

CHAPTER 3

Corps Civil Works Missions

3-1. Purpose and Authorities. 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 reduction, water supply, hydroelectric power generation and recreation. Navigation projects include both inland and deepwater projects. Ecosystem restoration projects improve ecosystem structure and function. Wherever possible and subject to budgetary policy, projects shall combine these purposes to formulate multiple purpose projects. For example, flood damage reduction projects could include ecosystem restoration and recreation; navigation projects could include hydroelectric power generation and ecosystem restoration. In carrying out studies to address problems and take advantage of opportunities within these mission areas, every effort should be made to formulate alternative plans that reasonably maximize the economic and environmental value of watershed resources, including urban watershed resources. In addition, every effort shall be made to be responsive to National, State and local concerns by considering the full range of programs available to provide solutions in a timely and cost-effective manner. Such programs may include Congressionally authorized projects, continuing authorities projects, planning assistance to states, flood plain management services and emergency authorities. [For a brief history of Corps involvement in water resources planning refer to “The US Army Corps of Engineers, A Brief History”, by Martin Reuss and Charles Hendricks to be published on the Corps web site.]

3-2. Navigation. The role of the U. S. Army Corps of Engineers with respect to navigation is to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation. The Corps accomplishes this mission through a combination of capital improvements and the operation and maintenance of existing projects. Capital improvement activities include the planning, design, and construction of new navigation projects. These activities are performed for the navigation of shallow draft (equal to or less than 14-foot draft) and deep draft (greater than 14-foot draft) vessels on both inland waterways and harbors, and coastal and lake ports, harbors and channels. With the exception of projects implemented pursuant to a continuing authority, Congress specifically authorizes harbor and waterway projects. Financial responsibility for project components is specified in the WRDA of 1986, as amended.

a. **Types of Improvements.** General navigation features of harbor or waterway projects are 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. Also included are dredged material disposal areas (except those for the inland navigation system, the Atlantic Intracoastal Waterway and the Gulf Intracoastal Waterway) and sediment basins. 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. These programs are described in more detail in paragraph 3-2a(2).

(1) Harbor and Waterway Projects. Harbors and waterways are treated differently for cost-sharing purposes. Harbors are places that offer vessels shelter from weather. A harbor is also a port if it provides facilities for the loading or unloading of cargo or passengers. Waterways are routes used by vessels. Their primary function is to facilitate the movement of vessels and they may simply connect bodies of deep or shallow water or they may be parts of riverine or coastal waterway systems. (See Table E-60, Appendix E for cost sharing requirements.)

(2) 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 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.

(a) Removal of Wrecks and Obstructions (Section 19, River and Harbor Act of 3 March 1899). The Corps may remove sunken vessels and similar objects if they are determined to be obstructions to navigation.

(b) Snagging and Clearing for Navigation (Section 3, River and Harbor Act of 1945). The Corps may remove trees, brush and other debris that may be determined to be obstructions to navigation or that may promote flooding.

(c) 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.

(3) 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 usually provided by the Coast Guard.

b. Specific Policies.

(1) Shoreline Changes. Pursuant to Section 5 of the River and 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 along the shore on either side of the improvement should be analyzed.

(2) Charter Fishing Craft, Head Boats, and Similar Recreation-Oriented Commercial Activities. Evaluation of benefits to charter fishing and other similar type craft is based on a

change in net income to the owners or operators of all vessels that would be using harbor facilities in the future without-project condition. Benefits to vessel operations that will be induced by the construction of a navigation project are also evaluated as the change in net income that would occur between the with- and without-project condition. Consideration should be given to those vessels that transfer from other areas, so that the proper change in National net income is estimated. Section 230 of the Water Resource Development Act of 1996 states that benefits to cruise ships will also be estimated as commercial benefits for the purpose of evaluating navigation projects.

(3) Subsistence Fishing. This is the activity of individuals who fish primarily for personal or family consumption and whose incomes are normally at or below the minimum subsistence level established by the Department of Commerce. For cost allocation purposes, subsistence fishing is considered commercial fishing.

(4) Coast Guard Coordination. The U.S. Coast Guard is responsible for Federal aids to navigation and enforcement of navigation regulations. Corps districts should confer directly with the Coast Guard concerning establishment or alteration of aids to navigation, and the regulation of lightage areas (docking and loading areas used to off-load heavy cargo from larger ships to smaller vessels and vice versa), anchorage and channels.

(5) Permit Coordination. During the formulation of navigation projects, a determination must be made 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 and berthing areas and land based 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 office.

(6) Placement of Dredged Materials on Beaches. Construction and maintenance dredging of Federal navigation projects shall be accomplished in the least costly manner possible. 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. When placement of dredged material on a beach costs more than the least costly alternative, the Corps may participate in the additional placement costs under the authority of Section 145 of the WRDA of 1976, as amended. The additional cost of placement may be shared on a 65 percent Federal and 35 percent non-Federal basis if: (1) requested by the State, (2) the Secretary of the Army considers it in the public interest, (3) the added cost of disposal is justified by hurricane and storm damage reduction benefits and (4) the shoreline on which the material is placed is open to public use.

(7) Use of Dredged Material for Ecosystem Restoration. 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 Appendix E for more information related to Section 207 and Appendix F for additional information regarding Section 204).

(8). Dredged Material Management Plans. Dredged material management planning for all Federal harbor projects is conducted by the Corps to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next 20 years. These plans address dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, potential for beneficial usage of dredged material and indicators of continued economic justification. The Dredged Material Management Plans shall be updated periodically to identify any potentially changed conditions.

(9) Local Service Facilities are the responsibility of non-Federal entities and shall be required as part of the cooperation agreements if they are necessary for project benefits to accrue.

(10) Categorical Exemption to NED Plan. For harbor and channel deepening studies where the non-Federal sponsor has identified constraints on channel depths it is not required to analyze project plans greater (deeper) than the plan desired by the sponsor. For example, if a sponsor only desires to deepen a channel to -40 feet and it is determined that the -40 foot channel is economically justified and has higher net benefits than a -39 foot or -38 foot channel, etc., then the -40 foot channel can be recommended without having to analyze deeper channel plans to identify the NED Plan. The recommended plan must have greater net benefits than smaller scale plans, and a sufficient number of alternatives must be analyzed to insure that net benefits do not maximize at a scale smaller than the recommended plan. If the plan proposed to be recommended contains uneconomical increments an exception from the ASA(CW) must be obtained. An essential element of the analysis of the recommended plan is the identification of trade-offs and opportunities foregone as a result of implementation of the smaller scope plan. The analysis of alternatives must be comprehensive enough to meet the requirements of NEPA.

(11) Other guidance related to navigation projects include [ER 1165-2-27](#), [ER 1165-2-123](#) and [ER 1165-2-124](#).

c. Evaluation Framework. The measurement standard and conceptual basis for benefits is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. The evaluation of navigation projects shall be conducted following the process described in paragraph 2-3e of this regulation. The procedures described in the following paragraphs apply to the estimation of benefits used in the economic

evaluation of navigation projects and are only a summary of requirements and procedures. Appendix E provides additional guidance on these procedures and requirements.

(1) National Economic Development Benefits. The base 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:

(a) Cost reduction benefits for commodities for the same origin and destination and the same mode of transit thus increasing the efficiency of current users. This reduction represents a NED gain because resources will be released for productive use elsewhere in the economy. Examples for inland navigation are reductions in costs incurred from trip delays (e.g. reduction in lock congestions), reduction in costs associated with the use of larger or longer tows, and reduction in costs due to more efficient use of barges. Examples for deep draft navigation are reductions in costs associated with the use of larger vessels, with more efficient use of existing vessels, with more efficient use of larger vessels, with reductions in transit time, with lower cargo handling and tug assistance costs, and with reduced interest and storage costs.

(b) Shift of mode benefits for commodities for the same origin and destination providing efficiency in waterway or harbor traversed. In this case, benefits are the difference in costs of mode transport between the without-project condition (when rails, trucks or different waterways or ports are used) and the with-project condition (improved locks, waterways or channels). The economic benefit to the national economy is the savings in resources from not having to use a more costly mode or point of transport.

