measures of marginal willingness to pay, the benefits from a water supply plan are measured instead by the resource cost of the alternative most likely to be implemented in the absence of that plan.

(2) The benefits from nonstructural measures are also computed by using the cost of the most likely alternative. However, the net benefits of certain nonstructural measures that alter water use cannot be measured effectively by the alternative cost procedure for the following reasons: (1) Structural measures and many nonstructural measures (except those that alter use) result in similar plan outputs, whereas use-altering measures (e.g., revised rate structures) may change levels of output; and (2) use-altering measures may have fewer direct resource costs than

measures based on higher levels of output. Because of this lack of comparability, the benefit from such use-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the benefits of use-altering nonstructural measures on the basis of willingness to pay are encouraged, although the display of such benefits is not required.

c. Planning Setting.

(1) Without Project Condition. The without project condition is the most likely condition expected to exist in the future in the absence of the proposed water supply plan, including any known changes in law or public policy. Several specific elements are included in the without project condition.

(a) Existing Water Supplies. Existing water supplies are included in the without project condition. Adjustments are made to account for anticipated changes in water supply availability because of the age of facilities or changed environmental requirements.

(b) Institutional Arrangements. Existing and expected future water systems and water management contracts and operating criteria are considered part of the without project condition unless revision of these systems, contracts, or criteria is one of the alternative plans being studied.

(c) Additional Water Supplies. The without project condition includes water supplies that are under construction or authorized and likely to be constructed during the forecast period.

(d) Probability of Water Supply. Include calculation and specification of the probability of delivery for each source of water supply in the analysis.

(e) Water Quality. Water use is based on both the quantity and the quality of water supply. Different uses may require different qualities as well as quantities of water. Supplies also vary according to quality and quantity. Because water quality is a critical factor in water supply, it should be specified in any consideration or presentation related to water quantity. The degree of detail used to describe water quality should be suitable to permit differentiation among water sectors or available water supply sources.

(f) Nonstructural Measures and Conservation. The without project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures. These measures include:

(1) Reducing the level and/or altering the time pattern of demand by metering, leak detection and repair, rate structure changes, regulations on use (plumbing codes), education programs, drought contingency planning;

(2) Modifying management of existing water development and supplies by recycling, reuse, and pressure reduction; and

(3) Increasing upstream watershed management and conjunctive use of ground and surface waters.

(2) With Project Condition. The with project condition is the most likely condition expected to exist in the future with the Federal water supply plan under consideration. The six elements and assumptions addressed in the without project condition should also be addressed in the with project condition. Nonstructural water supply measures may be used alone or in combination with structural measures. If the proposed measures are already in the process of implementation, they are part of the without project condition.

d. Evaluation Procedure

(1) General. Follow the steps described in the following paragraphs to estimate NED benefits that would accrue to one or more alternative plans for providing an M&I water supply (see Figure E-12). The level of effort expended on each step depends on the nature of the proposed development, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to the estimate.

(2) Step 1 - Identify the Study Area. The study area is the area within which significant project impacts will accrue from the use of M&I water supplies, including areas that will receive direct benefits and/or incur costs from the provision of M&I water supply.

(3) Step 2 - Estimate Future M&I Water Supplies. Prepare an analysis of all sources of supply expected to be available to the M&I water user. Data may be obtained from various sources, including water utilities, State and local planning agencies, and State water resources agencies. This analysis should be by time period and include existing water supplies, institutional arrangements, additional water supplies, probability of water supply, and water quality.

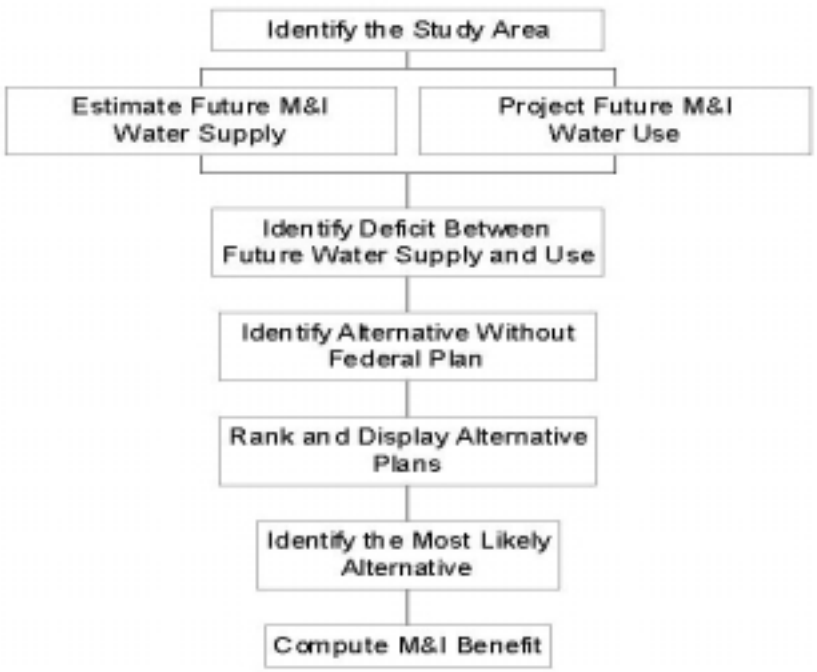


Figure E- 12 Flowchart of M&I Water Supply Benefit Evaluation Procedure

(4) Step 3 - Project Future M&I Water Use. Project future water use by sector in consideration of seasonal variation. Base projections on an analysis of those factors that may determine variations in levels of water use.

(a) Sector Analysis. Project future water use for the same time periods as for the supply projections for each of the following sectors: Residential (include indoor use and outdoor uses such as lawn irrigation and car washing); commercial (include water use for retail and wholesale trade, offices, hospitals, schools, medical lab (include all water used by manufacturing industries as an input in the production process); and additional uses (include public service use and unaccounted-for losses.

(b) Analysis by Time of Use. Identify seasonal variations in use for each of the above sectors and maximum day use for the system for each season.

(c) Related Factors Analysis.

(1) Identify the determinants of demand for each sector. Use such determinants as price of water and sewer service, income, number and type of housing units and population per unit, industrial mix, and level of economic activity. Explain the variable projection of these factors as well as the extent to which they influence projection of water use in various sectors.

(2) Determine the relationship expected to exist between future levels of water use and the relevant determinants of water demand. Develop and use a forecast or forecasts of future levels of the determinants to project alternative future water use by sector and explain the choice of the particular forecast used.

(3) Aggregation of Projections. Aggregate separate projections for each sector to a single projection by time period. (This is not a deterrent to meeting the needs of each sector by separate alternatives.)

(5) Step 4 - Identify the Deficit Between Future Water Supplies and Use. Compare projected water use with future water supplies to determine whether any deficits exist in the study area. Make an analysis of the intensity, frequency, and duration of the expected deficits. Address deficits in three basic options: (1) Reduce projected water use by implementation of nonstructural or conservation measures that are not part of the without project condition; (2) increase and/or more efficiently use water supplies through structural measures; and (3) accept and plan to manage water supply shortages. Plans generally are formulated to include some or all of these options.

(6) Step 5 - Identify Alternatives Without Federal Plan. Identify alternative plans that are likely to be implemented by communities and/or industries in the absence of any Federal alternative. Test various alternatives to the Federal plans for acceptability, effectiveness, efficiency, and completeness. These plans should be identified through analysis of the total water resources of the region, allowing for present and expected competing uses. Consideration of alternative plans is not limited to those that would completely eliminate the projected gap between supply and demand. Plans that do not completely satisfy water supply objectives should also be considered. Include in such plans measures to minimize and allocate shortages when they occur (drought management measures). Balance the increased risk of occasional shortages against the savings from lesser investments that would increase the probability of occasional shortages. The costs of shortages include the costs of implementing drought management measures and the costs of related public health and safety measures.

(a) Alternative plans need not be based on the development of a single source of supply at one time. They may consist of the development of a single source or the conjunctive development of several sources with increments phased to match anticipated growth in water use.

(b) If institutional obstacles to implementation are noted, the plan should still be considered if the barriers are substantially within the power of the affected water users to correct. Include a detailed description of the institutional obstacles, with a discussion of the basis for any conclusion that the obstacles cannot be overcome.

(7) Step 6 - Rank and Display the Alternative Plans Based on Least Cost Analysis.

(a) Rank all of the alternatives in order from the highest cost alternative to the lowest. Calculate the annualized costs of the alternatives on the basis of the service (depreciable) life of the facility or the period of analysis, whichever is less.

(b) Calculate costs of the alternatives on the following basis. Analyze all costs charged to the alternative on the basis of the Federal discount rate, no costs for taxes or insurance should be charged to the alternative; and all other assumptions and procedures used in calculating the costs of the alternatives, including external diseconomies, should be parallel to those employed in calculating the costs for the proposed Federal project.

(8) Step 7 - Identify the Most Likely Alternative. Begin identification of the most likely alternative with the least costly. If an alternative with a lesser cost is passed over for a more expensive one, present the justification for not selecting the lower cost plan.

(9) Step 8 - Compute M&I Water Supply Annualized Benefits.

(a) Annualized benefits of the Federal water supply plan are equal to the annualized cost of the most likely alternative. When applicable, the evaluation should reflect differences in treatment, distribution, and other costs compared to the most likely alternative.

(b) The alternative cost of providing a water supply for smaller communities (population of 10,000 or less) may be extremely expensive on a per capita basis because these communities lack the efficiencies of large-scale development. If such communities are not able to afford an alternative water supply comparable to the Federal water supply plan as identified in the procedure described above, the alternative should not be used as the basis for evaluating the benefits of the Federal water supply plan. In this case, the benefit may be considered equal to the cost of the separable M&I facilities plus an appropriate share of the remaining joint cost of the project. Provide documentation of the without project condition.

(10) Problems in Application of NED Evaluation Procedure.

(a) Two major problems exist in the application of this procedure. The first is identification of the value of conservation and other nonstructural measures. Examples of evaluation of conservation strategies, pricing methods, and drought management measures are available in technical publications.

(b) A second major problem will arise over the disaggregation of water use by sectors. Some communities do not collect water use data by sectors. Where the system is fully metered, such data can be obtained by coding customer accounts and accumulating data on use for at least one year. Water use by unmetered customers may be estimated by extrapolating experience with similar metered systems, recognizing that unmetered customers face a price of zero. Verify that data and/or forecasts obtained from all sources are reliable and reasonable.

e. Report and Display Procedures. Tables E-28, E-29, and E-30 are suggested presentations for reports that include municipal and industrial water supplies. Tables E-28 and E-29 summarize by time period (and season, if applicable) the projected use by sector, projected supply by source, and the difference between the two for average day and maximum day, respectively. Table E-30 shows the costs of alternative plans and the quantity supplied under each alternative by time period (season, if applicable).

E-56. Federal and Non-Federal Participation

a. Impacts of Section 932 of the Water Resources Development Act of 1986. This law further amends the Water Supply Act of 1958 (Public Law 85-500) as follows: Eliminates the 10-year interest free period for future water supply; modifies the interest rate formula; limits repayments to 30 years; and requires operation, maintenance, and replacement costs to be reimbursed on an annual basis. The amendments are applicable only to Corps projects.

b. Repayment Rate. The repayment rate used to calculate annual payment for storage in new projects, reallocated storage, and surplus water will be the yield rate defined in Section 932 of the Water Resources Development Act of 1986.

c. Repayment Period. The maximum repayment period for existing M&I storage, reallocated storage, and surplus water agreements will be 30 years from the date in which storage is available. For existing storage, this date will be the plant-in-service date or the date the first storage agreement is signed, whichever is later. For reallocated storage, the date will generally be the date the agreement is signed by the Assistant Secretary of the Army (Civil Works).

Table E- 28 M&I Water Supplies—Without Project Condition
Average Day Use and Capacity

Projected average day water use[1]	Time Period[2]			
	P_1	P_2	P_3	P_N
Residential (mgd).....	.....			
Commercial (mgd).....	.....			
Industrial (mgd).....	.....			
Additional (includes public services and unaccounted for losses) (mgd).....	.....			
Total.....	.....			
Average day water supply capacity				
Without a plan:				
Source 1 (mgd).....	.....			
Source 2 (mgd).....	.....			
Source 3 (mgd).....	.....			
Source X (mgd).....	.....			
Total.....	.....			
Difference between projected average day water use and supply without a plan (mgd).....	.....			

[1]Include effects on nonstructural and conservation measures
[2]Show by time period and season where there are seasonal variations.

Table E- 29 M&I Water Supplies—Without Project Condition
Maximum Day Use and Capacity

Projected average day water use[1]	Time Period[2]			
	P_1	P_2	P_3	P_N
Residential (mgd).....	.....			
Commercial (mgd).....	.....			
Industrial (mgd).....	.....			
Additional (includes public services and unaccounted for losses) (mgd).....	.....			
Total.....	.....			
Average day water supply capacity Without a plan:				
Source 1 (mgd).....	.....			
Source 2 (mgd).....	.....			
Source 3 (mgd).....	.....			
Source X (mgd).....	.....			
Total.....	.....			
Difference between projected average day water use and supply without a plan (mgd).....	.....			

[1]Include effects on nonstructural and conservation measures
[2]Show by time period and season where there are seasonal variations.

Table E- 30 M&I Water Supply Alternatives

[Period of analysis, price level, discount rate]

Alternatives	Annualized cost (in thousands of dollars)	Quantity supplied (mgd) time period[1]			
		P_1	P_2	P_3	P_N
Most likely alternative	.....	.....	.....	.....	.....
Recommended plan.....	.....	.....	.....	.....	.....
Other plans	.....	.....	.....	.....	.....

[1]Show by time period and season where there are seasonal variations

d. Water Withdrawal Agreements. The Corps of Engineers is not to use Section 501 of the Independent Offices Appropriations Act of 1952 to obtain reimbursement for water supply withdrawals. Existing contracts or agreements should be allowed to expire and not be extended.

e. Annual Operation and Maintenance Expense. The non-Federal sponsor is responsible for all water supply costs allocated to operation and maintenance. These costs must be paid yearly in advance, based on estimated expenditure. Appropriate adjustment will be made at the end of each year.

f. Repayment Period for Major Replacement and Major Rehabilitation Costs. Major replacement and major rehabilitation costs are to be paid either during construction or in lump sum upon completion of construction. The non-Federal sponsor should be encouraged to establish a sinking fund to cover these costs when they occur.

g. New Construction Starts. Cost sharing and financing will be based on construction new start guidance provided in the annual budget guidance circular. This applies to water supply included in projects considered for new start, projects funded for construction but which are not started, resumptions and separable elements of ongoing projects. Authorized but not constructed single purpose M&I projects will not be proposed for construction.

E-57. Other Authorities.

a. Interim Use of Water Supply for Irrigation. Section 931 of the WRDA of 1986 provides that the Secretary of the Army may allocate water at Corps lakes currently allocated to

M&I purposes but not under contract to irrigation purposes, on an interim basis. In accordance with the WRDA of 1986, the non-Federal sponsor cost share is 35 percent of the original project investment cost allocated to M&I water supply. The time period for computing annualized payments is 30 years. The non-Federal sponsor is responsible for 100 percent of the operation and maintenance expense, major replacement cost, and major rehabilitation cost allocated to the storage space contracted for.

(1) Investment Cost Computation. The investment cost for this interim use irrigation storage/water is calculated by multiplying 0.35 (35 percent) by the percentage of the interim use storage to the total M&I water supply storage (as determined by the use of Facilities cost allocation method). This factor is then multiplied by the original M&I water supply investment cost which would include accrued interest after a 10-year interest free period from the plant-in-service date. The project water supply interest rate in effect when the project went under construction is to be used for all interest computations including the repayment amortization schedule for the interim use storage agreement. In the case of projects that went under construction after 17 November 1986, the rate will be as established in Section 932, WRDA of 1986 and will be adjusted at 5-year intervals. The term of the agreement for this interim use shall not exceed five years. An option for incremental five year extensions is allowed with the basic agreement only if recalculations for annual O&M, major replacements and major rehabilitation costs are performed at the end of each five year increment.

(2) Annual Cost Computation. The annual O&M cost for the required interim use storage/water may be estimated if the expected annual O&M cost is relatively low and would not justify annual billing procedures. Otherwise, reimbursement of applicable actual project O&M expenses would be required. An estimated annual major replacement and major rehabilitation cost is to be determined and included as a part of the annual repayment costs.

(3) Credit. Future sponsors for municipal and industrial use of the storage space shall not receive any credit from the interim use payments toward repayment of investment cost when such interim use is for agricultural water supply.

(4) Agreements. Agreements for such interim use of the water supply storage for irrigation shall follow the same reporting requirements as those for water supply storage agreements (see paragraph E-58). A report shall accompany the draft agreement. The report shall document the exact use of the water to assure that it will not be used for municipal and industrial purposes. It will also explain the manner in which the annual costs in the agreement were developed and show the impacts of the interim use of the water supply for irrigation on the currently existing uses of such storage. Further, it will include an appropriate analysis describing and assessing any adverse and/or beneficial environmental impacts that are expected to result

from the interim use of storage for irrigation purposes, that were not discussed in the FEIS for the project.

b. Surplus Water.

(1) Authority. Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements for surplus water with states, municipalities, private concerns, or individuals at such prices and on such terms as he may deem reasonable. These agreements may be for domestic, municipal, and industrial uses, but not for crop irrigation, from surplus water that may be available at any reservoir under the control of the Department of the Army.

(2) Classification.

(a) Surplus water will be classified as either:

(1) water stored in a Department of the Army reservoir that is not required because the authorized use for the water never developed or the need was reduced by changes that occurred since authorization or construction; or

(2) water that would be more beneficially used as municipal and industrial water than for the authorized purpose and which, when withdrawn, would not significantly affect authorized purposes over some specified time period.

(b) An Army General Counsel opinion of March 13, 1986, states that Section 6 of the Flood Control Act of 1944 empowers the Secretary of the Army to make reasonable reallocations between different project purposes. Thus, water stored for purposes no longer necessary can be considered surplus. In addition, the Secretary may use his broad discretionary authority to reduce project outputs, envisioned at the time of authorization and construction, if it is believed that the municipal and industrial use of the water is a higher and more beneficial use. However, surplus water declarations citing use for higher beneficial purposes should be made with caution and only on a fixed period agreement for temporary use. When the user desires long term use, a permanent storage reallocation should be performed under the authority of the Water Supply Act of 1958, as amended.

(3) Requirements and Restrictions. Surplus water declarations will only be made when related withdrawals will not significantly affect authorized purposes. Surplus water agreements shall be accompanied by a brief letter report similar to reallocation reports and shall include how and why the storage is determined to be surplus. Surplus water agreements will normally be for small amounts of water and/or for temporary use as opposed to storage reallocations and

permanent right to that storage. Normally, surplus water agreements will be limited to 5 year periods. Use of the Section 6 authority should be encouraged only where non-Federal interests do not want to buy storage because the need of the water is short term or the use is temporary pending the development of the authorized use. The views of the affected state(s) will be obtained, as appropriate, prior to entering into any agreement under Section 6. The annual price deemed reasonable for this use of surplus water is to be determined by the same procedure used to determine the annual payment for an equivalent amount of reallocated storage plus an estimated annual cost for operation and maintenance, repair, replacement, and rehabilitation. The total annual price is to be limited to the annual costs of the least cost alternative, but never less than the benefits foregone (in the case of hydropower, revenues foregone). Declaration of surplus irrigation water in the 17 Western states will require appropriate coordination and consultation with the Department of the Interior (Bureau of Reclamation).

c. Drought Contingency Water Supply. Drought and other emergencies affecting municipal and industrial water supplies will likely generate requests for water stored in Corps reservoirs. When these situations occur, requests may require immediate action. Section 6 of the Flood Control Act of 1944 provides an opportunity to be responsive with surplus water. The preferred approach is for a State or subdivision to enter into a agreement with the Secretary of the Army and to agree to act as wholesaler for all of the water requirements of individual users. This places the local governments in a position to help their citizens and minimizes the potential for problems that could arise if the Secretary were to determine who is entitled to shares of surplus water. District commanders should take the initiative to make Section 6 assessments of the availability of storage for limited withdrawals (up to 99 acre-feet of storage may be reallocated by the District Commander). This assessment can be made prior to any specific request in order to be ready to respond to urgent requests in a timely manner. The assessment should also summarize the impacts of such withdrawals and should be kept on file. Preferably, one agreement for each reservoir with the State or political subdivision can be used to distribute the water to small users. If this is not possible, individual agreements may be executed. Project managers are authorized to sign these agreements. However, if the user will be installing water lines or other facilities or equipment, an appropriate real estate instrument must be issued as required in ER 405-1-12. Drought contingency agreements for greater than 50 acre-feet should follow the cost and contracting format for surplus water agreements.

d. Reallocation of Storage.