(c) Shift in origin and destinations that would provide benefits by either reducing the cost of transport, if a new origin is used or by increasing net revenue of the producer, if a change in destination is realized. This benefit cannot exceed the reduction in transportation costs achieved by the project.

(d) New movement benefits are claimed when there are additional movements in a commodity or there are new commodities transported due to decreased transportation costs. The new movement benefit is defined as the increase in producer and consumer surplus, thus the estimate is limited to increases in production and consumption due to lower transportation costs. Increases in shipments resulting from a shift in origin or destination are not included in the new movement benefits. This benefit cannot exceed the reduction in transportation costs achieved by the project.

(e) Induced movement benefits are the value of a delivered commodity less production and transportation costs when a commodity or additional quantities of a commodity are produced and consumed due to lower transportation costs. The benefit, in this case, is measured as the difference between the cost of transportation with the project and the maximum cost the shipper would be willing to pay.

(2) Without-Project Condition. The following specific assumptions are part of the projected without-project condition.

(a) All reasonably expected nonstructural practices within the discretion of the operating agency, port agencies, other public agencies and the transportation industry are implemented at the appropriate time.

(b) For deep draft navigation studies, alternative harbor and channel improvements available over the planning period (in place and under construction) and authorized projects are assumed to be in place. For inland navigation, only waterway investments currently in place or under construction are assumed to be in place over the period of analysis.

(c) Normal operation and maintenance practices are assumed to be performed over the period of analysis.

(d) In projecting commodity movements involving intermodal movements and in projecting traffic movements on other modes, sufficient capacity of the hinterland transportation and related facilities and the alternative modes is normally assumed.

(e) For inland navigation, user charges and/or taxes required by law are part of the without-project condition.

(f) Advances in technology affecting the transportation industry over the period of analysis should be considered, within reason.

(3) 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 the without-project condition underlie the with-project condition.

(4) Evaluation Procedure for Inland Navigation. The following ten steps are used to estimate benefits associated with improvements of the inland navigation system. The level of effort on each step depends on the nature of the proposed improvement, the state of the art for accurately estimating the benefits and the sensitivity of project formulation and justification to further refinement. Appendix E provides additional guidance for each of these steps.

(a) Step 1 - Identify the Commodity Types. The types of commodities susceptible to movement on the waterway segment under consideration are identified for new waterways and existing waterways, as applicable. For new waterways, commodity types are identified by interviews of shippers and by resources studies. For existing waterways, commodity types are identified by analysis of data on existing use of the waterway segment.

(b) Step 2 - Identify the Study Area. The study area is the area within which significant project impacts occur. The origins and destinations of products likely to use the waterway are normally included in the study area.

(c) Step 3 - Determine Current Commodity Flow. This step identifies the total tonnage that could benefit from using the waterway. This information is primarily obtained by interviews of shippers. Potential commodities that might use the waterway in response to reduced transportation costs are also identified.

(d) Step 4 - Determine Current Cost of Waterway Use. Current cost of waterway use is determined for all commodities that could potentially benefit from the waterway improvement. This cost includes the full origin-to-destination costs, including handling, transfer, demurrage and prior and subsequent hauls for the tonnages identified in the prior step. Costs are estimated for the without-project and with-project conditions. The difference between the with and without-project costs represents the reduction in current delays and gains in efficiencies with the project in place.

(e) Step 5 - Determine Current Cost of Alternative Movement. The current cost of alternative movement is estimated for all commodities under consideration. This cost includes full origin-to-destination costs, including costs of handling, transfer, demurrage and prior and subsequent hauls. The product of this step, combined with the products from the two previous steps, generates a first approximation of the demand schedule for waterway transportation. In the case of rail movements, the prevailing rate actually charged for moving the traffic shall be used to estimate the alternative movement cost. A “competitive” rate may be used if there is no prevailing rate. Appendix E provides a definition and guidance on how to compute “competitive” rates.

(f) Step 6 - Forecast Potential Waterway Traffic by Commodity. Projections of potential traffic are developed for selected years from the time of the study until the end of the period of analysis, for time intervals not to exceed 10 years. Normally, independent studies are undertaken to develop these projections. Available secondary data supplemented by interviews of relevant shippers, carriers and port officials, opinions of commodity consultants and experts and historical flow patterns are used to develop these projections.

(g) Step 7 – Determine Future Cost of Alternative Mode. The future cost of alternative mode per unit of each commodity will normally be the same as the current cost.

(h) Step 8 – Determine Future Cost of Waterway Use. The potential changes in cost of the waterway mode for future years for individual origin-destination commodity combinations are estimated in this step. Also, an analysis of the relationship between waterway traffic volume and system delays is conducted. This analysis generates data on the relationships between total traffic volume and the cost of transportation on the waterway.

(i) Step 9 – Determine Waterway Use, With and Without-Project. The data developed in previous steps is used to determine waterway use over time with and without the project. This determination is made based upon a comparison of costs for movements by the waterway and by the alternative mode and of any changes in the cost functions and demand schedules. The “phasing in” and “phasing out” of shifts from one mode to another are also considered in this analysis.

(j) Step 10 – Compute NED Benefits. The information produced in previous steps is used to compute total NED benefits for each category described in Paragraph 3-2c(1), as applicable. Total NED benefits are annualized and discounted using the applicable discount rate (published annually by HQUSACE).

(5) Evaluation Procedures for Deep Draft Navigation. The following nine steps are used to estimate deep draft navigation benefits. As in the case of inland navigation benefits, the 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. Appendix E provides additional guidance for each step.

(a) Step 1 – Determine the Economic Study Area. In this step, the economic study area is delineated. This step includes an assessment of the transportation network that is functionally related to the harbor considered for improvement. Foreign origins and destinations are also included in this assessment. The economic study area is likely to vary for different commodities. In the final delineation of the economic study area, the trade area relative to adjacent ports and any commonality that might exist with the area under study must be considered.

(b) Step 2 – Identify Types and Volumes of Commodity Flow. An analysis of commerce that flows into and out of the economic study area is performed to estimate the types and volumes of commodities that now move on the existing project or that may be attracted as a result of the proposed improvement. This analysis provides an estimate of gross potential cargo tonnage which is used to estimate the prospective commerce that may use the harbor during the period of analysis. Current volumes of prospective commerce are developed using available statistics on waterborne commerce. After determining the types and volumes of commodities currently moving or expected to move in the economic study area, data on origins, destinations and vessel itineraries are used to identify the commodity types and volumes that could benefit from the project. Commodities that are now moving without the project but would shift origins or destinations with the project, as well as induced movements, are segregated for additional analysis.

(c) Step 3 – Project Waterborne Commerce. Projections of the potential use of the harbor or waterway under study are developed for selected years from the time of the study until the end of the period of analysis. The commodities included in the projections should be identified, if possible, according to waterborne modes (e.g., containerized, liquid bulk, dry bulk, etc.) and by imports, exports, domestic shipments, domestic receipts and internal trade. Usually, independent studies are undertaken to develop these projections considering secondary data, data from interviews to shippers, carriers and port officials, opinions of consultants and experts and historical flow patterns. A sensitivity analysis of the projections is performed to account for uncertainties in the estimates.

(d) Step 4 – Determine Vessel Fleet Composition and Cost. The vessel fleet composition is determined by analyzing past trends in vessel size and fleet composition and trends in the domestic and world fleet. The vessel fleet composition is determined for both with- and without-project conditions. Changes in fleet composition may vary by trade route, type of commodity and volume of traffic. Canal restrictions, foreign port depths and lengths of haul also affect the vessel fleet composition. Vessel operating costs, by category of waterborne mode and size, are provided annually by HQUSACE. These costs may be modified to meet the needs of specific studies.

(e) Step 5 – Determine Current Cost of Commodity Movements. Transportation costs prevailing at the time of the study are determined in this step for all tonnage identified in step 2 that could benefit from the project. These costs include full origin-to-destination costs plus handling, transfer, and storage costs, and other accessory charges. Transportation costs are developed for both the with- and without-project conditions. For with-project conditions, these costs reflect efficiencies that can be reasonably expected, such as use of larger vessels, increased loads and reduction in transit time and delays (tides).

(f) Step 6 – Determine Current Cost of Alternative Movement. Alternative movement is the movement of commodities through other competitive harbors, and through other operational means such as lightering, lightening and topping-off operations, off-shore port facilities, transshipment terminals, traffic management, pilotage regulations and other modes of transportation. Transportation costs for these alternative modes of movement, as applicable, are estimated for the with- and without-project condition. These costs are used in the analysis of potential diversion of traffic. Factors to be considered in this analysis, in addition to transportation costs, are handling and transfer charges, available service and schedules, carrier connections, institutional arrangements, and other related factors.

(g) Step 7 – Determine Future Cost of Commodity Movements. Relevant shipping costs are estimated for with- and without-project conditions considering changes in the fleet composition, port delays and port capacity. Future transportation costs are based on the vessel operating costs prevailing at the time of the study.

(h) Step 8 – Determine Use of Harbor and Channel With- and Without-Project. To estimate the proposed harbor use over time, for with- and without-project conditions, the costs for movements via each proposed plan and via each alternative mode are compared. Changes in the cost functions and demand schedules in the current and future without-project condition and the current and future with-project condition are analyzed. The impact of uncertainty in the use of the harbor, the level of service provided and existing and future inventories of vessels are also considered.

(i) Step 9 – Compute NED Benefits. The tonnage moving with and without a project and the cost of movement via the harbor and via each alternative are used to compute total NED benefits for each category of benefits described in paragraph 3-2c(1).

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including navigation. Specific cost sharing requirements for this purpose are discussed in Appendix E of this regulation.

(1) Special Cases. Special cases that require a determination of Federal responsibility or cost sharing include, but are not limited to access channels not directly adjacent to primary channels, barge fleeting areas, and an initial single user with potential for future multiple users.

(2) 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 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 and would permit local entities 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.

(3) Land Creation at Harbors (other than inland harbors). The NED Plan for harbor projects that include land creation benefits shall be formulated using navigation benefits exclusively; thus, land creation benefits shall not be considered in the identification of the NED Plan. Special cost sharing will be required for land creation benefits associated with the NED Plan in proportion to the magnitude of these benefits to the total benefits. The procedure to estimate the cost sharing in this case is described in Appendix E. Non-Federal requests for exceptions to the NED Plan, to include land creation benefits, may be allowed provided all additional implementation costs are non-Federal and the incremental navigation benefits equal or exceed the incremental operation and maintenance costs for the general navigation features. 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 the non-Federal sponsor.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

3-3. Flood Damage Reduction. Section 1 of the Flood Control Act of 1936 declared flood control to be a proper Federal activity since improvements for flood control purposes are in the interest of the general welfare of the public. The Act also stipulated that for Federal involvement to be justified, “. . . the benefits to whomsoever they may accrue (must be) in excess of the estimated costs, and . . . the lives and social security of people (must be) otherwise adversely affected.”

a. Types of Improvements.

(1) Structural Measures: Structural measures are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Structural measures include: dams with reservoirs, dry dams, channelization measures, levees, walls, diversion channels, pumps, ice-control structures, and bridge modifications.

(2) Nonstructural Measures. Section 73 of the Water Resources Development Act of 1974 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. Damage reduction from nonstructural measures is accomplished by changing the use made of the floodplains, or by accommodating existing uses to the flood hazard. Examples are flood proofing, relocation of structures, flood warning and preparedness systems (including associated emergency measures), and regulation of floodplain uses.

(3) Major Drainage. Drainage projects are usually undertaken in rural areas to increase agricultural outputs. Some portions of drainage improvements may be considered flood damage reduction measures in accordance with Section 2 of the Flood Control Act of 1944. 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.

(4) 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.

b. Specific Policies.

(1) Flood Plain Management, Executive Order 11988. Executive Order 11988 (E.O. 11988) was issued in 1977 with the intent to avoid floodplain development, reduce hazards and risk associated with floods, and restore and preserve natural floodplain values (See [ER 1165-2-26](#) for Corps policy on this directive). In the event there is no alternative to construction in the floodplain, the Corps is required to minimize the adverse impacts induced by construction of the project. In considering adverse impacts, planners should address induced new development in the floodplain or induced improvements to existing development in the floodplain that would increase potential flood damages; and, the detrimental effect of induced activities on natural floodplain values.

(2) Project Performance and Risk Framework.

(a) Flood damage reduction studies are conducted using a risk-based analytical framework. 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 and what is lost. (See [ER 1105-2-101](#) and [EM 1110-2-1619](#) for details.)

(b) 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. 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 on 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. [ER 1105-2-101](#) further requires a probabilistic display of benefits and eliminates freeboard to account for hydraulic uncertainty.

(c) 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, documented and communicated. Departures from the NED plan may be considered options to manage this risk. In addition, explicit risk management alternatives may be formulated.

(3) Existing Levees/Dams. Proposals to modify existing levees must be evaluated using a risk based approach as described in [ER 1105-2-101](#). Downstream consequences of dams on flood risk are also analyzed in a risk-based framework. Evaluation of dam reliability and safety is based on engineering design criteria found in [ER 1110-2-1155](#).

(4) Residual Damages. The analysis of any proposed flood damage reduction project shall include an estimate of the residual expected annual damages that would occur with the project in place.

(5) Induced Flooding. When a project 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.

(6) 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 damage reduction authorities, downstream from the point where the flood discharge is greater than 800 cubic feet per second for the 10 percent flood (one chance in ten of being equaled or exceeded in any given year) under conditions expected to prevail during the period of analysis. Drainage areas which lie entirely within the urban area and which are less than 1.5 square miles in area, are assumed to lack sufficient discharge to meet the above hydrologic criterion. Urban streams and waterways that receive runoff from land outside the urban area shall not be evaluated using this 1.5 square mile drainage area criterion. Exceptions may be granted in areas of hydrologic disparity, that is areas producing limited discharge for the ten percent event but in excess of 1800 cubic feet per second for the one percent event (See [ER 1165-2-21](#)).

(7) Single Properties. The Corps will not participate in structural flood damage reduction for a single private property. Nor will it participate in nonstructural flood damage reduction 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 damage reduction measures protecting a single, non-Federal, public property. Work to provide protection to a single Federal property is accomplished only on a reimbursable basis, upon request from the Federal agency. In the event such properties are within the study area, Civil Works funds may be used for their protection.

(8) Recreation at Non-Lake Flood Damage Reduction Projects. The Corps participates in recreation facilities at non-lake flood damage reduction projects if the recreation activities have a strong, direct relationship to the proposed flood damage reduction measures, such as trails along the channel or levee right-of-way. Corps participation in these projects is limited by policy as discussed in Appendix E.

(9) Agricultural Flood Protection. The Corps flood damage reduction 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.

(10) Land Development and Floodplain Management. The following general policy principles apply to land development benefits at structural flood damage reduction projects.

(a) Communities participating in a flood damage reduction project with the Corps of Engineers are required to participate in FEMA's National Flood Insurance Program (NFIP) and to comply with the land use requirements of that program.

(b) Communities participating in a flood damage reduction project with the Corps must also prepare a flood plain management plan designed to reduce the impact of future flood events in the project area. This plan must be adopted within one year after signing a project cooperation agreement and the plan must be implemented not more than one year after the construction of a project. Although costs for the preparation of the flood plain management plan are sponsor costs, data collected during the planning process may be used in development of the plan.

(c) 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.

(d) Flood damage reduction projects can greatly impact what is required of a local community for participation in the NFIP. In addressing these impacts, the following should be considered:

- In coordination with the non-Federal sponsor and FEMA, consideration should be given to developing 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.
- The appropriate FEMA Regional office will be notified of proposed flood protection works or of changes to established flood protection works.

(11) Categorical Exemption to NED Plan. For flood damage reduction studies, where the non-Federal sponsor has identified a desired maximum level of protection, where the with-project residual risk is not unreasonably high, and where the plan desired by the sponsor has greater net benefits than smaller scale plans, it is not required to analyze project plans providing higher levels of protection than the plan desired by the sponsor. For example, if a sponsor desires a levee of sufficient height to meet FEMA's flood insurance requirements and it is determined that the levee to accomplish this has higher net benefits than smaller levees, then the levee desired by the sponsor can be recommended without having to analyze larger levees to identify the NED Plan. The recommended plan must have greater net benefits than smaller scale plans, and a sufficient number of alternatives must be analyzed to insure that net benefits do not maximize at a scale smaller than the recommended plan. If the plan proposed to be recommended contains uneconomical increments an exception from the ASA(CW) must be

obtained. An essential element of the analysis of the recommended plan is the identification of residual risk for the sponsor and the flood plain occupants, including residual damages and potential for loss of life, due to exceedence of design capacity. The analysis of alternatives must be comprehensive enough to meet the requirements of NEPA.