(1) Approval Authority. Reallocation or addition of storage that would have a severe effect on other authorized purposes or that would involve major structural or operational changes requires Congressional approval. Providing the above criteria are not violated, 15 percent of total storage capacity allocated to all authorized project purposes or 50,000 acre feet, whichever is less, may be allocated from storage authorized for other purposes or may be added to the project to serve as storage for municipal and industrial water supply at the discretion of the

Commander, USACE. For reallocations up to 499 acre-feet the Commander, USACE has delegated approval authority to the Division commanders. Reallocations which exceed the Commander's authority may be approved at the discretion of the Secretary of the Army if such reallocations do not require Congressional approval as described above. All reallocations or additions of storage should be to serve immediate needs. All reallocations or additions of storage must be accompanied by a report that includes:

(a) Purpose of the report and Background, including map

(b) Pertinent project data table

(c) Water supply needs analysis

(d) Test of financial feasibility

(e) Cost of storage analysis

(f) Analysis of alternatives considered to address the water supply needs

(g) Appropriate NEPA documentation of environmental impacts

(h) Pertinent letters from affected Federal, state and local interests, including documentation of public review and comment. Opportunities for public review and comment must be provided.

(i) Commander's recommendation

(2) Cost of Storage. The cost allocated to the non-Federal sponsor (i.e., the price to be charged for the capital investment for the reallocated storage) will normally be established as the highest of the benefits or revenues foregone, the replacement cost, or the updated cost of storage in the Federal project.

(a) Benefits Foregone. Benefits foregone are generally estimated using standard Corps NED economic evaluation criteria in compliance with the P&G. For small reallocations from hydropower (i.e., within the Chief of Engineers discretionary authority), benefits may be based on current estimates of long term power rates. These may be obtained from in house power value estimating procedures or otherwise in accordance with the P&G. For large reallocations, estimates should be calculated in accordance with P&G procedures for evaluation of hydropower benefits.

(b) Revenues Foregone. Revenues foregone to hydropower are the reduction in revenues accruing to the Treasury as a result of the reduction in hydropower outputs based on the existing rates charged by the power marketing agency. Revenues foregone from other project purposes are the reduction in revenues accruing to the Treasury based on any existing repayment contracts.

(c) Replacement Costs.

(1) If the reallocation is from flood control it is appropriate to utilize the replacement cost of equivalent protection. This would not be appropriate for reallocations within the Corps discretionary authority which by definition do not have severe impacts.

(2) For reallocation from hydropower the replacement cost of power should normally be considered equal to the benefits foregone and calculated in accordance with P&G procedures for evaluating hydropower benefits. In cases where the power marketing agency has existing customer contracts, the replacement cost of power may be estimated as the agency's cost of obtaining power from the lowest cost alternative source for the duration of the contracts. Once the contracts expire and for the remainder of the period of analysis the replacement cost of power should be equal to the benefits foregone. Documentation of the contracts and estimates of replacement costs of power to fulfill them should be included in the reallocation report.

(d) Updated Cost of Storage. The costs to be reallocated to the water supply storage are determined by first computing the costs at the time of construction by subtracting the specific costs from the total construction cost and multiplying the result by the ratio of storage reallocated (ac-ft) to total usable storage space (ac-ft). In this computation, usable storage does not include space set aside for sediment distribution or for hydropower head. The cost allocated to the storage on this basis is then escalated to present day price levels by use of the Corps of Engineers Civil Works Construction Cost Index System (CWCCIS). This index is maintained in EM 1110-2-1304. Because the CWCCIS does not cover all items, however, the Engineering News Record (ENR) Construction Index will be used for indexing three cost categories: relocations; buildings, grounds, and utilities; and permanent operating equipment. Land values will be updated, on a case-by-case basis, by a qualified Corps of Engineers real estate appraiser. The value of the land is not to include enhancement due to the presence of the existing project. Since the CWCCIS dates back only to 1967, the ENR Construction Index will be used to update the cost of older projects to the 1967 time frame. Costs are to be indexed from the midpoint of the physical construction period to the beginning of the fiscal year in which the agreement for the reallocated storage is approved. In this manner, interest during construction is not used in this updating procedure.

(3) Cost Accounts. All income and expenses (investment, operation, maintenance, and replacement) associated with the water supply function shall be separately identified in the official cost account record. When there is a loss of revenue of existing purposes, or additional

operation and/or maintenance expense to existing purposes are incurred because of the new water supply addition, such charges shall be shown as a direct charge against the water supply function. This will affect the appropriate cost reductions in the existing project purposes and all revenues from the new addition will be credited to the new purpose. If hydropower revenues are being reduced as a result of the reallocation, the power marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation assuming uniform annual repayment. In instances where existing contracts between the power marketing agency and its customer would result in a cost to the Federal Government to acquire replacement power to fulfill the obligations of contracts, an additional credit to the power marketing agency can be made for such costs incurred during the remaining period of the contracts. Such credits should not actually be made for replacement costs until the costs are incurred and documented by the power marketing agency.

(4) Annual Costs. The non-Federal sponsor shall also be responsible for an appropriate share of the specific and joint-use operation, maintenance, replacement and major rehabilitation (OMR&R) costs. In those cases where the cost of water supply is based on hydropower replacement costs, the OMR&R increment of such cost is to be deleted from the total charge and then billed separately based on a pro rata share of the actual experienced project costs.

(5) Financial Feasibility. As a test of financial feasibility, the governing annual cost of storage derived, as determined above, should be compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water which the non-Federal interest would undertake in the absence of utilizing the Federal project. This analysis is to be included in M&I storage reallocation reports.

(6) Funding for Reallocation Studies. Feasibility studies of storage reallocation should be conducted using the framework of the Principles and Guidelines . The study will have two phases, reconnaissance and feasibility. The reconnaissance phase should be sufficiently detailed to determine if a feasibility study is warranted and if Congressional authorization is required for reallocation or addition of M&I storage. The reconnaissance phase is normally done using Operation and Maintenance, General funds. Use of Section 216 authority and regular survey authority are also options however. If O&M funds are utilized and Congressional authorization is required, cost sharing of the additional studies with the non-Federal sponsor is required in accordance with WRDA 86. The Federal share of the additional studies or the feasibility phase cost in the case of a Section 216 or regular survey authority comes from the General Investigations appropriation. If at the start of the study it appears likely the proposed reallocation will require Congressional authorization, contact HQUSACE (CECW-P) for additional guidance on requesting funds for the feasibility phase. If the reallocation is determined to be warranted, but does not require additional studies or Congressional authorization, then Operation and Maintenance, General funds may be used to complete the reallocation at Federal expense.

e. Reallocation of Flood Control Storage.

(1) Introduction. When reallocations of storage from the flood control pool would impact existing water supply and hydropower users, the need to provide Dependable Yield Mitigation Storage (DYMS) to compensate the existing water supply users must be considered in the analysis. Also to be considered, where appropriate, is the need to compensate hydropower users through operational changes. The following paragraphs provide procedures and requirements for implementation of the DYMS analysis.

(2) Compensation to Existing Municipal and Industrial Water Users.

(a) Mitigation Storage. Whenever the conservation pool of a reservoir project is expanded into the flood control pool, the critical period dependable yield (which is produced from storage and inflow) per unit of storage will be reduced. This occurs because, even though there is more conservation storage available from which to draft water, the inflow into the reservoir remains the same. Since more users will be sharing the same inflow, the yield per unit of storage decreases even though the total yield of the project increases. While water storage contracts (agreements) do not guarantee a yield, due to fairness and possible legal liability, the Corps should not make additional (and discretionary) storage reallocations in a project which impose measurable negative impacts on existing water supply contracts by reducing their critical period yields. To avoid such negative impacts, sufficient storage would be reallocated to meet the needs of the new user and to maintain the dependable yield of the existing water supply contract holders. This additional storage required to keep existing users whole is termed Dependable Yield Mitigation Storage (DYMS). The new user of the new water supply storage space (i.e., the water supply requestor) will pay for all costs associated with DYMS. Cost of storage is computed using the same procedure as for any other reallocation. Instructions on how to compute DYMS are provided in the following paragraph. For a discussion of storage-yield relationships, see EM 1110-2-1420. Districts should determine when storage-yield curves need to be updated as part of their normal operations.

(b) Computation of DYMS. Computation of DYMS requires an understanding of the use of project yield curves. During the formulation of projects that provide conservation storage, curves are typically developed that depict critical period dependable yield. The resultant curve is a conditional relationship which is based on a given bottom elevation for the conservation pool storage zone. Any point on the curve then, defines the relationship for storage and yield for a specific project. To apply this relationship to any project, either the total conservation pool storage or desired yield is selected and the other corresponding value is read from the yield curve. No further use is made of the yield curve unless a different total conservation pool is to be evaluated. The total yield of the given conservation pool storage then, is prorated among the various users based on the percentage of the total conservation pool storage that they have

contracted for or that is allocated to them. In many cases it will be required that project critical period dependable yield curves be developed. This will be the case if a curve does not exist or there is any doubt as to the assumptions or source of an existing yield curve. The important consideration in DYMS computations is that all yield estimates for all water supply storage agreements and storage allocations for other purposes are on the same basis. The storage adjustments that are made, in many cases, will be quite small. Great care then must be taken to prevent presentation of data that would confuse the users and would be difficult to explain. There are many computer programs available that can be used to determine the critical period dependable yield by simulation of the operation of a reservoir operated either independently or in a multiple reservoir system. Again, however, it is important that the same program and input data be used throughout the analysis. Examples of DYMS computations are provided in Exhibit E-4.

(c) Adjustments to Water Supply Agreements. Districts should decide when to adjust water supply agreements. To avoid the excessive amount of work required to change every agreement each time a new reallocation is made, a suggested alternative is that changes be made at the same time the interest on the unpaid balance is adjusted. In the sample water supply agreement, Article 5 – Payments, this adjustment is made at 5-year intervals for reallocated storage agreements pursuant to Section 932 of the 1986 WRDA of 1986.

(3) Compensation to Hydropower Users.

(a) Financial Credits. When hydropower is adversely impacted by reallocation of the flood pool to satisfy additional water supply needs, hydropower losses can be mitigated through the provision of financial credit. In this case, credits will be provided to the hydropower account from a portion of the water supply storage proceeds. This credit is based on revenues foregone to the United States Treasury for repayment of the hydropower costs assigned to the project. Revenues foregone reflect the allocated costs to power upon which the rates are based. When reallocation is accomplished through this credit approach, in essence, the allocation of costs is adjusted without performing a laborious new cost allocation. Additionally, where existing Federal power delivery contracts require market purchases of power as a result of storage reallocations and withdrawals, the power marketing agency may obtain an additional credit for the funds expended for those purchases upon demonstration that they were made as a direct result of the reallocation.

(b) Operational Changes.

(1) General. While financial credits have historically been used to compensate for hydropower losses, the Power Marketing agencies (PMAs) have continued to express concern that such credits do not adequately compensate for losses, particularly for capacity losses.

Capacity losses are more critical from a marketing standpoint since they are the principle basis for contractual agreements with their customers. Project operational modifications, where appropriate, could be an effective mechanism for compensating for hydropower losses. Modification of operating rules should be considered only where the new water supply storage is reallocated from the existing flood control pool. The implementation of operational changes will help marketing agencies fulfill their Federal contractual agreements and will not financially impact new water supply users. They will also result in a reduction of the financial credit to the marketing agencies. The following paragraphs describe policies and procedures for the consideration of operational changes in reallocation studies. Other operational changes may be considered by districts on an ongoing basis. Operational changes for compensating hydropower users suggested in this regulation are over and above normal operational practices.

(2) Reservoir Regulation Schedule. The term reservoir regulation schedule refers to a compilation of operating criteria, guidelines, rule curves and specifications that govern basically the storage and release functions of a reservoir. In general, schedules indicate limiting rates of reservoir releases required during various seasons of the year to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system. Schedules are usually expressed in the form of graphs and tabulations, supplemented by concise specifications and are prepared and implemented by Corps Water Control Management staffs.

(3) Water Control Plans. Water control plans include coordinated reservoir regulation schedules for project/system regulation and such additional provisions as may be required to collect, analyze and disseminate basic data, prepare detailed operating instructions, assure project safety and carry out regulation of projects in an appropriate manner. ER 1110-2-240 require that necessary actions be taken to keep approved water control plans up-to-date. While water control plans and their documentation in water control manuals are developed for specific projects and reservoir systems, they will be revised as necessary to conform with changing requirements resulting from developments in the project area and downstream, improvements in technology, new legislation and other relevant factors. The instructions contained in ER 1110-2-240 are to be followed when modifications to water control plans become necessary due to reallocations of flood control storage to water supply. Funding of reallocation studies and associated modifications to water control plans/manuals is an internal decision to be made by each district. The reallocation report shall describe the proposed modifications to the water control plan/manual as a result of the reallocation action, if applicable.

(4) Criteria for Evaluation and Selection of Operational Change. The following criteria will be used for evaluating and selecting an operational change.

- The operational change shall not adversely affect flood damage reduction capability or any other project purposes.

- The objective of the operational change is to diminish as much as reasonably possible the loss in dependable capacity (and also energy if possible, but not probable), but not to increase dependable capacity beyond the level prior to the reallocation action.

- Consider to the maximum extent possible, making only seasonal changes to the operation plan (i.e., to the time of year when flood control is less likely to be needed and hydropower capacity is most critical).

- The change in the elevation of the conservation pool should not exceed (or significantly exceed) what the elevation would otherwise be if DYMS was provided for hydropower.

(5) Legal Considerations. There are three primary legal considerations that need to be addressed when project operational changes are recommended to compensate the hydropower purpose. The first relates to downstream impacts (i.e., flood control is jeopardized) and the second two considerations are related to the potential impacts of raising of the lake level. In this later action, raising of the lake could adversely impact the environment (e.g., impacts on trees and other vegetation, habitats, etc.) and it could impact on the real estate interest of surrounding land owners (e.g., marinas, residents, etc.). The impacts on these three items (flood control, environment and real estate) must be adequately addressed in the reallocation report . Resolution of these issues will require extensive coordination with all stakeholders and users of the reservoir. If significant legal problems are encountered as related to these or other items, a decision must be made whether the action can proceed under the discretionary authority, or if Congressional action is needed.

(4) Coordination Requirements. ER 1110-2-240, which implements Section 5 of WRDA of 1988, requires that before the Corps may modify a reservoir water control plan which will result in or require a reallocation of storage space or significantly affect any project purpose, it shall provide an opportunity for public review and comment to include public meetings. This coordination requirement, as previously described, applies to all reallocation actions.

f. Addition of Storage. When water supply storage is added to an existing project and storage is not reallocated, a willingness to pay concept is used to assign costs to the new water supply purpose. Under this concept the non-Federal sponsor is responsible for 100 percent of the new construction costs allocated to water supply. This is to be paid during the construction period. In addition, payments equal to 50 percent of the sponsor’s savings are required. The sponsor’s savings are construed as the cost of the most likely alternative which would be constructed by the non-Federal sponsor in lieu of the proposed modification, less the sponsor s share of the cost of the modification to the Corps project. This cost is to be repaid at the water supply rate current at the start of project modification. It is to be adjusted at 5-year intervals

within the remaining physical life of the project, but not to exceed 25 years from completion of project modification; or if water supply is already a project purpose, within 30 years from the time the project was first used for water supply. Total local capital contributions (original project plus modification) should not exceed the sum of the local share of the new construction costs, plus the Federal construction costs of the original project. The non-Federal sponsor shall also be responsible for an appropriate share of the specific and joint use operation, maintenance, replacement and major rehabilitation costs.

E-58. Water Supply Agreements. All revenues received, from agreements with non-Federal sponsors, shall be deposited into the Treasury of the United States as miscellaneous receipts.

a. Agreement Formats.

(1) Water Storage. Part 1 of the Model Formats for Agreements and Permits (see www.hq.usace.army.mil/cecc/ccpca.htm) is to be used in entering into agreements under the authority of the Water Supply Act of 1958, as amended. Bracketed language may be changed as appropriate and material particular to either present or future use storage may be deleted if such storage is not included in the agreement. Non-Federal parties to water storage agreements must meet the requirements of Section 221 of the Flood Control Act of 1970, as amended.

(2) Surplus and Agricultural Water Supply. The sample format set forth in Part 2 of the Model Formats for Agreements and Permits (see www.hq.usace.army.mil/cecc/ccpca.htm) is to be used for agreements under the authority of Section 6 of the Flood Control Act of 1944 and Section 931 of the WRDA of 1986. A agreement for either can also be tailored to the format of Part 1. The primary factor in deciding which format to use is whether the non-Federal sponsor wants storage space or water. Agreement terms are normally for 5 years with an option for a 5 year extension, until the space is needed for the authorized purpose, or until the authorized purpose is deauthorized.

(3) Drought Contingency. Agreements for small amounts of water (withdrawals from 100 acre-feet of storage or less) may be accomplished via the form provided as Part 3 of the Model Formats for Agreements and Permits (see www.hq.usace.army.mil/cecc/ccpca.htm). Larger amounts and long term arrangements should be the subject of a Section 6 agreement in accordance with this regulation, unless written approval by HQUSACE (CECW-P) is obtained.

(4) Disclosure of Lobbying Activities. Water supply agreements will be accompanied by a signed Certificate Regarding Lobbying and, if applicable, a completed Disclosure of Lobbying Activities. These forms must be thoroughly discussed with the sponsor prior to signature by the Contracting Officer. Completed forms will be attached to the agreement prior to its signature by the Contracting Officer, and kept on file by the district for later submittal to HQUSACE, if requested.

b. Submittal and Review.

(1) Water Storage.

(a) During initial negotiations leading to a draft agreement, significant departures from policy or complex interpretations of policy or legislation are to be submitted to HQUSACE (CECW-P) before spending time and resources negotiating a draft agreement.

(b) The first storage agreement on any project will be approved by the Assistant Secretary of the Army (CW), as will all agreements, which deviate from the approved model (other than editorial changes.) Approval authority for subsequent agreements and reallocation reports which do not require Congressional approval has been delegated to the Commander, USACE, and to Division and District commanders in accordance with Table E-31. Under these delegations, two copies of all agreements, draft and final, along with appropriate reallocation reports must be submitted to HQUSACE (CECW-AR). One will be retained in HQUSACE files and the other will be provided to ASA(CW). Draft agreements and reallocation reports which require ASA(CW) review (or approval), and final agreements requiring HQUSACE or ASA(CW) approval must be accompanied by four copies.

(c) The cutoff point for incorporation of policy changes into water supply agreements will be the date of draft agreement approval by the ASA(CW). An approved agreement will be exempt from application of policy changes provided a final agreement is signed by the local sponsor within six months of the date of draft agreement approval. An exception may be granted to the six-month limitation; however, a request for a longer time period should accompany the draft agreement and must contain a complete justification.

Table E- 31 Water Supply Storage Agreement Approval Authority [1]

Drafts				
Acre – Feet [2]		Storage Agreements [3]		Reallocation Reports [5]
From	To	Without Reallocation	With [4] Reallocation	
0	99	District [6]	District [6]	District
100	499	Division [6]	Division [6]	Division
500	999	Division [6]	ASA(CW)	HQUSACE [7]
1000	& up	ASA(CW)	ASA(CW)	HQUSACE [7]
Finals [8]				
Acre – Feet [2]		Storage Agreements		
From	To	Without Reallocation	With [4] Reallocation	
0	499	District	District	
500	999	District	HQUSACE	
1000	& up	HQUSACE	HQUSACE	

Footnotes:

[1] A copy of all approved agreements will be provided to ASA(CW).