(12) Exception to NED Plan for Urban Areas. When the NED Plan has less than 90 percent reliability of protecting against the 1 percent chance annual flood event, an exception to the NED Plan may be recommended. The conditions and requirements stated in Appendix E must be met in order to grant this exception.

(13) Use Of Lands Cleared Under The FEMA Hazard Mitigation Grant Program.
(Guidance is under development)

c. Evaluation Framework. The measurement standard and conceptual basis for benefits associated with flood damage reduction projects is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. The evaluation of flood damage reduction projects shall be conducted following the process described in paragraph 2-3e of this regulation. The procedures described in the following paragraphs apply to the estimation of benefits used in the economic evaluation of flood damage reduction projects, and summarize requirements and procedures. Appendix E provides additional guidance on these requirements and procedures.

(1) National Economic Development Benefits. Benefits from plans for reducing flood hazards accrue primarily through the reduction in actual or potential damages to affected land uses. There are three primary benefit categories, reflecting three different responses to a flood hazard reduction plan. Inundation reduction benefits are the increases in net income generated by the affected land uses when the same land use pattern and intensity of use is assumed for with- and without-project conditions. Intensification benefits are increases in net income generated by intensified floodplain activities when the floodplain use is the same with and without the project but an activity (or activities) is more intense with the project. The third category of benefits is location benefits. If an activity is added to the floodplain because of a plan, the location benefit is the difference between aggregate net incomes (including economic rent) in the economically affected area with and without the project. The magnitude of location benefits that can be claimed is limited by policy. In general, the NED Plan will be formulated to protect existing development and vacant property that is interspersed with existing development. Location benefits can be claimed for vacant property that is not interspersed with existing development only if it is demonstrated that the vacant property would be developed without the project and the benefits are based on savings in future flood proofing costs.

(2) Types of Flood Damage. Flood damages are classified as physical damages and nonphysical damages. Each activity affected by a flood can experience loss in one or both of these classes.

(a) Physical damages. Physical damages occur to residential, commercial, industrial, institutional, and public property. Damages occur to buildings, contents, automobiles, and outside property and landscaping. Physical damages include the costs to repair roads, bridges,

sewers, power lines, and other infrastructure components. Physical damages also include the direct costs and the value of uncompensated hours for cleanup after the flood.

(b) Nonphysical flood losses. Nonphysical flood losses include income losses and emergency costs. Income losses are the loss of wages or net profits to business over and above physical flood damages that usually result from a disruption of normal activities. Estimates of these losses must be derived from specific independent economic data for the interests and properties affected. Prevention of income losses result in a contribution to national economic development only to the extent that the losses cannot be compensated for by postponement of an activity or transfer of the activity to other establishments. Emergency costs include those expenses resulting from a flood that would not otherwise be incurred. For example, the costs of evacuation and reoccupation, flood fighting, and administrative costs of 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.

(3) Without-Project Condition. The without-project condition is the land use and related conditions expected to occur during the period of analysis in the absence of the proposed project. The following assumptions are part of the projected without-project condition:

(a) Existing flood hazard reduction plans are considered to be in place, considering the actual remaining economic life of existing structures. If there is a high likelihood of construction of a flood hazard reduction plan authorized for implementation but not yet constructed, the authorized plan is assumed to be in place.

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

(c) For planning purposes, the Corps shall assume that communities in the floodplain belong to the National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA).

(d) Compliance with E.O. 11988 (described in paragraph 3-3b(1)), Floodplain Management and E.O. 11990, Protection of Wetlands, is assumed.

(4) With-project Condition. The same assumptions that underlie the without-project condition apply to the with-project condition.

(5) Evaluation Procedure. The steps required to evaluate benefits for flood damage reduction projects are described in the following paragraphs. These steps are designed to determine land uses and relate these uses to the flood hazard from an NED perspective. 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. Appendix E provides additional guidance for each step. The first five steps result in a determination of future land use with emphasis on

evaluating the overall reasonableness of local land use plans with respect to State, County or other projections of a larger area encompassing the study area.

(a) Step 1- Delineate the Affected Area. The area affected by a proposed plan consists of the floodplain plus all other nearby areas likely to serve as alternative sites for any major type of activity that might use the floodplain if it were protected. All areas impacted by the proposed plan shall be included in the affected area.

(b) Step 2 – Determine Floodplain Characteristics. An inventory of the floodplain is undertaken to determine those characteristics that make it attractive or unattractive for particular uses as identified in the land use demand analysis. The floodplain is characterized in terms of flooding, including the designation of high hazard areas, natural storage capabilities and constraints, natural and beneficial values and potential for water-oriented transportation. Other attributes, such as physical characteristics, available services and existing activities are also included in the floodplain characterization.

(c) Step 3 – Project Activities in Affected Area. Economic and demographic projections are developed, as needed, on the basis of current unbiased economic growth indices. Whenever possible, the growth indices should be independent estimates.

(d) Step 4 – Estimate Potential Land Use. Demographic projections are converted to land use needs using conversion factors from published secondary sources, from other studies or from empirical data.

(e) Step 5 – Project land Use – Land use demand is allocated to floodplain and non-floodplain lands for the without-project condition and for each alternative floodplain management plan.

(f) 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. The basis for the determination of existing damages is losses actually sustained in historical floods supplemented by appraisals, application of depth-damage curves and an inventory of capital investment within the floodplain. (Further guidance on the use of generic depth-damage curves is provided in Appendix E.) Average annual damages are computed using standard damage-frequency integration techniques and computer programs that relate hydrologic and hydraulic flood variables such as discharge and stage to damages and to the probability of occurrence of such variables. These estimates are developed using a risk-based analytical framework as described in paragraph 3-3b(2) of this regulation.

(g) Step 7 – Project Future Flood Damages. Future flood damages are those damages to activities identified in Step 3 that might use the floodplain in the future with- and without-project conditions. Hydrologic and economic changes are considered in developing these estimates. Procedures described in step 6 are used to estimate future flood damages. Participation in the NFIP requires communities to preclude new development in the regulatory floodway, as defined by the community. It also requires that new development in the NFIP

regulatory floodplain outside of the floodway be constructed at or above the median probability 100-year discharge regardless of whether or not that discharge is expected to increase in the future during the period of analysis. Estimates of future flood damages are constrained by these requirements.

(h) Step 8 – Determine Other Costs of Using the Floodplain. The impact of flooding on existing and potential future occupants of the floodplain, in addition to flood losses, include increased flood proofing costs, increased costs of administration of the NFIP and less efficient use of existing structures. The increased cost of administration of the NFIP can be claimed as a benefit of flood damage reduction projects. HQUSACE annually publishes data on administration cost per policy to use in estimating this benefit. Increased flood proofing costs are used as a measurement of potential location benefits.

(i) Step 9 – Collect Land Market Value and Related Data. If land use is different with and without the project, the difference in income for the land is computed using flood proofing costs as a proxy of the market value of land. If land use is the same with and without the project but the use is more intense, the increased income is determined on the basis of direct computation of costs and revenues. Projects or separable increments of projects that achieve only land development benefits (protection of vacant lands) are not recommended for implementation.

(j) Step 10 – Compute NED Benefits. To the extent that step 5 indicates that the land use is the same with and without the project, inundation reduction benefits are computed as the difference in flood damages with and without the project. In the evaluation of relocation and evacuation projects considerable attention is paid to the with-project use of the land to be evacuated, as the benefit associated with such use may be crucial for project feasibility. NED benefits also include estimates of savings in administration costs of the NFIP, intensification benefits, location benefits and benefits associated with the use of unemployed or underemployed resources. Detailed procedures for computing NED benefits are provided in Appendix E.

(k) Section 219 of the WRDA of 1999 directs the Secretary of the Army to calculate benefits for nonstructural flood damage reduction projects using methods similar to those used in calculating the benefits of structural projects and further directs the Secretary to avoid double-counting of benefits in these projects. Guidance for the implementation of this Section will be included in Appendix E when finalized.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including flood damage reduction. Specific cost sharing requirements for flood damage reduction are discussed in Appendix E.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

f. Other Related Programs. Flood Plain Management Services (FPMS)

(1) The FPMS Program was established to carry out Section 206 of the Flood Control Act of 1960 as amended. Its objective is to encourage prudent use of the Nation's flood plains for the benefit of the national economy and general welfare by supporting comprehensive flood plain management planning at all appropriate governmental levels. The Corps may provide flood plain information and planning assistance to State, county and city governments, Native American (Indian) Nations, as well as to other Federal agencies. Flood and flood plain information is also provided to private citizens, corporations, and groups.

(2) Assistance can be provided in the form of technical services, planning guidance and assistance on floods and flood plain issues. The Corps also provides support to the National Flood Insurance Program (NFIP) by conducting flood insurance studies and related technical work. Funding for the FPMS Program is obtained through appropriations for non-reimbursable FPMS items and through cost recovery for reimbursable services. Reimbursements for support to the NFIP are obtained from FEMA. Upon request, program services are provided to State, regional, and local governments, Native American (Indian) Nations, and other non-Federal public agencies without charge. Program services also are offered to other Federal agencies and to the private sector on a 100 percent cost recovery basis.

(3) Coordination. Program activities shall be coordinated with State and local agencies and field offices of Federal agencies concerned with flood problems to ensure that they are informed of the Corps FPMS Program, that the Corps is apprised of related activities of other agencies, and that there is no overlap of effort.

3-4. Hurricane and Storm Damage Reduction. Congress has authorized Federal participation in the cost of restoring and protecting the shores of the United States, its territories and possessions. Under current policy, shore protection projects are designed to reduce damages caused by wind-generated and tide-generated waves and currents along the Nation's ocean coasts, Gulf of Mexico, Great Lakes, and estuary shores. Hurricane protection was added to the erosion control mission in 1956 when Congress authorized cost-shared Federal participation in shore protection and restoration of publicly owned shore areas. Protection of private property is permitted only if such protection is incidental to the protection of public areas, or if the protection of private property would result in public benefits. Federal assistance for periodic nourishment was also authorized on the same basis as new construction, for a period to be specified for each project, when it is determined that it is the most suitable and economical remedial measure.

a. 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, shall also be considered.

b. Specific Policies.

(1) 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 Commonwealth of Puerto Rico, the US Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands. The authority extends only that distance up streams where the dominant causes of damage are coastal storms or ocean tidal action (or Great Lakes water motion) and wind-generated waves. The program does not address damages caused by stream flows or vessels.

(2) Erosion Control Measures. In the past, particularly prior to passage of the WRDA of 1986, beach fill or beach restoration was frequently considered an erosion control measure, and erosion control was treated 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 (e.g., beach fill) shall be treated as means to the ends of hurricane and storm damage reduction, ecosystem restoration, or recreation; similar to breakwaters or revetments.

(3) Historic Shoreline. Existing authority provides for restoration and protection of beaches. It provides for extending a beach beyond its historic shoreline only when 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. In the case of multi-purpose projects that include ecosystem restoration as a project purpose, extending a beach beyond its historic shoreline is acceptable if it is environmentally justified.

(4) Formulation and Establishing Corps Participation. Single purpose shore protection projects are formulated to provide hurricane and storm damage reduction. Highest priority is for reducing damages to existing development. Reducing flooding on, or erosion to, undeveloped lands is not a high priority; and Federal participation in protection of privately owned, undeveloped shores, will not be pursued. Recreation is an incidental output.

(a) The Corps participates in single purpose projects formulated exclusively for hurricane and storm damage reduction, with economic benefits equal to or exceeding the costs, based solely on damage reduction benefits, or a combination of damage reduction benefits and recreation benefits. Under current policy, recreation must be incidental in the formulation process and may not be more than fifty percent of the total benefits required for justification. If the criterion for participation is met, then all recreation benefits are included in the benefit to cost analysis. Costs incurred for other than the damage reduction purpose, i.e. to satisfy recreation demand, are a 100 percent non-Federal responsibility.

(b) The Corps also participates in multiple purpose projects formulated for hurricane and storm damage reduction. For multi-purpose projects that include ecosystem restoration as a project purpose, the combined NED/NER Plan will be formulated in accordance with the guidance in paragraph 2-3g(3) and Appendix E of this regulation.

(5) Public Use and its Relation to Federal Participation. Federal involvement in shore protection has developed historically in relation to beaches, generally with efforts to stabilize, create or restore beaches. It is 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, public ownership and use of the beach is required. Items related to public use are discussed below.

(a) User Fees. Reasonable beach recreation use fees are allowable when used to offset the non-Federal sponsor share of project costs.

(b) Parking. Lack of parking may constitute a restriction on public access and use. Therefore, eligibility for Federal participation is precluded in areas where there is a lack of sufficient parking facilities provided for the general public (including nonresident users) reasonably near and accessible to the project beaches. In some instances non-Federal plans may encourage or direct substitution of public transportation access for private automobile access.

(c) Access. Corps participation is conditioned on provision of reasonable public access rights-of-way, consistent with attendance used in benefit evaluation and in accordance with local recreational use objectives.

(d) 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 826 of 1956.

(e) 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.

(6) Shore Lines Owned by Federal Agencies.

(a) Work to provide shore protection to lands under the jurisdiction of another Federal agency shall be accomplished 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.

(b) Protection of (non-Civil Works) Department of the Army lands shall be 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.

(7) Periodic Nourishment. In accordance with Public Law 826 of 1956 (Beach Nourishment), when the Chief of Engineers determines that the most suitable and economical remedial measures would be provided by a periodic nourishment project, the Chief may consider the periodic nourishment as continuing construction for the length of time that the Chief specifies. Classifying the periodic nourishment as continuing construction establishes the Federal interest in cost sharing renourishments, usually for the economic life of the project. If the NED plan for a shore protection project includes a combination of structures and periodic nourishment, the renourishments may be considered continuing construction while future costs needed to operate, maintain, repair, rehabilitate or replace the structural components are considered operation and maintenance which is a non-Federal responsibility.

(a) New Projects. Federal participation in periodic nourishment may be recommended to continue for the lesser of: (1) project economic life, (2) physical life of structural features required for the project, (3) fifty years.

(b) Existing Projects. Per authority in Section 934 of the WRDA of 1986, 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. Reevaluation using current evaluation guidelines and policies is necessary. 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 the provisions of WRDA of 1986. This Section 934 authority does not apply to projects using sand bypassing plants.

(8) 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 construction project funded or authorized by the Federal Government.

(9) Specific policies for hurricane and storm damage reduction are presented in more detail in [ER 1165-2-130](#).

c. Evaluation Framework. The measurement standard and conceptual basis for benefits is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. The evaluation of hurricane and storm damage reduction projects shall be conducted following the process described in paragraph 2-3e of this regulation. The procedures described in the following paragraphs apply to the estimation of benefits used in the economic evaluation of hurricane and storm damage reduction projects and summarize requirements and procedures. Appendix E provides additional guidance on these requirements and procedures.

(1) National Economic Development Benefits. For hurricane and storm damage reduction projects estimated benefits are principally reductions in actual or potential damages to affected land uses. Damages are most frequently due directly to storms or to the resultant shoreline erosion. Storm damage reduction benefits are categorized as wave damage reduction benefits, inundation reduction benefits and other benefits. Erosion protection benefits include loss of land, structural damage prevention, reduced emergency costs, reduced maintenance of existing structures and incidental benefits. The primary benefit to be claimed in hurricane and storm damage reduction projects is reduction of damages to existing structures. Recreation

benefits are incidental and are measured in accordance with the guidance provided in paragraph 3-7 of this regulation and in Appendix E.

(2) With- and Without-Project Conditions. The assumptions described in paragraph 3-3c(3) are also applicable to hurricane and storm damage reduction studies. In addition, whenever a hurricane and storm damage reduction project involves beach improvements, public ownership and use of the beach is required, as described in paragraph 3-4b(5) of this regulation.