[2] In any particular agreement, the acre-feet of storage needed to produce the water under agreement on a dependable basis.

[3] At projects where storage agreements have been previously approved. The first storage agreement on any project will be approved by the ASA(CW).

[4] For reallocations which do not require Congressional approval, i.e., no significant effect on other authorized purposes and/or no major structural or operational changes.

[5] When the cumulative amount of storage reallocated exceeds the lesser of 4000 ac-ft of 10% of available storage, reports will be submitted to ASA(CW) prior to approval.

[6] When using approved model or approved model with editorial changes only. Agreements involving other changes will be submitted to ASA(CW) for approval.

[7] Submitted to ASA(CW) with the draft agreement prior to approval.

[8] When using the approved draft agreement and local signature within six months of draft approval. If beyond six months or if changes are made, the final agreement will be resubmitted for approval to the office with approval authority for the draft. If the proposed agreement involves changes other than editorial changes, the agreement will be submitted to ASA(CW) for approval. The ASA(CW) reserves the right to retain approval authority of any final agreement he approved as a draft. In cases where that right will be exercised in advance, the draft agreement will so note.

Table E- 32 Surplus Water Agreement Approval Authority [1]

Drafts			
Acre - Feet [2]		Agreement [3]	Letter Report [4]
From	To		
0	99	District [5]	District
100	499	Division [5]	Division
500	999	Division [5]	HQUSACE [6]
1000	& up	ASA(CW)	HQUSACE [6]
Finals [7]			
Acre - Feet [2]		Agreement [3]	
0	499	District	
500	999	District	
1000	& up	HQUSACE	

Footnotes:

[1] A copy of all approved agreements will be provided to the ASA(CW).
[2] The storage needed to produce the agreed to water on a dependable basis.
[3] Not affecting authorized purposes (water not being used for an authorized purpose). When surplus water agreements involve water being used for an authorized purpose, they will be treated like a reallocation agreement and report (See Table E-31).
[4] When the cumulative amount of storage reallocated exceeds the lesser of 4000 acre-feet or 10% of available storage, reports will be submitted to ASA(CW) for approval.
[5] When using approved model or approved model with editorial changes only. Agreements involving other changes will be submitted the ASA(CW) for approval.
[6] Submitted to ASA(CW) with the draft agreement prior to approval.
[7] When using the approved draft agreement and local signature within six months of draft approval. If beyond six months or if changes are made, the final agreement will be resubmitted for approval to the office with approval authority for the draft. If the proposed agreement involves changes other than editorial changes, the agreement will be submitted to ASA(CW) for approval. The ASA(CW) reserves the right to retain approval authority of any final agreement he approved as a draft. In cases where he will exercise that right in advance, the draft agreement will so note.

(2) Surplus and Agricultural Water Supply. Procedures similar to those described above for water storage shall be applied to both agricultural and surplus water agreements. Delegations for surplus water are described in Table E-32. Agreements submitted to HQUSACE shall be accompanied by a brief letter report explaining the method used in determining the dollar values in the agreement, together with the recommendation of the division commander. Two copies of all agreements, draft and final, approved under delegated authority must be submitted to HQUSACE (CECW-AR).

SECTION IX - Multiple Purpose Projects

E-59. Federal Interest.

a. General. Federal interest in water resources development is established by law. Within the larger Federal interest in water resource development, the Corps of Engineers is authorized to carry out projects in seven mission areas: navigation, flood damage reduction ecosystem restoration, hurricane and storm damage prevention, water supply, hydroelectric power generation and recreation. Navigation projects include both inland and deepwater projects. Ecosystem restoration projects provide restored habitat for terrestrial and aquatic species. Wherever possible and subject to budgetary policy and Congressional authorization, projects shall combine these purposes to formulate multiple purpose projects. For example, flood protection projects could include ecosystem restoration and recreation. As another example, navigation projects could include hydroelectric power generation and ecosystem restoration. In addition, efforts to solve problems within these mission areas should consider the full range of programs as solutions. For example, flooding problems may be addressed by implementing solutions within the purview of the congressionally authorized projects, the Continuing Authorities Program, the Flood Plain Management Services Program or emergency authorities.

b. Watershed Approach. Watershed planning takes a systems view of water resources and opportunities over a large hydrologic region commonly called a river basin or a watershed. Watershed studies will usually be multiple purpose and multiple objective investigations. Watershed studies will likely involve participation of other Federal, State and local agencies and groups with interests and authorities to address problems and opportunities beyond the Corps missions. It is fundamental to the planning process to investigate the full range of solutions to problems, and to develop multiple purpose solutions to problems. Comprehensive systems planning, including watershed and river basin planning will improve our opportunity for sound water resource management.

E-60. Types of Improvements. The types of improvements to be considered in multiple purpose/multiple objective studies include, but are not limited to, the ones identified in previous paragraphs for each of the Civil Works mission area. Other types of improvements identified by other members of the planning team (representatives from other Federal agencies, State and local governments, tribal governments, non-profit organizations and the general public) will also be considered during the planning process. Corps participation in these type of improvements might be limited by law or policy.

E-61. Specific Policies

a. General. Specific policies and procedures for each of the Civil Works mission areas described in previous sections of this appendix apply to projects that are formulated for multiple purposes.

b. Cooperation with other Agencies. The cooperative efforts of multiple Federal agencies as well as non-Federal interests will generally be necessary to achieve multi-purpose economic and ecosystem goals. Corps multi-purpose planning efforts should complement and be complemented by the various authorities of other Federal and State agencies, Native American tribes and private groups, such that common objectives are identified early in the study process. The Corps will, in some instances, lead in the development of alternative restoration plans, and in other instances play only a supporting role. The Corps can provide assistance in planning, study management, engineering, construction, environmental science and analysis, and in economic analysis of plans generated by others.

c. Plan Selection. When a project has both NED benefits and NER effects the recommended plan should be "best" in the sense that no alternative plan or scale has a higher excess of NED benefits plus NER effects over total project costs. This plan should be called the combined NED/NER plan.

E-62. Benefit Evaluation Procedure

a. Conceptual Basis. The conceptual basis for evaluating NED benefits is society's willingness to pay for the increase in the value of goods and services attributable to improvements for navigation, flood damage reduction, hurricane and storm damage prevention, ecosystem restoration (in circumstances where the outputs can be monetized), hydroelectric power generation, recreation, and water supply. The conceptual basis for evaluating non-monetized NER benefits is society's value toward the increase in ecosystem services.

b. Planning Setting. The planning setting should be broadly conceived to include geographic scales compatible with watershed plans. Multiple programs and authorities for both the Corps and non-Federal participants should be considered to maximize the net beneficial effects of alternative plans.

c. Evaluation Procedure. The general evaluation principles described for each Civil Works mission area shall be followed in the evaluation of multiple purpose projects. Monetary and nonmonetary benefits will be estimated following the steps applicable to each mission area under consideration. One key element in the evaluation of multiple purpose projects is the potential need for tradeoffs between NED and NER outputs. Distinct implementation actions may produce only NED outputs or only NER outputs, and involve no conflicts of space

utilization, water utilization or land use, and if so no question of trading off one output for another arises. In other cases, more of one output (say, NER) can only be obtained by accepting less of another (say, NED). In these cases, tradeoffs between NED outputs and NER outputs are permissible, and should be made as long as the value of what is gained exceeds its implementation cost plus the value of what is foregone. Thus, it is acceptable to trade NED benefits in favor of NER outputs as long as the incremental (subjective) value of the NER outputs exceeds the sum of NED benefits foregone plus incremental costs. Incremental costs equal added cost necessary to realize added environmental outputs less reduced cost permitted by reduced NED outputs. Trades of one output for another shall be made until it is not possible to make further trades improving the total project. Naturally, the potential trades go in both directions, more NER output for less NED output and more NED output for less NER output. This is a formulation-evaluation process by which the Combined NED/NER Plan is discovered.

(1) Benefit-cost ratios are not relevant for environmental projects, and environment specific costs are not included in the benefit-cost ratio for a multiple purpose project. Displays in Tables E-33, E-34 and E-35 illustrate several cases. In the first example, Table E-33, the project produces only NED benefits.

(2) In the second example, Table E-34, the project produces only environmental benefits. In this example, several plan scales are shown so that the public and decision makers know at what level of incremental and total output the costs of the incremental units just equals the subjective valuation of their worth. Since a recommendation depends on this subjective evaluation of worth, which is not readily displayed in a table, no recommended plan is indicated.

(3) In the third example, E-35, the project produces NED and NER outputs. For the first two displayed plan scales there is no interaction between NED and environmental outputs and thus no tradeoff. The third plan scale indicates that the next increment of environmental outputs requires an additional environmental implementation cost of $5 and the foregoing of $10 in NED benefits, resulting in incremental adverse effects of $15. For this plan to be recommended the subjective worth of the additional environmental outputs would need to be (at least) $15. Total project costs are $150 but the benefit-cost ratio is based only on costs associated with the NED benefits, $110. Any of the displayed plans could be the recommended plan, provided that the economic development plan under consideration maximizes NED benefits or that the restoration plan under consideration is shown to be most cost effective.

Table E- 33 Project Produces only NED benefits

BENEFITS ($)	COSTS (4)*	BENEFIT-COST RATIO
150	100	1.5

*Includes justified mitigation cost, if any.

Table E- 34 Project produces only NER outputs

Environmental Outputs (Units)	Costs ($)	Cost per Unit ($)	Incremental Cost per Unit ($)
40	80	2.00	Not Available
50	105	2.10	2.50
60	135	2.25	3.00

Table E- 35 Project Produces NED and NER Outputs

NED Benefits ($)	Costs ($)	B/C	Net Benefits ($)	NEQ Outputs (Units)	Costs ($)	NED Benefits Foregone ($)	Total Adverse ($)	Cost per Unit	Inc Cost per Unit ($)	Total Project Cost ($)
140	110	1.3	30	40	30	0	30	0.75	NA	140
140	110	1.3	30	43	35	0	35	0.81	1.67	145
130	110	1.2	20	50	40	10	50	1.00	2.14	150

E-63. Federal and Non-Federal Participation

a. Cost Sharing. Multiple-purpose studies and projects are cost shared in accordance with the cost sharing policies applicable to each project purpose under consideration. Before determining the required cost sharing for projects, an allocation of total project costs to each purpose must be accomplished. The following paragraphs describe the requirements and procedures used by the Corps for allocating costs of multiple purpose projects.

b. Cost Allocation. The need for cost allocation stems from pricing and cost-sharing policies that vary among purposes. Cost allocation is the process of apportioning total project financial costs among purposes served by a plan. Financial costs are implementation outlays, transfer payments such as replacement housing assistance payments, and the market value of contributions in kind, e.g., lands. Financial costs are to be allocated to those purposes for which the plan is formulated. These purposes do not include other direct benefits and use of otherwise unemployed or underemployed labor resources. All purposes are to be treated comparably.

c. Definitions.

(1) Separable cost for each purpose in a plan is the reduction in financial cost that would result if that purpose were excluded from the plan. This reduction in cost includes:

(a) The financial cost of measures serving only the excluded purpose; and

(b) Reductions in the financial cost of measures serving multiple purposes. In some cases removal of a purpose would result in selection of different measures to address the remaining purposes.

(2) Joint cost is the total financial cost for a plan minus the sum of separable financial costs for all purposes.

(3) Alternative cost for each purpose is the financial cost of achieving the same or equivalent benefits with a single-purpose plan.

(4) Remaining benefit for each purpose is the amount, if any, by which the NED benefit or, when appropriate, the alternative financial cost exceeds the separable financial cost for that purpose. The use of alternative cost is appropriate when alternative financial cost for the purpose is less than the NED benefit, or when there are project purposes that do not address the NED objective.

d. Cost Allocation Standard. Costs allocated to each purpose are the sum of the separable cost for the purpose and a share of joint cost as specified below:

(1) Joint cost may be allocated among purposes in proportion to remaining benefits.

(2) Joint cost may be allocated in proportion to the use of facilities, provided that the sum of allocated joint cost and separable cost for any purpose does not exceed the lesser of the benefit or the alternative cost for that purpose.

e. Allocation of Constituent Cost. Cost-sharing policies for some purposes pertain to cost constituents such as construction costs, and operation and maintenance costs. Costs for each cost constituent specified in the relevant cost-sharing policy should be allocated among purposes.

f. Requirements for Cost Allocations. There are two types of cost allocation studies: Preliminary cost allocations and firm cost allocations. This paragraph prescribes policies and requirements common to both. A cost allocation is required for any multipurpose project with a reimbursable project purpose.

(1) General. Cost allocation studies shall identify specific facilities. The results of such studies shall be summarized to show the percentage of joint-use costs which, together with specific facilities costs, comprise the total allocation to each project purpose. Joint-use cost percentages are derived separately for construction expenditures and for operation and maintenance expenditures. Percentages for construction shall also be applicable to replacement and rehabilitation costs when these occur. As a general rule, percentages are to be rounded to the nearest tenth of one percent.

(2) Responsibility for Cost Allocations. Allocation of total costs among purposes of a project is the responsibility of the Commander, USACE for projects planned and constructed under his jurisdiction. Where cost allocation is assigned by law to another Federal agency, HQUSACE will furnish cost data to such agency, together with views concerning appropriate allocation.

(3) Purposes and Objectives to Which Costs Are Allocated. Preliminary cost allocations may allocate costs to all project purposes, recognized by current executive guidelines, which encompass the direct services or outputs of the project as recommended. In firm cost allocations reports, costs may be allocated only to the project purposes authorized by Congress, or those added under general authority.

(4) Costs Included in the Allocation.

(a) Costs to be allocated include the total construction expenditures, value of lands and property transferred without cost to the project, interest during construction, operation and maintenance costs (including replacement costs necessary to maintain conditions as constructed throughout the project life).

(b) The cost allocation computation shall be computed on the basis of annual costs and benefits, with all expenditures and benefit accruals reduced to a common time basis and equivalent annual values over the period of analysis.

(c) Interest during construction is computed on expenditures during the construction period, in accordance with prescribed procedures for cost estimating or cost accounting requirements.

(d) Deferred costs shall be included in the allocation only if they are an integral component of the plan and its justification, and if they are integral to the investment decision to initiate construction. Deferred recreation costs and benefits dependent thereon (both discounted to the initial project operation date) which do not meet these criteria, may be included only if a cost-sharing contract, including designated future facilities and a construction schedule, is signed and approved in advance of initiation of construction. If deferred costs are included the allocated costs should be presented in a breakdown as to initial and future costs.

(e) Funds allocated for Continued Planning and Design (CP&E) prior to authorization are not included in project costs if the funds were obligated prior to 1 October 1985. Funds allocated for CP&E obligated on or after 1 October 1985 and all advance engineering and design funds shall be made a part of the cost allocated to project purposes and of the cost apportionment between Federal and non-Federal shares.

(5) Costs Excluded from the Allocation.

(a) There are certain project costs included in the appropriations required for construction which by law or administrative regulation are excluded from economic analysis and shall not be allocated to the purposes of the water resources plan. These include the following:

(b) Highway betterments, pursuant to Section 208(c) of Public Law 87-874.

(c) Postauthorization costs of cultural resources mitigation, pursuant to Section 7 of Public Law 93-291, up to one percent of total funds authorized for appropriation, and costs in excess of one percent authorized by waiver pursuant to Section 208 of Public Law 96-515.

(d) Cost excluded from the allocation shall be shown in the allocation data by separate line item or footnote. The allocation data should identify the costs, including an appropriate share of Engineering and Design (E&D) and supervision and Administration (S&A), with sufficient information to permit a cost accounting determination consistent with the derivations in the cost allocation study.

(6) Addition of Purpose to Existing Project (Completed or Under Construction). All added costs incurred by the addition of a new purpose shall be allocated to that purpose and a recommendation shall be made for approval by HQUSACE as to how all purposes should share in the joint-use costs of the original plan considering comparative benefit accruals over the new period of analysis.

g. Preliminary Cost Allocation Studies.

(1) Allocation Study Reported in the Feasibility Report. The preliminary cost allocation study is to provide information to those responsible for reimbursement as to the magnitude and share of reimbursable costs which may be part of the local cooperation requirements and to develop an estimate of Federal costs. Supporting allocation data should be in the detail comparable to other economic analyses in the planning report, and should be available for reviewing officers to verify the reasonableness of the cost allocation. These percentages from the preliminary cost allocation study in the feasibility report shall be used in budget presentations for initial funds for preconstruction, engineering and design, unless and until an updated preliminary allocation is completed during preconstruction engineering and design, or as part of a restudy of an inactive or deferred project.

(2) Cost Allocation Study in Preconstruction, Engineering and Design. The division commander shall determine the need for updating the preliminary cost allocation study. An updated preliminary cost allocation study shall be based on current cost allocation standards and other planning and engineering studies current at the time of preparation. This cost allocation is particularly important for the following reasons:

(a) It provides the cost allocation data to be presented to local sponsors and other agencies as a basis for updated letters of intent or cost-sharing contracts required prior to initiation of construction.

(b) It provides the information on reimbursable and non-reimbursable costs to be included in budget presentations during implementation of a plan, until a firm allocation has been approved.

(c) It provides the information on allocated percentages of joint-use costs which will be used in project cost accounting until a firm allocation is adopted.

(3) Coordination of Preliminary Cost Allocation Studies. Interagency Coordination of preliminary cost allocations shall be accomplished as deemed necessary by the commander, or as specifically required for project purposes.

(a) Coordination of preliminary and firm cost allocation studies with hydropower as a purpose is required with the marketing agency to permit its determination of financial feasibility. Preliminary coordination should be accomplished by the district commander, and final field level coordination is the responsibility of the division commander.

(b) In Reclamation States, the division commander shall insure that preliminary and firm cost allocation studies are coordinated with the regional office of the Bureau of Reclamation which has the responsibility for determining financial feasibility and repayment capacity for irrigation.

h. Firm Cost Allocation Study.

(1) Requirements of a Firm Cost Allocation. The firm cost allocation shall be prepared as a separate report. The report shall present a summary description of the water resources plan, its purposes, and operational characteristics in sufficient detail for a reviewer to understand the relationship between the derived allocation and the formulation objectives. The supporting tables shall present relevant data on benefits, costs, and derivation of the cost allocation.

(a) A firm cost allocation is required at the time the first reimbursable purpose of a multipurpose project becomes operational. However, because projects often become operational before final contracts are awarded and final real estate purchases are made, the division commander may authorize a delay of up to one year in submission of the firm cost allocation report. Authorization of longer delays must have the concurrence of the Director of Civil Works.

(b) A project will be nearing completion of construction when a firm cost allocation report is prepared. The report shall reflect the actual expenditures up to the time the firm allocation study is made and provide a schedule for any remaining estimated expenditures.

(c) Interest during construction will be computed in accordance with accounting practices (ER 37-2-10) which provide for interest from the middle of the month in which expenditures are made to the in-service date of the function or separable unit thereof. The in-service date is the first of the month following availability for service.

(d) Estimates of alternative costs required for the cost allocation shall be developed to a level of detail and to a scope consistent with the plan to be implemented.

(e) Benefits for all project purposes shall be adjusted to a price level representative of the period during which the project was constructed.

(f) The interest rate to be used in the firm cost allocation study is the project evaluation rate, established by applicable laws and regulation.

(2) Review and Approval of Firm Cost Allocation Reports. The Chief of Engineers is the approving authority for firm cost allocation reports. The Division Commander, however, has review and coordination responsibilities as follows:

(a) District commanders shall submit firm cost allocation reports to the Division Commander for review and interagency coordination at the regional level.

(b) The Division Commander shall resolve all conflicts surfaced in review and coordination of the report, to the maximum extent feasible and shall forward the report with recommendations to HQUSACE (CECW-P). Division commanders are not to coordinate the report with the Federal Energy Regulatory Commission (FERC) regional offices. Formal coordination with FERC will be accomplished by HQUSACE.