(3) Evaluation Procedure. The steps to evaluate benefits for hurricane and storm damage prevention projects are described in the following paragraphs. 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 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.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including hurricane and storm damage prevention. Specific cost sharing requirements for this purpose are discussed in Appendix E.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

3-5. Ecosystem Restoration. The Corps of Engineers incorporated ecosystem restoration as a project purpose within the Civil Works program in response to the increasing National emphasis on environmental restoration and preservation. Historically, Corps involvement in environmental issues focused on compliance with NEPA requirements related to flood protection, navigation, and other project purposes. The ecosystem restoration purpose shall be carried out in addition to activities related to NEPA compliance as discussed in Appendix C. Ecosystem restoration features shall be considered as single purpose projects or as a part of multiple purpose projects along with navigation, flood protection and other purposes, wherever those restoration features

improve the value and function of the ecosystem. Ecosystem restoration projects should be formulated in a systems context to improve the potential for long-term survival of aquatic, wetland, and terrestrial complexes as self-regulating, functioning systems. Similar to other project purposes, the value of ecosystem restoration outputs shall equal or exceed their cost.

a. Types of Improvements. A wide range of improvements to ecosystem functions 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 structure, 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.

b. Specific Policies.

(1) The objective of ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. 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. A more detailed discussion of Corps ecosystem restoration policy is found in [ER 1165-2-501](#) and Appendix E of this regulation.

(2) Purposes. Projects implemented under this guidance should address the restoration of ecosystems and not restoration of cultural or historic resources, aesthetic resources, or clean up of hazardous and toxic wastes.

(3) 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.

(4) 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 interest and that the benefits do not accrue primarily to the property owner.

(5) 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.

(6) Recreational features. Limited recreational features compatible with the ecosystem outputs for which the project is designed are permissible. Recreational features must be justified and appropriately cost-shared, and should not increase the Federal cost of the ecosystem restoration project by more than 10 percent without prior approval of the ASA(CW). (See Appendix E for additional information.)

(7) Water Quality. Water quality is an important component of ecosystem structure and water quality improvement can be considered as an output of an ecosystem restoration project. However, projects or features that would result in treating or otherwise abating pollution problems caused by other parties where those parties have, or are likely to have a legal responsibility for remediation or other compliance responsibility shall not be recommended for implementation.

(8) Monitoring and adaptive management. Monitoring may be necessary to determine if the predicted outputs are being achieved and to provide feed back for future projects. 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 the period of cost shared monitoring shall not exceed five years following completion of construction. The cost of monitoring included in the total project cost and cost shared with the non-Federal sponsor shall not exceed one percent of the total first cost of ecosystem restoration features. For complex specifically authorized projects that have high levels of risk and uncertainty of obtaining the proposed outputs, adaptive management may be recommended. 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.

(9) Real Estate. Requirements specified in paragraph 4-3c(4) apply to ecosystem restoration studies. Generally, fee title is required for ecosystem restoration projects.

c. Evaluation Framework. While the planning process for single purpose ecosystem restoration projects is the same as for any other purpose, the evaluation process is different in that it focuses on quantitative and qualitative restoration outputs and monetary benefits are usually incidental. (See Appendix E for more information on the evaluation process.)

(1) Ecosystem restoration outputs must be clearly identified and quantified in appropriate units. Although it is possible to evaluate various physical, chemical, and/or biological parameters that can be modified by management measures which would result in an increase in ecosystem quantity and quality in the project area, the use of units that measure an increase in "ecosystem" value and productivity are preferred. Some examples of possible metrics which may be used include habitat units, acres of increased spawning habitat for anadromous fish, stream miles restored to provide fish habitat, increases in number of breeding birds, increases in target species and diversity indices. Alternate measures of ecosystem value and productivity may be used upon approval by CECW-P. Monetary gains (e.g., incidental recreation or flood damage reduction) and losses (e.g., flood damage reduction or hydropower) associated with the project shall also be identified.

(2) Cost Effectiveness-Incremental Cost Analyses – As used in this regulation, a plan is considered cost effective if it provides a given level of output for the least cost. Cost effectiveness analysis shall be used to identify the least cost solution for each level of environmental output being considered. Incremental cost analysis compares the additional costs to the additional outputs of an alternative. It is a tool that can assist in the plan formulation and evaluation process, rather than a dictum that drives that process. Incremental analysis helps to identify and display variations in costs among different increments of restoration measures and alternative plans. Thus, it helps decision makers determine the most desirable level of output relative to costs and other decision criteria. These analyses must be performed at an appropriate level of detail for each study to identify the most cost effective plan within the identified constraints.

(3) The significance of the outputs is a critical factor in determining if the monetary and/or non-monetary benefits of the proposed project justify monetary and/or non-monetary costs. The scarcity of the outputs is also a factor in this determination. The concepts of significance and scarcity are discussed in more detail in Appendix E. The risks and uncertainties associated with achieving the projected outputs must also be considered. (See Appendix E for additional information.) Contingent value procedures (survey techniques) for estimating existence, “option”, bequest, or other such non-use values will not be approved, and shall not be used, due to several factors including the conjectural nature of estimated values and the high difficulty in controlling bias.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including ecosystem restoration. Specific cost sharing requirements for this purpose are discussed in Appendix E. Appendix F provides details on cost sharing rules applicable to CAP authorities.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

3-6. Hydroelectric Power Generation. Congress, through various statutes, has directed the Corps to consider the development of hydroelectric power in conjunction with other water resources development plans. Current policy calls for the Corps to formulate comprehensive plans including the development of hydropower by a non-Federal sponsor. The Corps will pursue Federal development only where such non-Federal activity would be impractical. Even in those cases, all costs associated with development of hydroelectric power at the site of a Corps project are borne by non-Federal sponsors.

a. Types of Improvements.

(1) 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.

(2) Addition of Hydropower to Existing Projects. Corps projects without hydroelectric power facilities may add facilities through Federal Energy Regulatory Commission (FERC)

licensed non-Federal development. In rare cases, Congress may authorize Federal development. Cost of development must be borne by non-Federal sponsors.

(3) Pumped Storage. Pumped storage may be considered in the formulation of water resource projects. Non-Federal sponsors are encouraged to develop pumped storage facilities determined to be feasible.

b. Specific Policies.

(1) 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).

(2) Economic Justification Requirements. Corps development of single purpose hydropower is precluded. In addition, before hydropower can be included in a multiple purpose project, the project must be economically justified based on other outputs (e.g., flood damage reduction or navigation).

(3) Marketing of Federal Hydropower. 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 and sponsors.

(4) Studies. New studies may be conducted in cases where non-Federal development is impractical. This must be substantiated in order to justify a funding request. 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 costs of the feasibility study with the explicit understanding that any resultant Federal project will be financed by non-Federal funds.

(5) Technical Services. 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). 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 the Hydroelectric Design Center (HDC) located in Northwestern Division (NWD). Some technical services must be done by the HDC. Any technical service agreements must be coordinated with HDC.

(6) Minimum Facilities for Future Power Installations. To support future hydropower development, penstocks and some other features ("minimum facilities") may be included in initial project construction, while installation of full facilities is postponed.

(7) Transmission Facilities. The placement of transmission lines and substations must be considered with other project effects.

(8) Hydroelectric Development at Non-Corps Sites. The Corps has no general authority to participate in hydroelectric development at non-Corps sites.

c. Evaluation Framework. The measurement standard and conceptual basis for hydropower benefits is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. In the absence of direct measures of marginal willingness to pay, the benefit can be estimated using the resource cost of the most likely alternative to be implemented in the absence of the alternatives under consideration. Since the Corps current participation on the development of hydropower generation projects is very limited, the evaluation procedures are not summarized in this regulation. (See Appendix E for a detailed description, if needed). Current Corps involvement in hydropower generation projects involves the evaluation of major rehabilitation of existing projects. The procedures to evaluate major rehabilitation projects are also described in Appendix E.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including hydropower. Specific cost sharing requirements for this purpose are discussed in Appendix E.

3-7. Recreation. The U.S. Army Corps of Engineers is one of the Nation's largest providers of outdoor recreation opportunities. Although known primarily for the opportunities managed at its lake projects, the Corps also participates in the planning, design and construction of recreation facilities at a wide variety of other types of water resource projects. Such facilities might include hiking and biking trails associated with a stream channel or levee primarily designed for flood damage reduction. There is no general authority for Corps participation in a single purpose recreation project.

a. Types of Improvements. A list of recreational facilities which may be provided in recreation development at Corps projects is provided in Appendix E. As a general rule, the Corps does not participate in the development of improvements that provide outputs or services generally considered vendible. 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.

b. Specific Policies.

(1) Lakes (man-made).

(a) 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. Economically justified recreation facilities are cost shared 50 percent Federal and 50 percent non-Federal. The same conditions apply to separable lands acquired for future recreation development. Cost of recreation development at lakes may not exceed one-half of total project costs. If recreation is a project purpose, several scales of development must be formulated and evaluated.

(b) Reallocation of Storage. Storage reallocation for recreation which significantly affects other authorized purposes, or involves major structural or operational changes, requires Congressional approval. Costs reallocated to recreation and subject to cost sharing will be set to the highest of benefits foregone, revenues foregone, replacement costs, or updated cost of storage. Appendix E provides detailed information on how to compute these benefits, revenues and costs. Cost sharing of facilities is 50 percent Federal and 50 percent non-Federal.

(2) Non-lake Flood Damage Reduction and Navigation Projects. General policies described in the previous paragraphs also apply to non-lake projects, with the following exceptions:

(a) Basic recreation facilities that take advantage of project created opportunities may be provided, but only on lands acquired for non-recreation purposes.

(b) Separable lands acquired for access, parking and facilities, which are required for health and safety are eligible for recreation cost sharing.

(c) Generally, if there is no non-Federally sponsored recreation development, there is no Federal participation in minimum facilities.

(d) 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.

(3) Shore Protection Projects. Policy precludes the addition of sand to a beach solely to increase its potential for recreation. Other associated recreation developments are entirely non-Federal responsibility except on Federally-owned shores.

(4) Nonstructural Flood Damage Reduction Projects. Nonstructural flood damage reduction projects are justified mainly by creating new uses for floodplains, and one of the most important new uses is recreation. The limitation of increased Federal cost for recreation development, described in paragraph 3-7b(2), does not apply to projects formulated for nonstructural flood damage reduction that include recreation development. Cost of recreation development may not exceed one-half of the total project costs.

(5) 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. (Refer to Appendix E for a more detailed discussion on this matter.) Federal participation in recreation development at ecosystem restoration projects will be limited to the facilities shown on the list in Appendix E. Specific policies stated in paragraph 3-7b(2) of this regulation also apply to recreation development at single purpose ecosystem restoration projects. For multi-purpose projects that include non-structural 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). (See Appendix E for additional information on the implementation of this policy.)

(6) Continuing Authorities. Flood damage reduction, 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.

(7) Limitations on Corps of Engineers Participation in Recreation Projects. Budget Policy generally precludes using Civil Works resources to implement recreation oriented projects in the Civil Works program. An exception is where a project is formulated for other primary purposes and average annual recreation benefits are less than 50 percent of the average annual benefits required for justification (i.e., the recreation benefits that are required for justification are less than an amount equal to 50 percent of project costs).

c. Evaluation Framework. The measurement standard and conceptual basis for recreation benefits is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. The evaluation of recreation projects shall be conducted following the process described in paragraph 2-3e of this regulation. The procedures described in the following paragraphs apply to the estimation of benefits used in the economic evaluation of recreation projects and summarize requirements and procedures. Appendix E provides additional guidance on these requirements and procedures.

(1) National Economic Development Benefits. NED benefits from recreation opportunities created by a project are measured in terms of willingness to pay. Benefits for projects that increase the supply of recreational facilities are measured as the willingness to pay for the increment of supply. Benefits for projects that alter willingness to pay for recreational facilities are measured as the with- and without-project willingness to pay.

(2) Evaluation Procedure. It is frequently not possible to estimate demand directly from observed price-consumption data for publicly provided recreation. Thus, three alternate methods can be used to estimate use and willingness to pay. They are the travel cost method (TCM), contingent valuation method (CVM) and the unit day value method (UDV). Criteria to select the method to use include availability of regional demand model, type of recreation activities affected (general or specialized), estimated annual visits and cost of proposed facilities. Appendix E provides details on how to apply these criteria and on how to estimate benefits using each one these evaluation methods.

(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 increases, other variables being constant. TCM consists of deriving a demand curve by using the variable cost 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 collected 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. This method may be applied to site-specific studies only.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including recreation. Specific cost sharing requirements for this purpose are discussed in Appendix E.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

3-8. Water Supply. National policy regarding water supply states that the primary responsibility for water supply rests with states and local entities. The Corps may participate and cooperate in developing water supplies in connection with construction, operation and modification of Federal navigation, flood damage reduction, or multipurpose projects. Certain conditions of non-Federal participation are required.

a. Types of Improvements. The Corps is authorized to provide storage in multipurpose reservoirs for municipal and industrial water supply and for agricultural irrigation. Some facilities for releasing or withdrawing the stored water can be included in the project structure.

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The cost of storage and associated facilities must be repaid by the non-Federal sponsor. The Secretary of the Army is authorized to make agreements with states, municipalities and non-Federal entities for right to storage in Corps reservoirs. Storage for agricultural irrigation may be provided at the request of the Secretary of the Interior in 17 Western states as defined in Appendix E. Storage for this purpose can be provided in non-Western states provided cost sharing requirements described in Appendix E are met. Existing Corps projects may be modified to add storage for municipal and industrial water supply. Storage may also be reallocated from other purposes to municipal and industrial uses. Specific policies and procedures applicable to reallocations of storage are discussed in Paragraph 3-8b(5). Permanent reallocations for irrigation water supply may also be considered in existing projects through the submittal of a Section 216 report (Review of Completed Projects) to Congress. Paragraph 3-10b and Appendix G provide more information on Section 216 reports. The Secretary of the Army can also enter into agreements with states, municipalities, private entities or individuals for the use of surplus water as defined in, and under the conditions described in, Paragraph 3-8b(4). Surplus water can also be used to respond to droughts and other emergencies affecting municipal and industrial water supplies.

b. Specific Policies.

(1) 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.

(2) Permanent Rights to Storage. Under the authority of Public Law 88-140 of 1963 (Extension of Right to Water Supply Storage), the non-Federal sponsor acquires a permanent right to the use of storage as long as the space is physically available.

(3) New Projects. 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 pay all costs allocated to M&I water supply storage space. Conduits for release or withdrawal of stored M&I water may be designed as an integral part of the dam structure. Costs are identified as specific M&I water supply costs with 100 percent payment of investment and annual costs by users.

(a) Multi-purpose Project. Limits are placed on the percent of municipal and industrial (M&I) water that may be included in a multi-purpose project. To be considered multi-purpose, a project must fall in one of the following categories:

- The project has justified, separable storage for flood damage reduction 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 percent of total benefits the project is considered single purpose M&I water supply and thus not eligible for Federal participation.

- The project has no separable storage for flood damage reduction, 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 percent of total benefits the project is considered single purpose M&I water supply and thus not eligible for Federal participation.

(b) Single-Purpose Water Supply. The Corps does not conduct single purpose water supply studies, except for analysis of existing data under Section 22 of the WRDA of 1974 as amended. 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.

(c) Limits on Future Use Storage. The Water Supply Act of 1958, as amended, states that not more than 30 percent of total construction costs can be allotted to water supply for future use. In addition, Corps policy is to obtain full payment of allocated capital costs from non-Federal entities desiring water supply storage prior to or during construction. Failing this, non-Federal sponsors shall negotiate a repayment agreement, with payments to begin immediately after construction completion under the provisions of Section 932 of the WRDA of 1986.

(4) Surplus Water. Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any reservoir under the control of the Department. These agreements may be for domestic, municipal, and industrial uses, but not for crop irrigation. 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. Surplus water is either 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 water that would be more beneficially used as municipal and industrial water than for the authorized purposes over some specific time period. Use of the Section 6 authority is allowed only where non-Federal sponsors do not want to purchase storage because: use of the water is needed for a short term only or use would be temporary pending development of the authorized use and reallocation of storage is not appropriate. Terms of the agreements are normally for five (5) years, with an option for a five (5) year extension, subject to the space being needed for the authorized purposes, or the authorized purpose is deauthorized.