(c) Upon adoption by the Chief of Engineers, notice will be given by CECW-P to CERM-FC and to the District and Division commanders. Retroactive adjustment of cost accounts will be made as required, in accordance with EP 37-2-1. The joint use cost percentages of the adopted report shall also be used for allocations of all remaining expenditures, for future additions, rehabilitations and replacements, and for operations and maintenance expenditures.

i. Cost Allocation - Detailed Guidance. The remaining paragraphs of this section provide detailed guidance for and examples of allocation of cost among the purposes served by a multipurpose project.

(1) Definitions. The definitions presented in this paragraph are those specific to this section. General definitions of items, such as costs and benefits, are included in other sections of this regulation.

(a) Alternative Costs. The costs of alternative projects with one purpose eliminated, to determine separable costs, or the costs of single purpose projects necessary to obtain the same benefits for the corresponding purpose as in the multipurpose project. The cost of the most economical alternative means for obtaining the same service for any one project purpose frequently is used as the measure of that project benefit.

(b) Cost Allocation. A systematic distribution of costs among the project purposes of a multipurpose project.

(c) Joint-use Costs. Total project costs less all specific costs.

(d) Joint-use Facilities. All project facilities which cannot be identified as specific facilities.

(e) Joint Costs. The total project costs less the summation of separable costs. These are sometimes called "residual costs."

(f) Separable Costs. Costs incurred to add a purpose to a project. These costs are normally calculated as a step in project (plan) formulation in considering the economic feasibility of including a purpose in a joint project. The separable cost is the minimum amount which should be considered for allocation to a given purpose. The separable cost for any specified purpose is determined by subtracting from the cost of the multipurpose project the cost of the most economical alternative project to obtain the same benefits for the other purposes with the specified purpose omitted.

(g) Specific Costs. The costs of identifiable project features normally serving only one purpose, such as a powerhouse or switch yard. These costs are the total cost of identifiable project features for that purpose.

(h) Specific Facilities. Identifiable project features normally serving only one purpose.

(i) Total Costs. All costs for planning, design and construction of the project following completion of the feasibility report. These costs include the estimated value of all items transferred or furnished without cost to the United States government. Also included is accrued interest on these expenditures and values until the project becomes operational.

(2) Purpose of Cost Allocation. Cost allocations are made to derive an equitable distribution of project costs among authorized project purposes, or those proposed for authorization. Laws and regulations requiring reimbursement or cost-sharing generally specify recovery of costs incurred for the service or function. Cost allocation is, therefore, required for most multipurpose projects with a reimbursable purpose. An exception may apply where recreation is the only reimbursable purpose. Under present policy, reimbursement for recreation is limited to one-half of the separable costs. A complete cost allocation study normally would not be required to determine separable costs. However, it could be required to demonstrate that not more than 50 percent of project costs are allocated to recreation as required by Public Law 89-72 and the WRDA of 1986.

(a) The cost allocation is an essential part of the multipurpose planning process where cost-sharing will be required. It provides information needed to determine the magnitude and share of estimated project costs that are reimbursable. This information is essential to the tests of financial feasibility and plan acceptability. During subsequent planning and construction, it provides the information required for allocating actual expenditures and insures that cost accounts are maintained consistent with the plan formulation and allocation principles.

(b) The significant outputs of the cost allocation study are the percentages for allocating joint-use costs among purposes. Although each allocation study derives the amount of cost allocated to each purpose (by cost of specific facilities and allocated joint-use cost), the amounts are pertinent only to the cost estimate used in the study. As total project costs change during the planning and construction phases, revised amounts allocated to each purpose are derived by application of the joint-use percentages contained in the allocation study.

(3) Purposes and Objectives to Which Costs Are Allocated. The recognized services which can be included in a Federal water resources project plan and to which costs may be allocated include the following: environmental quality, navigation, flood control, storm damage reduction, coastal erosion control, irrigation, power, water supply, recreation (including fish and wildlife recreation), fish and wildlife enhancement, streamflow regulation and, in limited cases, water quality. In some cases bank stabilization may also be included.

(4) Method of Cost Allocation.

(a) The separable costs-remaining benefits method (SC-RB) of cost allocation was adopted by interagency agreement in March 1954 as the preferred method for allocating costs of Federal multipurpose water resource projects. Current Executive guidelines endorse its continued use. Under some circumstances, other methods may be used.

(b) Under the SC-RB method, each purpose included in a project is allocated at least its separable costs, i.e., the incremental costs associated with including the purpose in the project. Benefits limited by alternative justifiable expenditures are the upper limit of allocation to each purpose. Remaining benefits (i.e., benefits in excess of separable costs) provide the basis for equitably apportioning joint costs among purposes. A description of the method, extracted from the "Green Book" on "Proposed Practices for economic Analysis of River Basin Projects," is presented in paragraph E-63i(23).

(5) Addition of Purposes to Existing Projects (Completed or Under Construction). Modification of existing projects to accommodate a new purpose may result from a change in planned operation at no additional cost, or from a physical addition to or modification of project facilities, or both. If the added purpose is reimbursable, or would have an effect on existing

reimbursable purposes, the report in justification of the modification should include a determination of costs or charges to be assessed against the new purpose and any proposed reallocation of costs to existing purposes.

(a) The approach to be used in the analysis includes consideration of benefits of the new purpose, alternative costs to obtain the benefits, effects on benefits and revenues of existing purposes, change in project operation, reallocation of storage space, and changes in the physical scope and cost of the project.

(1) The significance of the added purpose should be clearly defined, both as to its benefits and its effects on all existing project outputs.

(2) A new period of analysis should be established when adding a project purpose. The period should be the lesser of the remaining physical life of the reformulated project, or 100 years from the time the purpose is added.

(3) Repayment period and interest rates should be discussed in the report setting forth the proposed addition of a reimbursable purpose. The repayment period should not exceed the new period of analysis, as established in accordance with a(1)(b) above. Normally, the interest rate will be the current year project formulation rate when considering addition of a new purpose to a project. Exceptions should be cleared individually with HQUSACE (CECW-PD).

(b) The economic principles of evaluation and cost allocation are the same as those relating to the previously approved project analysis. Benefits form the addition of a purpose to an existing project must equal or exceed the incremental costs of adding the purpose. These latter costs also include the opportunity costs of the reduction in the beneficial outputs of the existing project as operated. Allocation of costs to the purpose should cover, as a minimum, any additional or incremental costs; the total cannot exceed the lesser of the benefits or the justifiable alternative expenditure.

(c) Two different procedures or approaches are acceptable for applying these principles to derivation of charges for added purposes. The first of these approaches sets forth guidance to be followed where addition of a purpose is of incidental significance, involving only minor losses to other purposes, and there is no change in plan scope. The second approach deals with the addition of a purpose where the change is significant and the effect on other purposes creates a need for a new distribution of costs. Use of these two approaches is applicable to addition of any purpose with the exception of deferred recreation facilities developed at reservoir projects pursuant to Section 5 of the Federal Water Projects Recreation Act, and, for non-reservoir projects pursuant to Section 4 of the Flood Control Act of 1944, as amended, by Section 207 of the Flood Control Act of 1962.

(1) These approaches do not require a determination of the extent to which originally allocated costs of existing purposes have been reimbursed or amortized. Status of reimbursement for existing purposes should be adjusted as required in cost accounts relative to any reallocation.

(2) In no case should costs allocated to existing purposes be increased unless the physical magnitude of their outputs has been increased by a change in project operation.

(d) Addition of a Project Purpose with Insignificant Effect on the Authorized Project. When the addition of a project purpose is incidental and has no significant effect on other project purposes, and the general scope of the project is not altered, a cost allocation need not be made. Consideration will be given to added benefits, incremental costs, and benefits foregone by authorized project purposes using current conditions and interest rates. A procedure for determination of price when reallocating an insignificant storage volume to water supply is included in Section VIII of this appendix (Water Supply).

(e) Addition of a Purpose with Significant Effect on the Existing Project.

(1) When the addition of a new purpose entails identifiable costs and significant changes in expected benefits to other purposes, a cost allocation should be performed. Examples of situations that could require reallocation of costs are addition of power, addition of recreation which involves redistribution of storage allocations and not merely the addition of specific recreation facilities, or addition of water supply when it entails significant loss of flood control or other benefits.

(2) In addition to all modification costs required to add a new purpose to an existing project, joint-use costs equivalent to benefits foregone by pre-existing authorized project purposes should be assigned to the new purpose. These benefits and cost assignments should be computed using the current year interest rate and benefit levels for all purposes. (Should this computation result in an annual cost exceeding annual benefits for the added purposes, it obviously would not be economically justified. Joint-use costs assumed by the new purpose would be at current price (benefit) levels, establishing equity for that purpose. Cost reductions to pre-existing authorized purposes would be in proportion to lost benefits which should be proportional to any repayment capabilities lost by these purposes). Every effort should be made to avoid modifications to existing cost-sharing contracts. If a contract is impacted, equity must be maintained.

(6) Cost Allocations for Specific Project Purposes: Water Supply.

(a) Allocation of costs will be made in recognition of benefits and costs for future water supply that will be realized from storage included in the initially constructed plan.

(b) Where a project provides for both immediate and future water supply, the amount allocated to the future use component should be presented. The ratio of this amount to total estimated construction costs should also be given to demonstrate that allocation to future use does not exceed 30 percent of total estimated project construction cost, which is a limitation imposed by the Water Supply Act of 1958.

(7) Interest Rate for Cost Allocations: Water Supply. For water supply, the reimbursement rate may be different than the plan evaluation interest rate. The cost allocation study establishes the basis for allocation of construction costs to project purposes, and as such, the project evaluation interest rate should be used for the allocation. Cost accounts and reimbursement contracts should compute interest during construction and annual interest and amortization at the applicable reimbursement rate.

(8) Cost Allocation Prior to Initiation of Construction: Water Supply.

(a) Where water supply for immediate use is included in a plan, contracts should be executed with water users prior to initiation of construction or purchase of lands. Water users' responsibilities are fixed in terms of the percentages of specific and joint-use costs from the cost allocation report to be applied to actual cost as constructed.

(b) In most cases, a cost allocation under these circumstances will be based on preconstruction, engineering and design studies. However, costs, benefits, and all other aspects of the project should reflect the latest approved estimates.

(9) Addition of Water Supply to Completed Project. When addition of water supply is incidental and of no severe effect on other project purposes, and the project scope is not altered, a cost allocation should not be performed. Determination will be made as to appropriate charges for water supply. Adjustments to existing project purposes should be made by an internal bookkeeping credit as detailed in paragraph E-63i(9)(b) An example of appropriate charge determination when storage is reallocated is described below. This approach may be used on allocations for additions of other plan purposes, as determined appropriate by the District Commander subject to approval from HQUSACE. Questions on the use of this approach may be addressed to HQUSACE (CECW-P).

(a) Price of Water Supply Storage. The cost to the non-Federal interests for reallocated storage is established as the incremental increase in operations and maintenance costs plus the highest of benefits or revenues foregone, replacement costs, or the updated cost of storage in the Federal project.

(1) Benefits Foregone. Benefits foregone are estimated using a standard Corps NED economic evaluation using a constant price level, the Federal discount rate, and conditions projected for the remaining economic life of the project or 50 years, whichever is greater.

(2) Revenues Foregone. Revenues foregone to hydropower are the reduction in revenues accruing to the U. S. Treasury, based on existing rates charged by the power marketing agency as a result of the reduction in the hydropower.

(3) Replacement Cost. For reallocations from hydropower, the long-term replacement cost of power should normally be the same as benefits foregone. In some instances, however, where the power marketing agency has existing contracts with their customers, the replacement cost of power may be determined by the estimated cost to the power marketing agency to obtain outputs from alternative sources to fulfill the Federal Government contractual obligations for the duration of the contracts. Once the contracts expire, the replacement cost of power should be equal to the benefits foregone for the remainder of the period of analysis.

(4) Updated Cost of Storage. The costs to be reallocated to the water supply storage are determined by first computing the costs at the time of construction by using the Use of Facilities cost allocation procedures as follows:

(Total construction cost - specific costs) x [Storage reallocated (ac-ft)/Total usable storage (ac-ft)]

The cost allocated to the storage on this basis is then escalated to present day price levels. Costs are to be indexed from the midpoint of the physical construction period to the beginning of the fiscal year in which the contract for the reallocate storage is approved. By use of this procedure, interest during construction is eliminated from consideration. The cost of storage determined by this method is compared against the cost of the least costly alternative as determined in subparagraph (5) below. Based on this comparison, the FOA should recommend a cost for the water storage space, and provide justification for that recommendation. Operation, maintenance and major replacement costs should be computed annually by the Use of Facilities Method and added to the cost of the storage to determine the total yearly payment.

(5) Financial Feasibility. As a test of financial feasibility, the governing annual cost of storage derived as determined above should be compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water which the local interest would undertake in absence of utilizing the Federal project. This analysis is to be included in reports which request the reallocation of storage for municipal and industrial water supply.

(b) Cost Accounts. All income and expenses (investment, operation, maintenance, and replacement) associated with the water supply function should be separately identified in the official cost account record. When there is a loss of revenue to existing purposes, or additional operation and/or maintenance expense to existing purposes are incurred because of the new water supply addition, such charges should be shown as a direct charge against the water supply function. This will effect the appropriate cost reductions in the existing project purposes and all revenues from the new addition will be credited to the new purpose.

(c) Hydropower Credit. While existing signed contracts between the power marketing agency and their power customers are in force the power marketing agency may be given credit for the incremental increase in costs incurred to obtain power for these contracts (revenues foregone plus the incremental increase in the cost to purchase power, i.e. replacement cost). After the expiration of current contracts, the power marketing agency will be credited for the amount of revenues to the U.S. Treasury foregone as a result of the reallocation (as determined in (2) above assuming uniform annual repayment.

(10) Cost Allocations for Specific Project Purposes: Recreation and Fish and Wildlife Enhancement. The allocation of recreation costs is made in light of the following:

(a) Recreation developed as a purpose pursuant to Public Law 89-72 or by the project authorization will bear its full and equitable share of joint-use costs. However, if recreation development must be eliminated from initial project construction because of lack of sponsorship, its later addition does not require reallocation of a share of joint-use costs to recreation. Lands may be acquired for possible future recreation and fish and wildlife development pursuant to Section 3 of Public Law 89-72. No lands, however, will be acquired under this authority unless a non-Federal public body has agreed to the same project cooperation requirements applied to all recreation lands and facilities.

(b) The inclusion of recreation in a plan pursuant to authority of the 1944 Flood Control Act does not constitute a purpose to which joint use costs are allocated. Only the cost of specific facilities and any other related costs specifically for recreation may be allocated to recreation in these cases, unless a project reformulation has been presented to Congress with costs otherwise allocated.

(c) Exceptions may be made for projects not yet constructed, if recreation is proposed as a purpose in postauthorization planning prior to the initiation of construction. These cases should be brought to the attention of the HQUSACE with a revised project reformulation and preliminary cost allocation report incorporating allocation of costs to recreation as a purpose.

(11) Lake Recreation Benefits. Recreation, sports fishing and wildlife enhancement, which are derived primarily from availability and use of the lake, should be treated as a single purpose in the cost allocation process, if required to properly identify separable lake costs for their common use. Suballocation of separable costs should be made as necessary to identify cost-sharing requirements for different sponsors.

(12) Downstream Benefits: Recreation and Fishery. Recreation and fishery benefits accruing downstream as a result of lake releases are not usually associated with the plan formulation and operational aspects that produce the lake recreation and fishery. When they are, derivation of an equitable apportionment of costs for these benefits would require separate consideration. The total allocation to recreation would then be presented as a combination of the two separately determined amounts. Information on plan formulation which is pertinent to the cost allocation process will dictate when this approach is to be utilized.

(13) Fish Mitigation Benefits. Fishery mitigation facilities required by plan construction are not a specific or separable cost of fishery enhancement. Even though enhancement may be realized incidentally from mitigation facilities, the separable enhancement costs calculated by SC-RB procedures are limited to incremental facilities for enhancement over and above mitigation requirements. Contributions of mitigation facilities to realization of enhancement benefits is recognized in the allocation of separable and joint costs to the enhancement purpose.

(14) Addition of Recreation and Fish and Wildlife Enhancement to Completed Projects. The provisions of Section 5 of the Federal Water Projects Act permit acquisition of lands for deferred recreation and fish and wildlife enhancement development at reservoir projects. These lands will be acquired only if a non-Federal entity agrees, prior to acquisition, to local cooperation and cost sharing requirements applied to all recreation lands and facilities. Further authorization is not required if facilities are subsequently developed. Federal costs of lands and facilities are allocable to recreation and fish and wildlife, and these are subject to cost-sharing requirements as specified by the Federal Water Projects Act. The repayment obligation begins at the time non-Federal sponsors sign a contract indicating their intent to meet the cost-sharing requirements. In plans where only this type of development is added, no joint-use costs are to be allocated. However, if a modification to the dam and lake is proposed, all modification costs for the purpose of adding recreation and fish and wildlife enhancement to the project are chargeable to the added purpose.

(15) Interest Rate: Recreation. The reimbursement rate for recreation may be different than the project evaluation interest rate. The cost allocation study establishes the basis for allocation of construction costs to project purposes, and as such, the project evaluation interest rate will be used in its preparation. Cost accounts and reimbursement contracts will compute or recompute interest during construction, and annual interest and amortization, at the applicable reimbursement rate.

(16) Incidental Fish and Wildlife Enhancement. Costs should not be allocated to fish and wildlife enhancement if such enhancement is not an authorized project purpose and the benefits to fish and wildlife are incidental to meeting other project purpose goals.

(17) Cost Allocations for Specific Project Purposes: Hydroelectric Power. Cost allocations for multipurpose projects with hydroelectric power should be coordinated with the Federal Energy Regulatory Commission (FERC). This will usually be in the form of a proposed cost allocation report. The Corps should also provide FERC with information to assist FERC in its responsibilities for specifying charges in its permits and licenses.

(18) Annual Notification of Power Marketing Agency. The appropriate power marketing agency should be notified annually as to the amount of credit, if any, that should be deducted from power reimbursement requirements based on adjustments in cost accounts.

(19) Construction Period and Price Level for Alternative Power Projects. The construction period for alternative power projects should be the average period for projects of the type and size used in the FERC analysis to determine economic benefits. The price level for the power alternative in firm cost allocations should be at a point in time one-half of the alternative project construction period back from the initial power-on-line date. The latest available price level shall be used in preliminary cost allocations.

(20) Cost Allocations for Specific Project Purposes: Navigation Projects Producing Commercial, Recreational and Land Enhancement Benefits. The costs of specific or separable project features will be allocated to the purposes served. The costs of jointly used general navigation facilities producing commercial, recreational, or land enhancement benefits, will be allocated to each use in proportion to the remaining benefits expected to accrue to each use. Thus, the costs of breakwaters would be allocated to commercial and recreational navigation, and the cost of dredging to these uses and to land enhancement as well.

(21) Cost Allocations for Specific Project Purposes: Mitigation Cost-Sharing. In the general case of multipurpose projects, for which all project costs are allocated by the separable costs-remaining benefits method (SC-RB), the mechanical procedures which lead to appropriate mitigation cost-sharing conforming to our policy are not susceptible to appreciable variation. The annual costs for mitigation measures are entered into the computations along with the annual costs for all other project features, and when these have been allocated to the several purposes the several increments of annual costs are translated back into their first cost and annual operation and maintenance (or management) cost components. These are then apportioned to Federal and non-Federal interests based on the established legislative and policy requirements for each individual purpose.

(22) Single Purpose Procedures. In the case of single purpose projects (navigation or flood control) which, on the surface, are simpler because they do not involve any elaborate allocations of costs to purposes, future reports should use the following procedure:

(a) Basic project costs (less mitigation), first costs and annual operation, and maintenance**,** repair, rehabilitation and replacement costs, will first be apportioned to Federal and non-Federal sponsors based on the established legislative and policy requirements for the project purpose.

(b) The Federal/non-Federal percentages for sharing mitigation costs will then be determined on the basis of the respective sums of basic project costs apportioned to each entity: first costs plus the capitalized (present worth) value of annual operation, maintenance, repair, rehabilitation and replacement costs.

(c) These percentages will then be applied to the sum of estimated mitigation costs: first costs for mitigation measures plus the capitalized value of annual operation, maintenance, repair, rehabilitation and replacement (or management) costs for the mitigation plan.

(d) The Federal/non-Federal share of mitigation first costs will then be adjusted as appropriate depending upon which entity is assigned actual performance of operation, maintenance, repair, rehabilitation and replacement (or management) for mitigation; that entity receiving credit, against its apportioned responsibility for total mitigation costs, for the capitalized value of the estimated costs for the annual work it will perform.

(23) Separable Cost-Remaining Benefit Method (SC-RB). This recommended method of cost allocation is extracted verbatim from: Report to the Inter-Agency Committee on Water Resources, Proposed Practices for Economic Analysis of River Basin Projects (The "Green Book", prepared by the Subcommittee on Evaluation Standards, May 1958).

> "The separable costs-remaining benefits method of cost allocation is a method for obtaining an equitable distribution of the costs of a multipurpose project among the purposes served. Briefly, it provides for: (1) assigning to each purpose its separable costs, i.e., the added costs of including the purpose in the project; and (2) assigning to each purpose a share of the residual or remaining joint costs in proportion to the remaining benefits; i.e., the benefits (as limited by alternative costs) less the separable costs. Thus, the method provides for an equitable sharing among the purposes in the savings resulting from multiple-purpose development.
>
> "The separable costs-remaining benefits method described in detail below is recommended for general use in allocating costs of Federal multiple-purpose river basin

projects. It differs from the generally recognized benefits method in that the amount of benefits used as a basis for the allocation in the recommended method is limited by the costs of available single-purpose alternative projects. In this respect it resembles closely the alternative justifiable expenditure method, except that the concept of specific costs for each purpose is replaced by the concept of separable costs for each purpose. The separable costs for each purpose are determined as part of the procedures recommended herein for project formulation, so that no added work should be required by this method of cost allocation. Since separable costs include all specific costs and generally include other added costs, residual joint costs to be allocated are usually smaller under the separable costs-remaining benefits method than under the alternative expenditure method. Thus, the separable costs-remaining benefits method maximizes the direct allocation of costs and minimizes the residual costs to be apportioned.

Description of Method

"The method consists of (1) determining the separable cost of including each function in the multiple-purpose project, and (2) determining an equitable distribution of costs incurred for several purposes in common. It makes allowance for any economic significance attributable to the peculiarities of any one purpose in its use of facilities or its prior right to project services. Thus, the use of benefits as a basis for cost allocation under this method makes allowance for both the use made of conditions assumed with respect to those factors. Furthermore, the separable costs determined through project formulation reflect the costs of providing facilities used by each purpose as explained more fully below.

"Separable Costs. The separable cost for each project purpose is the difference between the cost of the multiple-purpose project and the cost of the project with the purpose omitted. Separable costs include more than the direct or specific costs of physically identifiable facilities serving only one purpose, such as an irrigation distribution system. They also include all added costs of increased size of structures and changes in design for a particular purpose over that required for all other purposes, such as the cost of increasing reservoir storage capacity. In effect, separable costs are computed from a series of project cost estimates, each representing the multiple-purpose project with one purpose omitted. Such information will be readily available when the recommended practices of project formulation have been followed. Where project formulation has not been of the detail suggested in the recommended procedure and separable costs are not available, specific costs may be used in lieu of separable costs (as in the alternative justifiable expenditure method).

"Distribution of Residual or Remaining Joint Costs. Residual costs are here defined as the difference between the cost of the multiple-purpose project as a whole and the total of the separable costs for all project purposes. Residual costs thus represent a remaining joint cost attributable to all or several purposes. The amount of project benefits used as a basis for allocation of residual costs to any purpose is limited by the cost of providing equivalent services from the most likely economically feasible alternative source available in the area to be served. From such benefits for each purpose, separable costs are deducted to give remaining benefits. Then residual costs are distributed in proportion to the remaining benefits for each purpose. The distribution of residual costs in proportion to the excess of benefits over separable costs assigns to each purpose an equitable share of project savings.

"If the total separable costs of all purposes should exceed the cost of the multiple-purpose project, there are in effect no residual costs as defined above, but rather a joint saving, which can be distributed among purposes by reducing separable costs to obtain the allocation to each purpose instead of by adding a portion of residual costs to each separable cost as illustrated herein.

"Total Allocation. The sum of the separable costs and the allocated residual cost for each purpose constitutes the total allocation to that purpose. Under the separable costs-remaining benefits method, the total cost allocated to each purpose will not be less than the cost of including that purpose in the project (unless the total of separable costs for all purposes exceeds the multiple-purpose project costs as explained in preceding paragraph), and will not be more than the benefits of that purpose or the cost of the most economical single-purpose alternative."

j. Reporting Requirements: Firm Cost Allocation Study. The following paragraphs provide the format for the firm cost allocation report. Give name of project and location by river, State and nearby community. Indicate current status; as under construction, in operation, etc. Cite purposes of project to which costs are allocated.

(a) Plan of Improvement.

(1) Authorized Plan. Review authorizing legislation for the original plan of improvement and subsequent authorizations which modify the scope. The outline should fully cover any aspects of project authorization which have a bearing on the allocation of costs to the various purposes. Pertinent parts of authorizing legislation and recommendations in project documents should be referenced.

(2) Related Improvements. If the project is a unit in an overall development, its relationship to other units in the plan should be described. Modifications in purposes and operations contemplated when additional units in the plan are added should be explained to the extent that they are pertinent to the allocation of costs. The relationship of the project to upstream or downstream developments which have been constructed, or which are proposed for construction by others, should be outlined. If any payment for downstream benefits pursuant to the provisions of the Federal Power Act is anticipated, explain how such prospective payments have been taken into account in the cost allocation. Refer to drawing(s) included with the studies showing locations of the project and related improvements.

(3) Operational Requirements. Outline the manner in which the project is to be operated to achieve the various objectives, describing the requirements for, and relationships of, the individual purposes as they pertain to such operation. Include explanation of any use to be made of seasonal or multiple use storage, and limitations to be imposed on operations for the various purposes.

(4) Description of Project. Refer to drawings and briefly describe major features of the project such as type of construction, length, and height of dam and spillway structures; reservoir capacity; initial and ultimate power generating facilities; etc. Refer to Table E-36 for additional information. Identify facilities which are used specifically for one project purpose, facilities which are used for several but not all project purposes, and facilities used for all project purposes. Identification should be referenced to the breakdown of costs into specific and joint-use classifications given on a table entitled "Summary of Construction Expenditures" (Table E-37).

(5) Construction Program. The planning and construction program for the multipurpose project should be outlined under this paragraph. Dates when planning and construction were initiated should be stated. Dates upon which the project became, or is scheduled to become, partially and fully available for each of the major purposes should be given and related to the in-service dates used in the cost allocation.

(6) Project Costs and Charges.

(a) Construction Expenditures. Give estimate of construction expenditures for the multipurpose project, the value of items furnished without cost to the Federal Government, and amounts assigned for specific and joint-use features. Identify facilities provided in initial construction for future use and give estimated cost and bases for estimates. (See Table E-37 for breakdown of costs.) The following remarks pertain to Table E-37. This table should clearly identify specific and joint-use costs, and facilitate a comparison of the cost of similar items in the

multiple purpose and alternative projects, both single purpose and multipurpose with each purpose omitted. Costs should be segregated in this table generally in accordance with the classification of permanent features as outlined in ER 37-2-10.

- Funds allocated for CP&E prior to authorization are not included in project costs if the funds are obligated prior to 1 October 1985. Funds allocated for CP&E obligated on or after 1 October 1985 and all advance engineering and design funds shall be made a part of the cost allocated to project purposes and of the cost apportionment between Federal and non-Federal shares, except where exempted by law.

- Costs for Engineering and Design and for Supervision and Administration will be distributed to the applicable project features.

- Costs will be recorded against sub-features necessary to identify the source of specific and joint-use costs.

- Care should be exercised in identifying specific and joint-use features because of the relationship between the breakdowns made for the cost allocation report and subsequent accounting of actual costs.

- Fish facilities should be segregated as between mitigation and specific enhancement facilities.

- Any specific recreation costs for lands or other items not under the recreation account should be identified.

- Wildlife enhancement lands should be shown as a separate line item.

- Costs not allocable to project purposes, such as certain highway improvement costs and certain costs related to cultural resources, should be identified and carried as separate line items.

Table E- 36 Cost Allocation Report: Lake Pertinent Data

Item	Unit	Multiple-purpose Project (as constructed)	Alternative single-purpose Project (Power)	Alternative multiple-purpose project	
				Without Power	Without Flood Control
General					
Location:		Middle Fork Willamette River	Middle Fork Willamette River	Middle Fork Willamette River	Middle Fork Willamette River
RM above Mouth of Middle Fork Willamette	Mile	47.8	47.8	47.8	47.8
RM above Lookout Point Dam	Mile	26.5	26.5	26.5	26.5
Drainage Area	Sq. mile	389	389	389	389
Reservoir					
Elevation:					
Full & Max. Pool	Ft MSL	1,543	1,536	1,524	1,541
Flood Control Pool	Ft MSL	1,543	-	1,524	-
Max. Conservation Pool	Ft MSL	1,541	-	1,522	1,541
Max. Secondary FC Pool	Ft MSL	1,480	-	-	-
Min. FC Pool	Ft MSL	1,448	-	1,414	-
Min. Power Pool	Ft MSL	1,414	1,411	-	1,414
Stream bed at dam axis	Ft MSL	1,244	1,244	1,244	1,244
Minimum tailwater	Ft MSL	1,223	1,223	1,223	1,223
Reservoir area:					
Maximum Pool	Acre	2,735	2,650	2,480	2,715
Flood Control Pool	Acre	2,735	-	2,480	-
Conservation Pool	Acre	2,715	-	2,450	2,715
Max. Secondary FC Pool	Acre	1,930	-	-	-
Min. FC Pool	Acre	1,575	-	1,320	-
Min. Power Pool	Acre	1,325	1,300	-	1,325
Storage capacity:					
Total	Acre-foot	356,000	337,000	307,000	350,000
Flood Control, primary	Acre-foot	145,000	None	200,000	-
Flood Control, Secondary	Acre-foot	55,000	-	-	-
Power	Acre-foot	49,000	233,000	None	243,600
Dead + Inactive	Acre-foot	107,000	104,000	107,000	107,000
Summer Flood Control	Acre-foot	5,400	-	5,400	-
Dams & Appurtenances					
Dam:					

Type			Earth and Gravel Fill	Earth and Gravel Fill	Earth and Gravel Fill	Earth and Gravel Fill
Elevation, top of dam	Ft MSL		1,548	1,541	1,529	1,546
Length	Feet		2,150	2,135	2,105	2,135
Height (from stream bed)	Feet		304	297	285	302
Spillway:						
Type			Gated chute	Gated chute	Gated chute	Gated chute
Elevation of crest	Ft MSL		1,495.5	1,486.7	1,476.5	1,491.7
Number of gates			3	3	3	3
Size of gates		Feet	42x47.3	42x49.5	42x47.5	42x49.3
Spillway design flood (reservoir inflow)		c.f.s.	151,000	151,000	151,000	151,000
Spillway design capacity		c.f.s.	141,600	151,000	141,600	151,000
Fish Facilities:						
At site			None	None	None	None
At existing Leaburg Hatchery			Added ponds	Added ponds	Added ponds	Added ponds
Outlet conduits:						
Type			Tunnel	Pipe	Tunnel	Pipe
Diameter of tunnel or pipe (bypass)						
Operating gates (or bypass valve)			13’9”	2’0”	13’9”	2’0”
Emergency gates (or bypass valve		each	2-6’6”x12’6”	1-24”	2-6’6”x12’6”	1-24”
Penstocks:		each	2-6’6”x12’6”	1-24”	2-6’6”x12’6”	1-24”
Number			1	1	-	1
Diameter		feet	12	12	-	12
Power Plant						
Powerhouse:						
Type			Indoor	Indoor	-	Indoor
Dimension			55’3”x118’6”	55’3”x118’6”	-	55’3”x118’6”
Installed capacity:						
Number of generating units			2	2	-	2
Capacity of units, each		KW	15,000	15,000	-	15,000
Installed capacity		KW	30,000	30,000	-	30,000
In-service dates:						
1st unit			May 1962	May 1962		May 1962
2nd unit			May 1962	May 1962		May 1962
Power Data						
Operating gross head:						
Maximum		Feet	317	310	-	315
Minimum		feet	188	185	-	186
Net regulated flow:						
Average critical period net power flow		c.f.s	746	724	-	746
Power available (31 months)						

Continuous power, critical hydro. Period	Kw	13,100	13,100	-	13,100
Dependable power, critical hydro. Period	Kw	16,400	16,400	-	16,400
Minimum peaking capability	Kw	24,200	24,000	-	23,400
Primary energy per year	Kwh	114,756,000	114,756,000	-	114,756,000
Total energy per year	Kwh	162,279,000	162,279,000	-	162,279,000
Load factor critical period	Percent	80	80	-	80

Table E- 37 Cost Allocation Report: Lake Summary of Construction Expenditures

Permanent Features	Multiple Purpose Project (as constructed) Specific Cost Power	Joint Use Cost	Total Cost	Alternative Single-Purpose Project Power	Alternative multiple purpose-projects Without Power	Without Flood Control
Lands and Damages	--	$743,100	$743,100	$743,100	$715,300	$743,100
Relocation	--	9,858,200 4/	9,858,200	9,858,200	9,593,200	9,830,200
Reservoirs	--	1,024,300	1,024,300	992,300	928,800	1,016,800
Dams	$3,137,600	26,946,800	30,084,400	25,709,500	24,025,900	26,918,500
Main dam		(23,947,900)	(23,947,900)	(22,505,900)	(21,207,900)	(23,659,900)
Outlet Works (exclusive of power)		(2,943,900)	(2,943,900)	(66,000) 3/	(2,763,000)	(66,000) 3/
Power Intakes works	(3,124,600)	--	(3,124,600)	(3,124,600)	--	(3,124,600)
Domestic and powerhouse fire Protection water supply inlet	(13,000) 1/	(55,000) 2/	(68,000)	(13,000) 1/	(55,000) 2/	(68,000)
Fish Facilities (for Mitigation)	--	140,500	140,500	140,500	140,500	140,500
Power Plant	3,412,000	--	3,412,000	3,412,000	--	3,412,000
Roads, Railroads, and Bridges	--	130,500	130,500	130,500	70,000	130,500
Buildings, Grounds, & Utilities	--	227,800	227,800	227,800	227,800	227,800

Permanent Operating Equipment	--	97,100	97,100	72,100	64,200	72,100
Project Cost 2/	$6,549,600	$39,168,300	$45,717,900	$41,118,000	$35,765,700	$42,491,500
Credit						
Transfer of property without cost	300	-17,600	-17,300	--	--	--
TOTAL EXPENDITURE OF PROJECT FUNDS	$6,549,900	$39,150,700	$45,700,600 4/	$41,118,000	$35,765,700	$42,491,500

Note: The alternative single-purpose flood control project is substantially the same as the alternative multiple-purpose project without power, as shown above. The alternative multiple-purpose projects without irrigation and without navigation are identical to the overall multiple-purpose project shown above.

1/ Fire protection facilities.
2/ Water supply facilities for possible future use.
3/ Increased size of bypass pipe (for conservation releases) 20” to 24”.
4/ Exclusive of $500,000 non-allocable highway improvement costs.

(b) Interest During Construction. Refer to tables on "Interest During Construction" and explain method by which interest during construction for the multipurpose project has been calculated. Interest during construction will be separately identified for the cost of specific facilities (Table E-38) and the cost of joint-use facilities (Table E-39). Computations will be based on scheduled construction expenditures (including value of items transferred), either actual or estimated. Interest will be computed from the middle of the month in which expenditures are incurred until the first of the month following the availability for service. Interest on any additional expenditures after the in-service date will be an operating expense. The various features and sub-features of a project will be considered in service progressively as they are completed and the project is available for serving the corresponding purposes. For this purpose, is not contemplated that features and sub-features related to a project purpose will be reported individually as sub-items but will be treated essentially as a unit, such as the specific flood control facilities being considered in service at the time the project is completed to the extent that it is available for flood control. The in-service date for a feature or sub-feature will be considered as the first of the month following the availability for service. In-service dates will be documented by memorandums to files or reported to higher authority as provided in other regulations. At the time the project is available for serving a particular purpose, the total cost of the joint-use facilities allocated to that purpose will be considered in-service, and interest during construction on those costs will be discontinued. For a multiunit power installation, each generating unit together with its proportionate share of joint-use facilities will be considered separately for purposes of computing interest during construction. Thus, when the first unit of a four unit power installation is available for service, interest during construction will be discontinued on one-fourth (assuming 4 identically sized power units) of the total cost of the specific power facilities, as well as interest on one-fourth of the total

(c) Investment Cost. The total project investment cost consisting of construction expenditures, (including value of items transferred without cost to the Federal government) plus interest during construction, will be summarized. If the project includes non-allocable costs, this will be noted and total investment subject to allocation will be emphasized.

(d) Annual Costs.

- Interest and Amortization. Interest rate and economic life at which costs are amortized will be specified and the amount of annual interest and amortization costs will be cited. The basis for establishment of the project interest rate will be presented.

Table E- 38 Cost Allocation Report: Lake Interest During Construction - Specific Power Facilities

Period		Expenditures				Interest During Period
Beginning D.M.Y.	End D.M.Y.	During Period	At Beginning of Period			
			Total	In Operation	Interest Bearing	
010352	300652	6,927		Dollars		28
010752	300653	37,277	6,927		6,927	638
010753	300654	20,926	44,204		44,204	1,366
010754	300655	22,270	65,130		65,130	1,906
010755	300656	39,740	87,400		87,400	2,680
010756	300657	133,690	127,140		127,140	4,849
010757	300658	289,441	260,830		260,830	10,138
010758	300659	95,148	550,271		550,271	14,945
010759	300660	2,197,143	645,419		645,419	43,599
010760	300661	2,643,727	2,842,562		2,842,562	104,110
010761	301161	706,918	5,486,289		5,486,289	60,829
011261	300562	261,187	6,193,207	1/	6,193,207	79,047
010662	300662	13,024	6,454,394	6,549,600	95,206-	
010762	300663	57,618	6,467,418	6,549,600	82,182-	
010763	300664	5,896	6,525,036	6,549,600	24,564-	
010764	300665	18,653	6,530,932	6,549,600	18,668-	
010765	300666	15	6,549,585	6,549,600	15-	
010352	000000	6,549,600				324,135

Table E- 39 Cost Allocation Report: Lake Interest During Construction - Joint-Use Facilities

Period		Expenditures				Interest During Period	Comments
Beginning D.M.Y.	End D.M.Y.	During Period	At Beginning of Period				
			Total	In Operation	Interest Bearing		
010352	300652	40,044		Dollars		166	
010752	300653	215,459	40,044		40,044	3,694	1/ In-service, functions other than power:
010753	300654	120,951	255,501		255,501	7,898	
010754	300655	128,727	376,454		376,454	11,020	.7525 x 39,169,300 = 29,473,656
010755	300656	333,567	505,176		505,176	16,798	
010756	300657	2,098,401	838,741		838,741	47,198	2/ Interest during construction of joint-use facilities other than power:
010757	300658	7,428,851	2,937,144		2,937,144	426,075	
010758	300659	13,354,128	10,365,995		10,365,995	684,509	Interest to date: 2,595,700
010759	300660	7,320,636	23,720,123		23,720,123	846,149	
010760	300661	5,610,555	31,040,759		31,040,759	385,954	29,474,000 x $2,595,700 - $2,042,800 37,452,000
010761	301161	800,654	36,651,314		36,651,314	103,828[2]	
011261	300562	664,157	37,451,968	29,473,656[1]	7,978,312-		Interest during construction of joint-use facilities chargeable to power:
010662	300662	96,312	38,116,125	39,168,298	1,052,173-		
010762	300663	272,625	38,212,437	39,168,298	955,861-		
010763	300664	651,222	38,485,062	39,168,298	683,236-		$2,699,600 - $2,042,800 = $656,800
010764	300665	30,392	39,136,284	39,168,298	32,014-		
010765	300666	1,624	39,166,676	39,168,298	1,622--		3/ Both power units to service.
010352	000000	39,168,300	39,168,300			2,699,627	INOPERATION DATES OF FACILITIES Power units Nos. 1 & 2 1 June 1962 Function other than power 1 December 1961
							Trial percentages for allocation of joint costs:
							Functions other than power 75.25% Power 24.75%

- Operation and Maintenance. Give estimates of total average annual cost for operation and maintenance of the multipurpose project and the amounts assigned to specific and joint-use classifications. Give basis for these estimates. Refer to table "Summary of Average Annual Operation and Maintenance Costs" for breakdown (Table E-40). Costs for Operation and Ordinary Maintenance should be segregated in this table generally in accordance with the classification in ER 37-2-10.

- Major Replacements. A breakdown of major replacements in accordance with the Rehabilitation accounts is not normally necessary in cost allocation reports as the item is small and usually is estimated empirically. As with construction expenditures, the classification of specific and joint-use costs should be carefully prepared so that insofar as practicable the cost allocation report will be consistent with actual recorded costs. Amounts should be included in a separate line item in Table E-40.

- Total Annual Costs. Cite amount and refer to appropriate tables showing specific and joint-use costs summary (Table E-41).

(7) Project Benefits. By separate subparagraph for each purpose, give amounts of estimated benefits and reference planning reports which explain bases of estimates. Any major deviation from planning reports must be explained.

(8) Alternative Projects. Describe why estimates of alternative single purpose projects and of alternative projects with a purpose omitted are needed for the allocation study. By single or separate subparagraph describe briefly the alternative projects, costs, and investments. Refer to Tables E-36, E-37, E-40, E-41and E-42 and drawings as appropriate. In regard to interest during construction for alternative projects, the computation of such on the basis of a year-by-year analysis of costs is often impractical. In such cases the reporting offices should furnish estimates of interest during construction which they consider to be appropriate. If basic information on alternative projects or features is not of the scope indicated in the illustrative tables, in explanation should be furnished.

Table E- 40 Cost Allocation Report: Lake Summary of Annual Operation & Maintenance and Replacement Costs

	Multiple-purpose project				Alternative multiple-purpose projects	
	Specific Costs					
	Power	Control	Joint use	Total	Without power	Without Flood Control[1]
Operation and Maintenance						
Dam, Reservoir	--	--	$26,000	$26,000	$26,000	$26,000
Real Estate Management	--	--	1,000	1,000	1,000	1,000
Roads, Railroads, and Bridges	--	--	1,000	1,000	1,000	1,000
Buildings, Grounds, Utilities, Operating Equipment	$3,000	--	8,000	11,000	8,000	11,000
Power Plant	28,000	--	--	28,000	--	28,000
Fish and Wildlife Facilities	--	--	18,000	18,000	18,000	18,000
Condition and Operation Studies	3,000	$2,000	20,000	25,000	20,000	20,000
Supervision, Administration, and Reports	3,000	1,900	5,000	9,900	5,000	5,000
Surveys and Layouts	--	--	1,000	1,000	1,000	1,000
Subtotal - Operation and Maintenance	$37,000	$3,900	$80,000	$120,900	$8,000	$111,000
Major Replacements	14,000	--	7,000	21,000	7,000	20,600
Total	$51,000	$3,900	$87,000	$141,900	$87,000	$131,600

1/ Also applicable to the alternative single purpose power project

Table E- 41 Cost Allocation Report: Lake Summary of Costs, Charges, and Benefits

	Multiple-Purpose Project[3/]	Alternative Projects		
		Single Purpose	Multiple-Purpose	
	Total	Power	Without Power[1/]	Without Flood Control
Construction Costs	$45,717,900	$41,118,000	$35,765,700	$42,491,500
Interest During Construction				
Specific facilities costs				
Power	324,100	2,677,000	--	324,100
Joint-use facilities	2,699,700	--	2,365,500	2,486,400
Total	3,023,800	2,677,000	2,365,500	2,810,500
Federal Investment	48,741,700	43,795,000	38,131,200	45,302,000
Average Annual Charges				
Interest and amortization	1,718,600	1,544,200	1,344,500	1,597,400
Operation and maintenance	120,00	111,000	80,000	111,000
Major replacements	21,000	20,600	7,000	20,600
Total	1,860,500	1,675,800	1,432,500	1,729,000
Average Annual Benefits				
Flood control	3,945,000	--	3,945,000	--
Irrigation	258,100	--	258,100	258,100
Power	793,500	793,500	7,000[2/]	793,500
Navigation	33,500	--	33,500	33,500
Recreation	167,000	--	167,000	167,000
Total	5,197,100	793,500	4,410,600	1,252,100
Benefit-to-Cost Ratio	2.79 to 1			

[1/]Alternative single-purpose flood control project would be the same as the multiple purpose project without power.
[2/]Downstream power.
[3/]Exclusive of non-allocable highway improvement costs: construction $500,000; investment $530,000; interest and amortization $18,700

Note: Recreation was not a purpose to which joint costs were allocated. There were no costs for specific facilities. If recreation facilities had been included, these would have been charged as a specific recreation cost.

- Alternative Single Purpose Projects. The most likely single purpose alternatives should in general be something other than a single purpose project constructed at the same general site as the multipurpose project. For example, the most economical single purpose alternative for power is likely to be a steam, nuclear, combustion turbine, or combined cycle plant. A likely alternative for water supply that would be developed in absence of the multipurpose project is a tributary site development or wells. An alternative project for recreation might be one or a number of smaller lakes at other nearby sites. The alternative costs used in the allocation process as a limitation on benefits should be determined on the basis of financing costs comparable to the Federal plan. The alternative used to limit benefits should be available at the same time as the multipurpose project, or where benefits are based on future need, at the time the alternative project would be required to satisfy the need. Discounting based on future use may be a factor if the entire project purpose is based on a future requirement, or if the requirement is for an increasing project output and construction of the alternative single purpose project would be staged by the non-Federal sponsor. An example of the matter would be adding wells to an alternative water supply project as the demand for water increased. In some cases, the development of detailed data on alternative single purpose plans may not be required; for example, where it can be conclusively established that costs would be greatly in excess of benefits and hence would not be a limitation on the amount allocated to the purpose.

- Alternative projects with a purpose omitted should briefly describe significant differences from the multipurpose project as constructed to permit understanding of the separable costs determination. Reference should be made to appropriate tables. A derivative table (Table E-43) showing separable costs of each function, for construction, investment, OM&R and total annual costs, should be presented.

(9) Discussion of Cost Allocation Method. The cost allocation method will be briefly described, referring to steps of the allocation and the conversion of cost allocation results to cost accounting application in terms of specific facilities costs and allocated joint-use costs. Reference should be made to the cost allocation table (Table E-44).

(a) If costs included in the allocation cover both initial and future costs, results in Table E-44 will include subheadings (1) and (2) under table line item 5g to show breakdown between initial construction cost and additional future costs (present worth value if appropriate) respectively. It may be desirable to present a summary tabulation (Table E-46), particularly if the cost allocation has included both initial and future costs. In such cases, Table E-45 would be limited to initial costs, providing a better understanding of results for cost accounting use.

Table E- 42 Cost Allocation Report: Lake Annual Benefits, Multipurpose Project

1.	FLOOD CONTROL		$3,945,000
2.	NAVIGATION		33,500
3.	POWER		
	a. At site		
	Capacity: 16,400 x 19.29 x .955	$302,100	
	Energy: 162,279,000 x .00386 x .965	604,500	
	Less cost of transmission: 34,500 x 3.48 -	120,000	
	Net benefit at load center		786,500
	b. Downstream		
	Capacity		
	Energy: 2,800,000 kwh at 2.5 mills		7,000
4.	IRRIGATION		258,100
5.	RECREATION		167,000
	TOTAL		$5,197,100

(b) Proper understanding of the cost allocation requires inclusion of data as presented in tables E-36 through E-45. The data should generally be presented in the format shown to provide understanding of the relations between the multipurpose project and alternative projects as to pertinent data, costs, and benefits. Additional tables as required should be included on computation of interest during construction (IDC) for all purposes with specific facilities.

(c) The procedures for computation as illustrated in the tables required that an approximate determination be made of percentages for allocating joint-use construction costs in order to derive project investment. Interest during construction is partially dependent on the allocation, yet the estimated investment is required before the cost allocation can be made. The approximation can be made using construction expenditures instead of investment, or by approximating percentage for placing plant in service in computing interest during construction on joint-use costs. Where the approximate percentages do not differ more than one-half of one percent from the final percentages determined for allocating construction cost, no further adjustment is necessary. Where the deviation is greater than one-half of one percent, a subsequent refinement shall be made in the computations. It is not necessary to include the trial allocation in the report. However, the table showing interest during construction on joint-use facilities should state the trial percentages used in placing purposes in service, and other data as required for understanding the computation of interest during construction (reference footnotes on Table E-39).

(10) Summary of Cost Allocation Findings.

(a) The final paragraphs of the text should present the percentages for cost accounting use, including those for joint-use construction costs and for O&M costs rounded to the nearest one-tenth of one percent. It should be specified that percentages for operation and maintenance are also applicable to replacement costs.

Table E- 43 Cost Allocation Report: Lake Determination of Separable and Joint Costs

Item	Construction Expenditures	Investment	Annual Charges				
			Operation and Maintenance	Interim Replacements		Interest and Amortization	Total
MULTIPLE-PURPOSE PROJECT					DOLLARS		
As Constructed	45,717,900	48,741,662	120,900	21,000		1,718,631	1,860,531
Without Flood Control	42,491,500	45,301,869	111,000	20,600		1,597,343	1,728,943
Without Irrigation	45,717,900	48,741,661	120,900	21,000		1,718,630	1,860,530
Without Navigation	45,717,900	48,741,661	120,900	21,000		1,718,630	1,860,530
Without Power	35,765,700	38,131,227	80,000	7,000		1,344,507	1,431,507
SEPARABLE COST							
Flood Control	3,226,400	3,439,793	9,900	400		121,288	131,588
Power	9,952,200	10,610,435	40,900	14,000		374,124	429,024
Total Separable Costs	13,178,600	14,050,230	50,800	14,400		495,414	560,614
RESIDUAL COSTS	32,539,300	34,691,432	70,100	6,600		1,223,217	1,299,917

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

Table E- 44 Cost Allocation Report: Lake Allocation by Separable-Cost-Remaining-Benefit Method[1]

Item	Function				
	DOLLARS, unless otherwise noted				
	Flood Control	Irrigation	Navigation	Power	Total
1. Allocation of annual costs:					
a. Average annual benefits	3,945,000	256,100	33,500	793,500	5,030,100
b. Alternate costs	1,430,300			1,675,000	
c. Limited benefits	1,430,300	258,100	33,500	793,500	2,515,400
d. Separable costs	131,588				560,614
e. Remaining benefits					
(1) Amount	1,298,712	258,099	33,499	364,476	1,954,786
(2) Percent of total	66.44	13.20	1.71	18.65	100.00
f. Allocated joint costs	863,633	171,633	22,276	242,373	1,299,917
g. Total allocation	995,221	171,634	22,277	671,397	1,860,531
2. Allocation of operation and maintenance costs:					
a. Separable costs	9,900			40,900	50,800
b. Allocated joint costs	46,572	9,255	1,201	13,070	70,100
c. Total allocation	56,472	9,255	1,201	53,970	
3. Allocation of major replacements:					
a. Separable costs	400			14,000	
b. Allocated joint costs	4,384	871	113	1,230	
c. Total allocation	4,784	871	113	15,230	

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

Table E-44 (cont.). Cost Allocation Report: Lake Allocation by SC-RB Method

Item	Function				
	DOLLARS, unless otherwise noted				
	Flood Control	Irrigation	Navigation	Power	
4. Allocation of investment:					
a. Annual investment cost	933,965	161,508	20,963	602,197	
b. Allocated investment	26,487,946	4,580,487	594,526	17,078,757	
5. Allocation of construction expenditures:					
a. Special investment				6,873,735	
b. Investment in conventional joint-use facilities	26,487,946	4,580,487	594,526	10,205,022	
c. Interest during construction on conventional joint-use facilities	1,708,911	295,517	38,356	656,845	
d. Construction expenditure in conventional joint-use facilities	24,779,035	4,284,970	556,170	9,548,177	
e. Percent of construction expenditures in conventional joint-use facilities	63.26	10.94	1.42	24.38	
f. Construction expenditures in specific facilities				6,549,600	
g. Total construction expenditures	24,779,035	4,284,970	556,170	16,097,777	

[1/]Exclusive of non-allocable highway improvement costs, as noted in Table 7.

Table E- 45 Cost Allocation Report: Lake

Item	Flood Control	Irrigation	Power	Navigation	Total
	Thousands of Dollars				
Construction expenditures:[1/]					
Total allocation	$24,779.0	$4,285.0	$16,097.8	$556.1	$45,717.9
Specific expenditures	0	0	6,549.6	0	6,549.6
Allocated joint-use expenditures	24,779.0	4,285.0	9,548.2	446.1	39,168.3
Percent of joint-use expenditures	63.3	10.9	24.4	1.4	100.0
Operation and ordinary maintenance:					
Total allocation	56.4	9.3	54.0	1.2	120.9
Specific costs	3.9	0	37.0	0	40.9
Allocated joint-use costs	52.5	9.3	17.0	1.2	80.0
Percent of cost of conventional joint-use facilities	65.6	11.6	21.3	1.5	100.0

[1/] Exclusive of $500,000 highway improvement costs.

Table E- 46 Cost Allocation Report: Lake Summary of Cost Allocation Findings

	CONSTRUCTION 1/	O&M 2/
Flood Damage Prevention	63.3	65.6
Power	24.4	21.3
Irrigation	10.9	11.6
Navigation	1.4	1.5

1/ Non-allocable highway relocation costs are not included, but costs in the amount of dollars are set aside as a highway improvement cost.
2/ Applicable also to replacements costs.

(b) Appropriate reference should be made to separable recreation costs relative to specific costs. If they differ, information must be presented to permit accounting identification of separable costs consistent with the cost allocation findings. Identification will be by designation of sub-features or proportionate part, as may be appropriate. The summary findings should also make reference to any non-allocable costs. If final amounts are known at the time of the allocation study, these should be cited. Otherwise, information should be provided as to how final determination will be made, with reference to a percentage of appropriate feature or sub-feature costs.

(c) The summary, with reference to the project cost allocation, should be presented as in Tables E-44 and E-45. For application to financial records, the percentages for allocations of joint-use costs are summarized as in Add cost allocation file here.

SECTION X - Major Rehabilitation Studies

E-64. Background. Major Rehabilitation projects began to be budgeted under Construction, General and Flood Control, Mississippi River and Tributaries (construction element) appropriation accounts beginning in FY 1993. Major Rehabilitation new starts have to compete with other types of new construction starts for scarce resources. To successfully compete as new starts, Rehabilitation Evaluation Reports and supplemental information sheets will have to provide a level of detail and evidence of criticality commensurate with other civil works new starts. The following steps outline generic procedures which can be used to evaluate major rehabilitation projects. Although these guidelines have primarily been used in evaluating hydropower and inland navigation projects, they are applicable to other project purposes.

a. Federal Interest. For the majority of cases, the Federal interest in an existing project will be obvious. However, reasonable argument which shows a Federal interest, and in some cases, a non-Federal interest (i.e. proposed cost sharing), will be provided in the report. Emphasis shall be placed on project outputs and whether they serve priority purposes as defined in the Annual Program and Budget request for Civil Works Activities, Corps of Engineers.

b. Base Condition. The base condition is the alternative which all other plans will be measured against. In comparison to other Corps planning studies, the base condition is synonymous with the without project condition. The base condition assumes that the project will be operated in the most efficient manner possible without the proposed rehabilitation. This treatment of the base condition is uniquely defined and applicable only to analysis of major Rehabilitation projects. Should the project benefit stream be interrupted due to unsatisfactory feature performance, it is assumed that emergency funds will be available to fix the feature. For the economic analysis, allowance must be made for the effect of the repair on the reliability of the feature. Considerable risk and uncertainty is inherent in the base condition. The timing, frequency, and consequences of system disruption are all unknown and must be estimated. The analysis should explicitly show the effects of reasonable alternative assumptions concerning these variables. Portray the base condition in the following manner.

(1) Step 1. Based upon the reliability index calculated for the current physical condition select the probability of unsatisfactory performance for each feature, or component, from the Target Reliability Indices Table in the annual Major Rehabilitation Guidance. If the probability of unsatisfactory performance is due to a combination of events, provide the method used to determine these probabilities. Both the probability of unsatisfactory performance of a feature and the probability of occurrence of an event which results in load conditions causing the unsatisfactory performance shall be explicitly discussed and displayed. Reporting requirements to support the reliability analysis are also addressed in the Major Rehabilitation Guidance.

(2) Step 2. Based on the existing physical condition of, and the current and forecasted demands on the features, estimate the frequency of service disruption and the physical consequences resulting over the planning period. Frequencies and consequences should be expressed in terms which are unambiguous and which facilitate analysis. For example, estimate the percent chance of disruption per year (annual probability) or probability of disruption per event (per event probability).

(3) Step 3. Develop an event tree. A useful way of presenting information of alternative future pathways is an event tree diagram. The event tree is used to display the possible outcomes from some initiating event.

(4) Step 4. Estimate All Costs Necessary to Correct the Service Disruption. The repair should be the least cost fix necessary (as considered reasonable for the circumstances) to continue service.

(5) Step 5. Estimate the Economic Cost for Each Disruption. (The economic cost for different project purposes should be calculated using the guidelines contained in other sections of this appendix)

(6) Step 6. Combine the frequency of service disruption with the consequences of disruption. Monte Carlo simulation is one technique for combining risks and determining expected values. This technique is especially useful when the arithmetic of the expected value calculation is highly complex or intractable. Under some, perhaps many situations, the standard statistical procedure of summing the products of the probabilities and corresponding consequences is sufficient. That is, calculating the value analytically may be more expedient and transparent than estimating by simulation. An advantage of the Monte Carlo approach is that it yields both the expected value and the variance. The fundamental point of the analysis however, is to explicitly consider the likelihood and consequences of the base condition.

c. With Rehabilitation Condition.

(1) General. As previously stated, the base condition should not describe an immediate or certain failure. Nor is the only project alternative immediate and full scheduled rehabilitation. There are a variety of intermediate strategies that should be evaluated. In addition, the rehabilitation decision must give consideration to the choice of timing and extent of rehabilitation. Therefore, the approach is to develop alternatives to solve the problems. This does not predetermine that one major rehabilitation scenario is the only alternative.

(2) Alternatives Considered. Discuss the alternatives considered. The narrative should address the level of detail developed for each alternative, the data available, assumptions made

and the level of reliability, risk and uncertainty associated with the alternative. Present the results of the analysis for each alternative. The following represent some potential alternative plans that should be evaluated and compared.

- Advance maintenance strategy. Advance maintenance consists of expenditures in excess of routine O&M that reduces the likelihood of some emergency repairs and temporary service losses, or the rate of service degradation. Under this scenario, one must evaluate the effect that probabilities and consequences of the strategy have on expected service disruptions and reliability.

- Scheduled repair strategy. Assess the components of the feature in terms of the service disruption probabilities and consequences to the reliability of the structure. Based on this assessment, stockpile replacement parts and make other preparations on this assessment to reduce the time of expected project service disruption.

- Scheduled rehabilitation strategy. The scheduled rehabilitation strategy requires that the optimum rehabilitation timing be identified based on service disruption rates, service degradation and their economic cost.

- Immediate rehabilitation strategy.

d. Summary Statistics. Provide a table to illustrate the cost, benefits, net benefits and benefit to cost ratios of the base condition and each alternative considered.

e. For additional information on the Major Rehabilitation Program and applicable procedures refer to ER 1130-2-500 and EP 1130-2-500.

Exhibit E- 1 Summary of Federal/non-Federal Cost Sharing by Civil Works Mission

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal**	
		Construction	**OMRR&R**
Navigation **Harbors** Sections 101&214, WRDA ’86 Section 13, WRDA ’88 Section 201, WRDA 96	For primary access channels, anchorages, turning basins, locks and dams, harbor areas, jetties, and breakwaters.	Down to 20 ft below mlw—10% non-Federal Over 20 ft and down to 45 ft below mlw—25% non-Federal Exceeding 45 ft below mlw –50ft non-Federal	100% Federal 100% Federal 50% of incremental costs for O&M associated with project depths in excess of 45 ft.
	Projects (GNF) with no channel deepening	GNF is cost shared at the same depth zones as the existing project depth or, if no existing project, the natural controlling depth	
	Channel deepening limited to one depth zone (40 to 45 feet)	Entire cost of GNF is shared at the depth zones of the improved depth	
	Channel deepening not limited to one depth zone (40 to 50 feet)	The existing and improved main channel depths will be used to determine cost sharing. The GNF costs of non-depth related features will be assigned to the depth zones in the same proportion that dredging costs are assigned to each zone	

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Navigation, Harbors (Cont)	Where more than one disposal site is used for a specific reach in one dredging operation and each disposal site has a different unit cost. Where more than one disposal site will be used for a specific reach of channel when dredging will be done in phases.	The cost of disposal for deepening that reach will be assigned to the depth zones proportionally. Each depth zone will be assigned its actual cost of disposal.	
	Channel deepening is in segments and segments are in 2 different cost-sharing zones.	Entire cost of GNF associated with deepening segment is determined by improved depth for that segment. GNF costs for non-depth related features will be assigned to the depth zones in the same proportion that dredging costs are assigned. Where non-depth features are associated with only one channel segment, cost is shared in accordance with that segment.	

Exhibit E-1 (Continued)

Additional Considerations for Navigation, Harbors Non-Federal sponsor shall: Provide all LERR for construction and maintenance. Hold and save US free from damages due to construction, operation and maintenance. For all depths, provide additional cash contribution of 10% of GNF, which includes dredged material disposal construction costs. These costs may be financed over a period not exceeding 30 yrs. Sponsor costs for LERR, except utilities, are credited against 10% cash contribution. The owner of a utility requiring relocation as part of an improvement deeper than 45 ft below mlw must fund 50% of the costs thereof. Removal of a utility is at the owner's expense. The owner of a bridge requiring modification must share the costs according to the principles of the Truman-Hobbs Act (P.L. 77-647); the balance is cost shared as part of the GNF.			
Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal**	
		Construction	**OMRR&R**
Dredged Material Disposal Facility Section 217, WRDA '96	The SA may at the request of the non-Federal interest, add capacity at a dredged material disposal site being constructed by the SA. Disposal plan which consists of construction of a rehandling facility for dewatering and stabilization of dredged material, evacuation from the rehandling facility and transportation to a commercial landfill and payment of the tipping fee.	100% costs for additional capacity paid by non-Federal sponsor. The costs for the disposal plan are shared as GNF for both disposal of material from O&M of an existing Federal project or disposal of material from construction of a Federal harbor improvement.	

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/Non-Federal)**	
		Construction	**OMRR&R**
Navigation, Inland Waterways Section 102, WRDA ’86 and Section 206, Inland Waterways Revenue Act ’78, as amended by Section 1405, WRDA ’86	Lock and dam replacements are studied and recommended for specific Congressional authorization; other extensive work is normally accomplished under the major rehabilitation program Dredging and Disposal facilities.	If the waterways users are subject to fuel taxes paid into the IWTF – 100% non-Federal Inland channels not specifically designated by Congress as part of the taxable system will be cost shared according to the terms of harbors.	100% Federal O&M will be cost shared according to the same terms as harbors.
Navigation, Recreational Section 103(c)(4), WRDA ‘86		All ancillary shoreside facilities including interior access channels and berthing areas – 100% non-Federal All related LERRD for construction and maintenance, except to the extent that the value may exceed 50% of the total (separable and joint) recreational navigation costs – 100% non-Federal Cash contribution plus LERRD = 50% non-Federal	100% non-Federal

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal**	
		Construction	**OMRR&R**
Structural Flood Control Sections 1 & 3, FCA ’36 Section 2, FCA ’41 Section 103(a), WRDA ’86 Section 202(a), WRDA ‘96	Federal Government should participate in improvements for flood control purposes if the benefits to whomsoever they may accrue exceed the estimated costs	All LERRD uncontaminated with hazardous and toxic wastes, and minimum cash contribution amounting to 5% of the flood control features of TPC -–non-Federal. For projects authorized on or before 10/12/96: If the value of LERRD plus cash is less than 25 % of TPC, non-Federal provides additional cash to make 25% of TPC. For projects authorized after 10/12/96: If value of LERRD plus 5% is less than 35% of TPC, then non-Federal provides cash to make 35 % of TPC. Maximum non-Federal contribution will not exceed 50% of TPC (5% cash, 45% LERRD).	100% non-Federal
Additional Considerations for Structural Flood Control: Non-Federal cost sharing may be reduced under the ability to pay rule. Funding LERRD in excess of 45% will be covered in PCA. Generally, this excess LERRD is reimbursed. There is a $200,000 credit for flood control for territories other than Puerto Rico. Non-Federal will hold and save U.S. free from damages due to construction, operation and maintenance. Community has to participate in FEMA’s NFIP and comply with requirements of the program. Community must prepare a floodplain management plan which must be adopted within one year of signing PCA. Non-Federal will prevent future encroachment or modification that might interfere with proper functioning of the project.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Nonstructural Flood Control Section 73, WRDA ’74 Section 103(b), WRDA ’86 Section 202(a), WRDA ‘96	In Corps planning, consideration will be given to nonstructural alternatives to prevent or reduce flood damages.	For projects authorized on or before 10/12/96: non-Federal sponsor must provide all LERRD, except to the extent that the value thereof may exceed 25% of TPC for nonstructural measures. For projects authorized after 10/12/96, non-Federal sponsor must provide all LERRD, except to the extent that the value thereof may exceed 35% of TPC for the nonstructural measures. If the value of the non-Federal contribution is less than 25% or 35% of TPC, a cash contribution must be made, that when combined with LERRD value equals 25% or 35% of TPC	100% non-Federal
Additional Considerations for Nonstructural Flood Control: If LERRD is greater than the 25% or 35% prescribed, the excess will be reimbursed. Recreation can provide up to 50% of the benefits of a project. Non-Federal sponsor will hold and save U.S. free form damages due to construction, operation and maintenance. Community has to participate in FEMA’s NFIP and comply with requirements of the program. Community must prepare a floodplain management plan which must be adopted within one year of signing PCA. Non-Federal will prevent future encroachment or modification that might interfere with proper functioning of the project.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Emergency Section 5a, FCA ’41, as amended Emergency Flood Control Funds Act of ’55 P.L. 87-874, RHA ’62 P.L. 93-523, Safe Drinking Water Act ’74 P.L. 95-51 Section 917, WRDA ’86 Section 302, WRDA ’90 Section 204(e), WRDA ‘96	Planning preparedness for all natural disasters. Flood fighting and rescue operations. Emergency repair and restoration of flood damaged or destroyed flood control works. Nonstructural alternatives to the repair or restoration of flood damaged flood control works. Emergency protection of the Federal hurricane or shore protection project structures damaged or destroyed by extraordinary storm occurrences. Emergency supply of clean drinking water where source is contaminated. Emergency supply of water for human consumption in drought distressed areas.	LERRD – 100% non-Federal Construction costs, including S&A, excluding E&D for repair or restoration of non-Federal flood control works – 20% non-Federal	100% non-Federal in connection with any flood control measures undertaken pursuant to Section 5(a) of the FCA ’41, as amended.
Additional Considerations for Emergency: Advance measures are undertaken only to supplement state and local efforts (when their capabilities are exceeded). The sponsor may be asked, in connection with these or any other of the efforts authorized under Section 5(a) of the FCA '41, as amended, to provide such other measures of cooperation that, in the discretion of the Chief, would be appropriate to the specific case.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Floodplain Management Services Program Section 206, FCA '60	General authority to provide floodplain information and planning assistance to state, county and city govts., and other Federal agencies. Flood and floodplain information is also provided to private citizens, corporations and groups. Flood proofing and general floodplain management guidelines are developed and published. Hurricane evacuation studies and flood warning preparedness studies are conducted jointly with other Fed. Agencies for state and local governments.	Non-Federal public entities may not pay the Corps for these services; private citizens and other Federal agencies may.	

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Hurricane and Storm damage Reduction, Shore Protection, General Authority (including beach erosion control) 1946 Shore Protection Cost Sharing Act, as amended Sections 103(c)(5) and (d), WRDA ’86 Section 55, WRDA ’74 Section 14, WRDA ’88 WRDA 99	Federal policy to assist in construction but not maintenance of works for the improvement and protection of shores of the U.S. against erosion by waves and currents. Provide technical and engineering assistance to non-Federal public interests in developing structural methods of preventing damages attributable to shore and streambank erosion. Corps projects must be formulated primarily for hurricane and storm damage reduction.	LERRD – 100% non-Federal Costs assigned to protection of federally owned lands and shores – 100% Federal Costs assigned to privately owned lands (undeveloped) and shores (where use of the shores is limited to private interests) – 100% non-federal. Costs assigned to privately owned, developed lands where criteria for public access and public use of the shores are met – 35% non-Federal. Costs assigned to non-federal public shores used for parks and recreation -–50% non-Federal.	100% non-Federal for non-Federal shores
Additional considerations for hurricane and storm damage reduction: The non-Federal LERRD will be credited against the sponsor’s total (percent) responsibility or sharing construction costs; any excess of LERRD will be reimbursed to the sponsor. Sponsors must comply with Federal flood insurance and floodplain management programs requirements.			

Exhibit E-1 (Continued)

Authority	Provisions	Cost Sharing (Federal/ Non-Federal)	
		Construction	**OMRR&R**
Hurricane and Storm Damage Reduction, Shore Protection, Periodic Nourishment 1956 Beach Nourishment Act WRDA '99	Federal assistance in periodic beach nourishment is provided on the same basis as new construction when it would be the most suitable and economical remedial measure.	Costs are shared in the same proportion as the initial project construction costs.	100% non-Federal for non-Federal shores.
Hydroelectric Power, General Section 103(c)(1), WRDA '86	Corps policy is to maximize sustained public benefits from each of its projects for all desirable purposes, including power. Power developed at Corps projects surplus to project's needs is turned over to DoE for marketing.	All capital investment and OMRR&R allocated to power are reimbursable. DoE's PMAs establish power rates that will recover costs over time (usually 50 years). Cost sharing will be in accordance with existing law, currently 100% non-Federal.	
Additional Considerations for Hydropower, General: The Corps can survey the potential and methods of rehabilitating former industrial sites for use as hydroelectric facilities and provide technical assistance in dredging projects to rehabilitate the sites that have been surveyed. In return, the non-Federal entity will receive power produced, or an equivalent value of power for 30 years. Non-Federal power development may be conducted at Corps projects through FERC licensing procedures, and it is Corps policy to encourage non-Federal interests to develop such hydropower potential where it is feasible and not authorized for Federal development. No general authority exists for Corps development of hydropower at non-Corps sites, although this has been done through specific Congressional authority.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Hydroelectric Power Facilities for Future Power Installations (Minimum Provisions) Section 4, FCA ’83 and subsequent authorizing acts	Penstocks and other similar facilities may be included in the initial construction of projects where power is not authorized. Requires approavl of the SA, on recommendation of the Corps and FERC. Probability of future economic and financial viability and willingness to pay of the non-Federal interest to finance or contract for the facilities must be determined. Purpose of this authority is to preclude loss of hydropower viability and to provide significant future construction savings.	Costs allocated to hydropower are reimbursable. The DoE PMAs establish rates that recover costs over time (usually 50 years) when power is ultimately developed.	

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Water Supply Storage Water Supply Act ’58 P.L. 88-140, Permanent Rights to Storage Section 932, WRDA ’86 Section 103(c(2) and (3), WRDA ‘86	Grants permanent rights to use the storage space to the sponsor upon completion of the payments of the cost of storage.	Sponsor must contract to provide 100% reimbursement of the costs allocated to water supply within the life of the project but not more than 30 years from the initial use of the projects for water supply. For new projects reimbursement is based on the actual development costs allocated to water supply storage and shall be made during the period of construction. For reallocations, reimbursement is based on the highest of benefits or revenues foregone, the replacement cost or the updated cost of storage.	100% reimbursement of the O&M on an annual basis and repairs, reconstruction and major rehabilitation and replacements, as they are required for storage allocated to water supply.
Additional Considerations for Water Supply Storage: 10% of benefits for new projects must be flood control or navigation.			

Exhibit E-1 (Continued)

Authority	Provisions	Cost Sharing (Federal/ Non-Federal)	
		Construction	OMRR&R
Water Supply, Surplus Water Section 6, FCA '44	ASA(CW) can enter into contracts with states, private concerns and individuals at prices and terms ASA(CW) finds reasonable, to provide surplus water or temporary use of available storage from Corps reservoirs for domestic and industrial uses, rather than reallocating and granting a permanent right to storage.	For the period of use, user pays an annual amount based on the updated cost of storage plus OMRR&R.	
Additional Considerations for Water Supply, Surplus Water: The storage must have been provided in the reservoir for some other purpose not yet being realized, or the water would have been more beneficially used as M&I water than for authorized purposes. The use must not significantly affect the authorized purposes. Such contracts are normally limited to 5 years, with provisions for an additional 5-year extension.			
Water Supply, Minor Emergency Withdrawals Section 6, FCA '44	When a governor of a state has declared an emergency due to drought, withdrawals of up to 50-acree feet of storage may be permitted for domestic and industrial uses for a period of up to 1 year.	The cost assigned to the water is based on the current value of the storage, with a minimum of $50 per year. The project manager signs the permit.	

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Recreation, Lake Projects Section 4, FCA, as amended Federal Water Project Recreation Act ’65, as amended Section 103(c)(4), WRDA ’86 Section 2804, Reclamation Projects Authorization and Adjustments Act ‘92	Projects must be under the control of the Army. Requires non-Federal cost sharing. If there is no willing cost sharing partner, Corps may only provide minimum facilities. The Corps may also provide type “C” visitor centers, handicap access and operational boat ramps.	50% first costs of all recreational features, except when those costs are paid from SRUF funds – non-Federal. Upgrading sanitary facilities on Corps operated areas – 100% Federal LERRD – 100 % non-Federal	100% non-Federal
Additional Considerations for Recreation, Lake Projects: ASA(CW) requires the sponsor share to be provided during construction. Minimum facilities are joint costs and are shared among the project purposes in accordance with Section 103(c)(4), WRDA ’86. Non-Federal sponsor will hold and save the U.S. free from damages due to construction, operation and maintenance.			

Exhibit E-1 (Continued)

Authority	Provisions	Cost Sharing (Federal/ Non-Federal)	
		Construction	OMRR&R
Recreation, Non-lake Projects Section 4, FCA '44 Federal Water Project Recreation Act '65 Section 103(c)(4), WRDA '86 Section 313, WRDA '90	Requires non-Federal cost sharing. Recreation benefits do not influence project formulation. Non-lake structural projects must attain a benefit to cost ratio greater than unity without recreation. Facilities must be on lands required for basic project. Separable lands may be acquired at flood control projects for access, parking and facilities required for health and safety. Recreational development costs at structural flood control projects may not increase the Federal project cost by more than 10% without prior approval by ASA(CW). Facilities are not provided at shore protection projects. Corps can expend up to $2 million annually to mitigate for adverse impacts on recreation from the maintenance, repair, rehabilitation or reconstruction of a project.	Separable costs – 50% non-Federal For harbor and channel projects, 50 % of the joint and separable costs allocated to recreational navigation – non-Federal. LERRD – 100% non-Federal	OMRR&R for all types of projects – 100% non-Federal
Additional Considerations for Recreation, Non-lake Projects: ASA(CW) requires the sponsor share to be paid during construction. Facilities that are eligible for cost sharing must be on the facilities checklist in Appendix E. Other qualifications and guidance is also provided in this document.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Ecosystem Restoration and Protection Section 210, WRDA '96	Address ecosystem restoration needs and opportunities, as a single objective or one of multiple objectives, as per provisions of the specific authorization.	35% implementation costs (LERRD, post feasibility phase design, including plans and specifications, materials and project construction – non-Federal The value of LERRD is credited towards the 35% share of total first costs, and the Corps will reimburse the sponsor for the amount that LERRD exceeds 35% of first costs. The sponsor must pay the difference between the LERRD and the 35% in cash.	100% non-Federal
Additional Considerations for Ecosystem Restoration and Protection: The sponsor can not receive credit for work-in-kind for post-feasibility phase design, plans and specifications, materials or project construction. 50% non-Federal feasibility costs can be work-in-kind (i.e., 25% of total feasibility cost). Non-Federal will hold and save the U.S. free from damages due to construction, operation and maintenance.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Mitigation, Fish and Wildlife F&W Coordination Act ’58 Section 906, WRDA ‘86	Requires projects to include justifiable means and measures of mitigation. Requires Congressional authorization of land acquisition except for authority provided by Section 906(b), WRDA ’86. Requires the Corps to determine justification and desirability of project modification.	Costs are assigned to appropriate project purposes and are shared accordingly.	O&M responsibilities are project specific, but the following is generally true: For projects owned and operated by the Corps, OMRR&R will be paid by the Federal Gov. For projects that will be turned over to the sponsor to be operated, OMRR&R will be paid by the sponsor.
Additional Considerations for Mitigation, Fish and Wildlife: Water rights: If required by state water laws, rights for the use or release of stored water, to maintain reservoir pools or regulate stream flows for fish and wildlife mitigation shall be provided by the non-Federal sponsor. Reasonable costs of rights for water to accomplish initial filling of the reservoir, including water for mitigation requirements, are eligible for credit in cost-sharing determinations. The computation is dependent on the manner of repayment. Non-Federal sponsors are also required to furnish assurance that appropriate action will be taken to prevent downstream withdrawals of water that would negate fishery benefits credited to such releases.			

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Mitigation, Cultural and Historic Resources Section 7(a) of P.L. 93-291	Funds expended during feasibility for sample surveys, intensive surveys, or other needed historic preservation investigations are cost shared. These costs may be treated as planning costs and thus, are not accountable under the statutory 1% limit on expenditures.	Mitigation, including data recovery and all other mitigation treatments or measures – 100% Federal up to 1% of construction costs. Costs in excess of 1%, with a waiver, may be cost shared according to project purposes.	O&M responsibilities are project specific, but the following is generally true: For projects owned and operated by the Corps, OMRR&R will be paid by the Federal Gov. For projects that will be turned over to the sponsor to be operated, OMRR&R will be paid by the sponsor.

Exhibit E-1 (Continued)

Authority	**Provisions**	**Cost Sharing (Federal/ Non-Federal)**	
		Construction	**OMRR&R**
Aesthetic Resources Section 232, WRDA '96	Corps shall consider measures to preserve and enhance scenic and aesthetic qualities in the vicinity of water resources projects.	Costs will be cost shared in the same proportion as the associated project. Any incremental aesthetic costs associated with a recreation project will be allocated to that purpose and cost shared with the non-Federal sponsor on a 50% basis. In multi-purpose projects, costs will be shared in accordance with the purpose to which the costs are allocated.	100% non-Federal
Review of Completed Projects Section 216, FCA '70	Review of completed projects, when found advisable due to changed physical, economic or environmental conditions. A report is made to Congress on advisability for modifying structures or operations.	Project construction cost sharing determined by project purpose	

Exhibit E-1 (Continued)

Authority	Provisions	Cost Sharing (Federal/ Non-Federal)	
		Construction	OMRR&R
Planning Assistance to States Section 22, WRDA '74, as amended Section 605, P.L. 96-597 Section 221, WRDA '96	Provide technical assistance to support state, territories and tribal preparation of comprehensive water and related land resources development plans, including watershed and ecosystem planning. Assist in conducting individual studies supporting these plans. Assistance is provided at the request of non-Federal entity and upon availability of Corps expertise.	No construction will be accomplished under this program.	
Additional Considerations for Planning Assistance to States: Technical services, rather than grants, are provided without charge or cost sharing. Nationwide annual funds may not exceed $10 million, with not more than $500,000 in any one year in any one non-Federal entity. The Corps can provide assistance to state and local governments in disaster preparedness, response and recovery efforts. Section 22 can not be used to supplement other ongoing or pending efforts, or to offset required state contributions to Federal grant programs.			

Notes:
WRDA – Water Resources Development Act
Mlw- mean low water
LERR –Lands, easements, rights-of-ways and relocations
GNF – general navigation features
ASA(CW) – Assistant Secretary of the Army for Civil Works
IWTF – Inland Waterways Trust Fund
LERRD – Lands, easements, rights-of-ways, relocations and disposal/borrow areas
NED – National Economic Development
PCA – project Cooperation Agreement
OMRR&R – Operation, maintenance, repair, replacement and rehabilitation
PMA – Power Marketing Agency
FERC – Federal Energy Regulatory Commission
S&A – Supervision and administration
E&D – Engineering and design
P.L.- Public law
DoE – Department of Energy
SA – Secretary of the Army
FCA – Flood Control Act
TPC – Total Project Cost
RHA – Rivers and Harbors Act
SRUF – Special recreation user fees
F&W – Fish and wildlife

Exhibit E-2 Recreation Facilities Checklist

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
I. Access and Circulation			
Roads 5/		x	x
Turnarounds	x	x	x
Trails			
Hiking		x	x
Exercise			x
Bicycle/Jogging		x	x
Equestrian/without jumps		x	x
Snowshoe		x	x
Cross County Ski		x	x
Ski Slopes			x
Chairlifts/Tows			x
Snowmobile		x	x
Off-Road Vehicles		x	x
Water		x	x
Slalom			x
Artificial White Water			x
Parking 5/		x	x
Bridges and Culverts		x	x
Boat Launching Devices			
Mechanical			x
Surfaced Ramps	x	x	x
Boat Piers (Fixed or Floating)		x	x
Walks		x	x
Steps (Outdoor)		x	x
Pedestrian Ramps		x	x
Fishing piers and attendant facilities		x	x
Footbridges 9/		x	x

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
II. Structures			
Sanitation			
Vault Toilets	x6/	x	x
Comfort Station	x6/	x	x
Comfort Station w/showers	x	x	
Laundry Room			x
Bath-Changehouse		x	x
Fish Cleaning Station		x	x
Shelters			
Picnic		x	x
Overlook		x	x
Trail		x	x
Group Camp			
Cabins and Dormitories			x
Dining Hall			x
Infirmaries			x
Amphitheaters		x	x
Caretaker Quarters			x
Outdoor Cooking		x	x
Beaches		x	x
Docks		x	x
Camping pads		x	x
Swimming Beaches		x	x
Visitor Center	x2/		x
Nature Center			x
Historical Centers			x
Archeological Centers			x
Environmental-Education Centers			x
Lodges/Cabins			x
Hotels/Motels			x
Restaurants/Snack Bars			x
Stores/Commissaries			x
Bait/Tackle Shops			x

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
Marina			x
Docks/Piers			x
Fuel Dispensing/Storage			x
Repair Facilities			x
Storage Facilities			x
Swimming Pools			x
Clubhouse			x
Stables			x
Corrals			x
Equestrian Jumps/Courses			x
Fountains/Statuary			x
Decorative Lakes/Ponds			x
Decorative Promenades			x
Maintenance and Operation			
Vehicle and Material Storage			x
Garages			x
Work Shops			x
Utility Buildings			x
Inflammable Storage			x
Administrative Facilities			x
Gate House, Control Structures			x
Boat Storage			x
Employee Quarters			x
Bulk Storage			x
III. Utilities			
Water Supply			
Municipal System		x	x
Wells		x	x
Treatment Plant		x	x

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
Storage		x	x
Distribution		x	x
Fountain and Outlets		x	x
Irrigation System (manual)		x	x
Irrigation System (automatic)			x
Camp Site Hook-ups		x	x
Sewage and Waste Water Disposal			
Municipal System		x	x
Septic Tanks and Tile Fields		x	x
Treatment Plants		x	x
Oxidation Lagoon		x	x
Sanitary Dump Station (Boats and Camping Trailers)		x	x
Camp Waste Water and Garbage Disposal		x	x
Storm Drainage		x	x
Public Telephone		x2/	x
Electrical			
Lighting		x	x
Lift Pumps		x	x
Camp Site Hook-ups		x	x
Gas, Natural/Propane		x	x
Land Fill			x
Incinerator			x
IV. Site Preparation and Restoration			
Clearing and Grubbing (Includes vista clearing)		x	x
Grading and Land Form		x	x
Tree Planting		x	x
Shrub Planting		x	x

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
Other Planting		x	x
(Perennial, etc.)			x
Turf Establishment		x	x
Reforestation		x	x
V. Park Furniture			
Picnic Tables		x	x
Grills and Fireplaces		x	x
Campfire Circles		x	x
Trash Receptacles/Holders		x	x
Benches		x	x
Camping Pads		x	x
Flag Poles			x
Lantern Hangers		x	x
VI. Play Facilities			
Courts			
Multiple Use		x7/	x
Tennis			x
Basketball			x
Handball			x
Shuffleboard			x
Volleyball			x
Horseshoe-Pits			x
Sports/Play Fields			
Baseball Diamond with Backstop		x	x
Bleachers			x
Dugouts			x

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
Fencing			x
Lighting			x
Playfield Area (open space)		x	x
Marking/Goals			x
Play Equipment			
Standard		x	x
Elaborate 8/			x
Golf Course/Putting Greens			x
VIII. Signs			
Entrance-Directoral-Marked		x	x
Traffic Control (Vehicular and Pedestrian)		x	x
Instruction (Includes Fire Danger Notices)		x	x
VIII. Interpretive Guidance and Media			
Display Boards		x	x
Display Cases			x
Interpretive Markers (Natural, Historical Archeological, etc.)		x	x
Electronic Audio-Visual Devices		x	
Exhibit Space			x
Bulletin Boards		x	x
IX. Protection, Control, Health and Safety			
Protection and Control			

Exhibit E-2 (Continued)

Activity/Facility	Joint Cost 2/	Cost Shared 3/	100% Other 4/
Gates and Barricades	x	x	x
Cattle Guards		x	x
Walls and Fencing		x	x
Guardrails	x	x	x
Breakwaer-fishing walkways		x	x
Entrance Stations		x	x
Buoys/Waterways Markers		x	x
Fire Fighting and Protection			x
Communication			x
Vandalism and Theft Control Devices			x
Campground Registration Box		x	
Health and Safety			
Lighting		x	x
Life Guard Stand (Where life guard services are authorized)			x
First Aid Station			x
Handrails		x	x

1/ Includes new and completed lakes, local protection projects, navigation projects, etc. Facilities not listed must be justified and approved prior to commitments made to cost sharing partners. This check list will be modified as appropriate.

2/ The facilities to be provided are to be limited to those required for minimum health and safety; beyond these the Corps will also provide type "C" visitor center and operational boat ramps. Handicapped access will be a consideration.

3/ Facilities to be cost shared are limited to standard designs that do not include embellishments such as decorative stone work, planters, elaborate designs or pretentious space.

4/ Includes facilities which may not be resource oriented, are revenue producing or are over and above that which would normally be provided at a water resource project.

5/ When roads and/or parking are to be used and/or designed for use under more than one financing category, cost will be allocated on the basis of estimated use by function. The discretion of the D.E. is to be applied.

6/ Minimum sanitary facilities are limited to those that meet minimum Federal and local health requirements.

7/ Grading and paving, to the extend they represent least cost alternatives to stabilizing floodways, may be used by local interests for recreational activities or facility developments not eligible for cost sharing. Such grading and paving may be done by the Corps to specifications more costly than necessary for floodway stabilization provided the additional cost is met by a non-Federal sponsor.

8/ Includes extensive specialized play equipment over and above basic climbing, swinging and sliding apparatus.

9/ Footbridges are to be austere and used only when other crossing methods are impractical. Footbridges which are the center of a recreation experience are to be at local costs.

Exhibit E-3 Checklist of Facilities which may be Cost Shared in Recreation Developments at Environmental Protection and Ecosystem Restoration Projects[1]

I. Access and Circulation

Roads
Turnarounds
Trails (multiple-use)
Parking
Bridges and Culverts
Walks
Steps/ramps
Footbridges [2]

II. Structures

Sanitation - Vault Toilets, Comfort Stations
Shelters - Picnic, Trail

III. Utilities

Water Supply - Municipal System [3] , Wells, Drinking Fountains and Faucets
Sewage and Waste Water Disposal - Municipal System, Septic Tanks and Tile Fields
Storm Drainage
Public Telephone

IV. Site Preparation/Restoration

Clearing and Grubbing
Grading and Land Form
Vegetative restoration - includes native trees, shrubs and turf establishment

V. Park Furniture

Picnic Tables
Trash Receptacles/Holders
Benches

Exhibit E-3 (Continued)

VI. Signs

Entrance-Directional-Marker
Traffic Control (Vehicular and Pedestrian)
Instructional (Includes Fire Danger Notices)

VII. Interpretive Guidance and Media

Display Boards
Interpretive Markers (Natural, Historical, Archeological, etc.)
Bulletin Board

VIII. Protection, Control, Health and Safety

Gates and Barricades
Cattle Guards
Walls and Fencing
Guardrails
Entrance Stations
Lighting
Handrails

1/ Facilities to be cost shared are limited to standard designs consistent with the natural environment of the surrounding area but should not include embellishments, elaborate designs, or be ostentatious.

2/ Footbridges are to be austere and used only when other crossings methods are impractical. Footbridges which are the center of recreation experience are to be a non-Federal cost. Pedestrian bridges at highways or railroads are normally a non-Federal cost; however, if they are integral to the recreation feature and the most cost effective alternative, they may be cost shared.

3/ Connection to an existing municipal system.

Exhibit E-4 Examples of DYMS Computations

1. Hypothetical Situation. The first example is a hypothetical situation. For this example the assumptions as shown in Table E-47 are made on an exaggerated bases for computational ease.

Table E- 47 DYMS Hypothetical Example

Item	Existing project	Expanded project
Total conservation storage	100,000 a-f	300,000 a-f
Critical period dependable yield	200 cfs	300 cfs
Unit yield	2 cfs per 1000 a-f	1 cfs per 1000 a-f
Contracted storage (user # 1)	100,000 a-f	200,000 a-f
Dependable yield (user # 1)	200 cfs	200 cfs
Contracted storage (user # 2)	none	100,000 a-f
Dependable yield (user # 2)	none	100 cfs
DYMS	none	100,000 a-f

In this example, user #1 had a prior contract for 100,000 a-f of storage, which was the entire conservation pool of the existing project. The estimated critical period dependable yield for that storage was 200 cfs. Subsequently, a second user requested storage in the project sufficient to provide an estimated critical period dependable yield of 100 cfs. The sum of the required critical period dependable yield for both users would then be 200 + 100 = 300 cfs. Reading of the yield curve at 300 cfs indicated a required total conservation storage of 300,000 a-f. In the expanded project, user #1 requires 200,000 a-f rather than the contracted 100,000 a-f to provide an estimated critical period dependable yield of 200 cfs. The difference (200,000 - 100,000 = 100,000 a-f) is the DYMS. User #2 requires 100,000 a-f of storage to provide an estimated critical period dependable yield of 100 cfs. The water supply contract for user #1 would be amended at no cost to him to provide that his share of the conservation pool is 200,000 a-f and 2/3 of the total. The contract with user #2 would provide that his share of the conservation pool is 100,000 a-f and 1/3 of the total. User #2, however, would be required to pay for 200,000 a-f. The 100,000 a-f provided to him by the contract and the 100,000 a-f of DYMS storage required to maintain the critical period dependable yield of user #1.

Exhibit E-4 (Continued)

2. The following paragraphs describe two procedures to estimate DYMS manually for a project without storage allocated to hydropower (Table E-48) and for one with storage allocated to hydropower (Table E-49). It is assumed that the project yield curve already exists.

Table E- 48 Procedure for a Project Without Storage Allocated to Hydropower

Step	Procedure
1	Tabulate the conservation storage allocated to each existing user. The sum of these should be equal to the total existing conservation storage.
2	Read the yield curve corresponding to the total existing conservation storage to obtain the total yield.
3	Prorate the total yield among the existing users on the basis of the percentage of the total conservation storage that is allocated to each user.
4	Add the yield required by the new user to the total yield provided by the existing conservation storage to arrive at the total yield to be provided by the expanded project.
5	Read the yield curve corresponding to the total yield to be provided by the expanded project to obtain the total conservation storage of the expanded project..
6	Prorate the total conservation storage of the expanded project to each of the existing users and the new user on the basis of the percentage of their yield to the total yield of the expanded project. The storage so determined will be each user's allocation.
7	The DYMS (the new user is responsible for paying for the DYMS) is the increase in storage determined in Step 6 over that provided in Step 1 for each of the users in the existing project.

Exhibit E-4 (Continued)

Table E- 49 Procedure for a Project With Storage Allocated to Hydropower

Step	Procedure
1	Tabulate the conservation storage allocated to each existing user including hydropower. The sum of these should be equal to the total existing conservation storage.
2	Read the yield curve corresponding to the total existing conservation storage to obtain the total yield.
3	Prorate the total yield among the existing users and hydropower on the basis of the percentage of the total conservation storage that is allocated to each user.
4	Assume a value for the total conservation storage of the expanded project. This value will be greater than the total conservation storage of the existing project.
5	Read the yield curve for the assumed total conservation storage of the expanded project to obtain the corresponding total yield.
6	Determine the storage required in the assumed expanded project for each of the water supply users in the existing project by using the percentage their existing yield is to the total yield of the expanded project. The storage required by the new use would be similarly obtained using the desired yield of the new user. The storage so determined would be each water supply user's allocation in the assumed expanded project. The remaining storage (assumed total conservation storage minus the sum of the water supply storage for each user) would be for hydropower. If this value is not equal to the hydropower storage tabulated in Step 1, repeat Step 4 through Step 6.
7	The DYMS (the new user is responsible for paying for the DYMS) is the increase in storage determined in Step 6 over that provided in Step 1 for each of the water supply users in the existing project.

The procedure in the above example is straightforward whenever the entire conservation pool of the existing project is allocated to water supply storage. However, when the existing project has some or the entire existing project allocated to hydropower, the procedure requires a trial and error reading of the yield curve with various assumptions of total conservation storage. This is required for two reasons: (1) it is Corps policy that, to the extent possible, impacts to hydropower will be compensated through means other than the application of DYMS (financial

Exhibit E-4 (Continued)

credits and operational modifications, if possible); and, (2) to comply with the requirement that critical period dependable yield be prorated to all users on the basis of the percentage of the total conservation pool that is allocated to each. The computations of DYMS should not be performed manually because of their tedious nature and more importantly to avoid round off errors in the storage adjustments.

3. Example with Hydropower Storage Held Constant. The next example is an actual case for the Greers Ferry Project in the Little Rock District. In this example, hydropower storage is held constant because of the policy that DYMS does not apply to hydropower storage. This discussion is relative to a proposed expansion of the conservation pool at Greers Ferry Lake, AR. Greers Ferry Lake is a multiple purpose project, which had the storage allocations as shown in Table E-50 prior to the proposed expansion.

Table E- 50 Greers Ferry Lake Storage Allocations, Prior to Expansion

(Example with Hydropower Storage Held Constant)

Item	Elevation (Feet NGVD)	Storage Capacity (Acre-Feet)
Top of flood pool	487	2,844,500
Top of power pool	461	1,910,500
Bottom of power pool	435	1,194,000
Flood pool zone	461-487	934,000
Conservation pool zone	435-461	716,500
Hydropower storage		714,367
Water supply storage		2,133
Heber Springs W.S. agreement		1,008
CWS water supply agreement		225
Clinton water supply agreement		900

Exhibit E-4 (Continued)

Community Water System (CWS) had requested additional storage sufficient to yield 6.8 MGD. They needed this storage in two phases, with an initial request of 3.3 MGD. The example only addresses the 3.3 MGD request and the determination was made that it should be provided by an expansion into the flood pool. A detailed daily sequential reservoir routing computer program was utilized to determine the points on the dependable yield curve. This program was selected because the hydrologic data was already available and because the program had been used for numerous flood control and hydropower studies in the past. The detail required for hydropower analyses generally dictates that a weekly or daily reservoir routing model be utilized. Again, the most important consideration is not which routing model is used but rather that the same model and data set be used for the entire study.

The results of the routings produced four points on the dependable yield curve as shown in Table E-51. These data encompasses a 50,000 acre-foot expansion (the Corps' discretionary reallocation limit) into the flood pool.

Table E- 51 Routing Results

(Example with Hydropower Storage Held Constant)

Dependable Yield (cfs)	Required Conservation Storage (acre-feet)
909.2	716,500
914.0	722,200
930.5	741,500
952.0	766,500

The results of the analysis assuming that hydropower storage is held constant (the equivalent of the policy that DYMS does not apply to hydropower storage) are shown in Table E-52. The DYMS was computed as the sum of the difference of required storage (expanded project - existing project) for prior water supply storage contracts. The DYMS for this example is barely significant. CWS would be responsible for all costs of the added storage. The 4,031 acre-foot required to provide their phase 1 request and the 4 acre-feet DYMS required. After rounding to the nearest 1 acre-foot, the DYMS is distributed as 2 acre-feet for Heber Springs and 2 acre-feet for Clinton to maintain the yield of prior water supply contracts.

Exhibit E-4 (Continued)

Table E- 52 DYMS Holding Hydropower Storage Constant

Item	Existing Project		Expanded Project		DYMS
	Acre-feet	cfs	acre-feet	cfs	acre-feet
Total conservation storage	716,500		720,535		
Critical period dependable yield		909.0		912.6	
Allocated storage (hydropower)	714,367		714,367		0
Dependable yield (hydropower)		906.5		904.8	
Contracted storage (Heber Springs)	1,008		1,010		2
Dependable yield (Heber Springs)		1.3		1.3	
Contracted storage (CWS – prior)	225		225		0
Dependable yield (CWS - prior)		0.3		0.3	
Contract storage (Clinton)	900		902		2
Dependable yield (Clinton)		1.1		1.1	
Contracted storage (CWS - phase 1)	None		4,031		
Dependable yield (CWS - phase 1)		none		5.1	
DYMS					4

Exhibit E-4 (Continued)

4. Example with Hydropower Yield Held Constant The next example assumes that hydropower yield is held constant. While it is not Corps policy to maintain hydropower yield constant, these computations are necessary in order to determine the maximum limit of operational changes that could be implemented to minimize the impacts on hydropower and to determine the adjustments to the financial credits provided to the power marketing agencies. In addition, this example is included for the evaluation of alternatives that incidentally preserve the hydropower yield (e.g., an alternative that increases the average head and actually provides greater hydropower benefits than the existing project). The information in Table E-53 shows the results of the analysis assuming that hydropower yield is held constant. The DYMS was computed as the sum of the difference of required storage (expanded project - existing project) for prior water supply storage contracts and hydropower.

Exhibit E-4 (Continued)

Table 1 (E-53) Holding Hydropower Yield Constant

Item	Existing Project		Expanded Project		DYMS
	acre-feet	cfs	Acre-feet	cfs	acre-feet
Total conservation storage	716,500		722,562		
Critical period dependable yield		909.0		914.3	
Allocated storage (Hydropower)	714,367		716,388		2,021
Dependable yield (Hydropower)		906.5		906.5	
Contracted storage (Heber Springs)	1,008		1,011		3
Dependable yield (Heber Springs)		1.3		1.3	
Contracted storage (CWS - prior)	225		226		1
Dependable yield (CWS - prior)		0.3		0.3	
Contracted storage (Clinton)	900		903		3
Dependable yield (Clinton)		1.1		1.1	
Contracted storage (CWS - phase 1)	none		4,035		
Dependable yield (CWS - phase 1)		none		5.1	
DYMS					2,028