(5) Reallocation of storage. Reallocation or addition of storage that would seriously affect other authorized purposes or that would involve major structural or operational changes requires Congressional approval. Provided these criteria are not violated, 15 percent of the 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, this amount may be added to the project to serve as storage for municipal and industrial water supply at the discretion of the Commander, USACE. When reallocating storage from the flood control pool to municipal and industrial water supply, the need to compensate existing water supply contract holders shall be evaluated. Dependable yield mitigation storage (DYMS) shall be analyzed and implemented to

compensate these users. Compensation to existing hydropower users through minor operational changes, where appropriate, may also be considered. Procedures and requirements to analyze and implement DYMS and operational changes are described in Appendix E.

(a) Costs of Reallocated Storage. The cost allocated to the non-Federal entity (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. The methodologies to be used to compute these benefits, revenues and costs are discussed in Appendix E. The non-Federal entity shall also be responsible for an appropriate share of the annual costs that include specific and joint-use operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs. In those cases where the cost of water supply is based on hydropower replacement costs, the OMRR&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.

(b) Financial Feasibility. A test of financial feasibility must be performed to demonstrate that reallocation of storage is the most efficient water supply alternative. Appendix E provides additional information on how to conduct this analysis.

(c) 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 M&I 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.

(6) 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. However, project specific authorizations are not precluded. 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. Modifications must be consistent with authorized project purposes and law. Cost sharing requirements for seasonal operations for water supply are provided in Appendix E.

(7) Water Withdrawals Contracts. The Corps will not use Section 501 of the Independent Offices Appropriations Act of 1952 to obtain reimbursement for water supply withdrawals. Existing contracts under this authority should be allowed to expire under the terms of the contract. These contracts are not to be extended.

c. Evaluation Framework. The measurement standard and conceptual basis for benefits is willingness to pay for each increment of output from a plan. In some planning situations it is infeasible to directly measure willingness to pay; therefore, alternative techniques are used to estimate the total value of a plan's output. The evaluation of water supply projects shall be conducted following the process described in paragraph 2-3e of this regulation. The procedures described in the following paragraphs apply to the estimation of benefits used in the economic

evaluation of water supply projects and summarize requirements and procedures. Appendix E provides additional guidance on these requirements and procedures.

(1) National Economic Development Benefits. Where the price of water reflects its marginal cost, that price is used to calculate willingness to pay for additional water supply. If such direct measures of marginal willingness to pay are not available, the benefits are measured by the resource cost of the alternative most likely to be implemented in the absence of the proposed plan. The benefits from nonstructural measures are also computed using the cost of the most likely alternative.

(2) With- and Without-Project Condition. Specific elements included in the definition of the without-project condition are existing water supplies, existing and expected future water systems, water management contracts and operating criteria, water supplies that are under construction or authorized and likely to be constructed during the period of analysis, the probability of delivery for each source of water supply, water quality, and conservation measures. These six elements are also considered under the with-project condition.

(3) Evaluation Procedure. The steps required to evaluate benefits for water supply projects are described in the following paragraphs. 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. Appendix E provides additional guidance for each step.

(a) 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.

(b) Step 2 - Estimate future M&I water supplies. All sources of supply expected to be available to the M&I user are analyzed. The analysis is performed by time period and includes existing water supplies, institutional arrangements, additional water supplies, probability of water supply and water quality.

(c) Step 3 - Project future M&I water supply. Future water use is projected by sector considering seasonal variations in use. The projections are based on an analysis of the factors that may determine variations in levels of water use.

(d) Step 4 – Identify the deficit between future water supplies and use. Projected water use is compared to future water supplies to determine whether any deficits exist in the study area. An analysis of the intensity, frequency and duration of the expected deficits is performed.

(e) Step 5 – Identify alternatives without the Federal plan. Alternative plans that are likely to be implemented by communities and/or industries in the absence of a Federal plan are identified in this step. These plans should be identified through analysis of the total water resources of the region, allowing for present and expected competing uses.

(f) Step 6 – Rank and display the alternative plans based on least cost analysis. All the alternatives are ranked in order from the highest cost alternative to the lowest. Annualized costs for each alternative are calculated on the basis of the service (depreciable) life of the facility or the period of analysis, whichever is less.

(g) Step 7 – Identify the most likely alternative. The least cost alternative is identified as the most likely alternative.

(h) Step 8 – Compute M&I water supply annualized benefits. The annualized benefits of the Federal supply plan are equal to the annualized cost of the most likely alternative.

(i) Risk-analysis techniques, required for all water resources studies, have not been specifically developed for municipal and industrial water supply projects. Where water supply constitutes a substantial portion of total benefits, districts are required to perform, at a minimum, sensitivity analysis of key variables such as cost of least cost alternative, future demand for water and future availability of water supplies.

d. Cost Sharing Requirements. Paragraph 2-8 discusses general cost sharing considerations applicable to all project purposes including water supply. Specific cost sharing requirements for this purpose are discussed in Appendix E.

e. Other Authorities. Other authorities that may be applicable to this project purpose are discussed in paragraph 3-10.

3-9. Multiple Purpose Studies.

a. Definition. Multiple purpose studies can examine more than one type of water resources problem or opportunity and recommend projects with more than one purpose. Corps mission areas can be combined to address multiple objectives within the localized study area. For example, many existing flood control dams also supply water for M&I or agricultural uses, or provide hydropower. Additionally, there may be opportunities to address some combination of purposes which also could include ecosystem restoration and/or recreation. Oftentimes there will be competing water resources uses; therefore environmental, social, and economic considerations need to be evaluated. The evaluation process for these projects will demonstrate the trade-offs for providing various combinations and levels of economic, social, and environmental outputs. Multiple purpose studies will typically result in the recommendation of a single project or set of projects that satisfy the range of water resources purposes identified.

b. Comprehensive studies. A comprehensive study characterizes, measures, and evaluates a particular water resources problem or opportunity across a broad area or region. Typically, the focus of comprehensive studies is water resources problems related to the Corps main mission areas (flood damage reduction, ecosystem restoration or navigation). Non-Federal entities with interests common to the Corps mission area(s) identified should be encouraged to participate in the study investigations; the general public should not only be informed about the study but also be canvassed for information related to needs, opportunities and constraints. Based

on evaluation that considers existing and without-project conditions, the study will determine the need for further Corps studies and projects.

c. **Watershed Studies.** Watershed studies are planning initiatives that have a multi-purpose and multi-objective scope and that accommodate flexibility and collaboration in the formulation and evaluation process. Possible areas of investigation for a watershed study include water supply, natural resource preservation, ecosystem restoration, environmental infrastructure, recreation, navigation, flood management activities, and regional economic development. This multi-purpose approach is recommended since numerous entities within the boundaries of any watershed must agree with and support watershed improvement and management initiatives in order to successfully implement effective system-wide solutions. The outcome of a watershed study will generally be a watershed resources management plan which identifies the combination of recommended actions to be undertaken by various partners and stakeholders in order to achieve the needs and opportunities identified in the study. The watershed resources management plan may or may not identify further Corps studies or implementation projects.

d. **Cost Sharing Requirements.** Multiple-purpose studies and projects are cost shared in accordance with the cost sharing policies applicable to each project purpose required. Before determining the required cost sharing for projects, an allocation of total project costs to each purpose must be accomplished. The following paragraphs summarize the requirements and procedures used by the Corps for allocating costs of multiple purpose projects. Detailed cost allocation procedures are discussed in Appendix E.

(1) **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 project. Financial costs are implementation outlays, transfer payments such as replacement housing assistance, and the market value of in-kind contributions. Financial costs are to be allocated to those purposes for which the project is formulated.

(2) **Cost Allocation Standard.** Cost sharing policies may differ for construction costs and other costs such as operation, maintenance, repair, replacement and rehabilitation costs. Allocations for each one of these types of costs shall be made, as applicable, to the particular project. The Separable Costs/Remaining Benefits (SCRB) method shall be used for the allocation of costs among project purposes. Costs allocated to each purpose are the sum of the separable cost for the purpose and a share of joint cost. Joint costs may be allocated among purposes in proportion to remaining benefits. They may also 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. The SCRB method is also applicable for multi-purpose projects that include ecosystem restoration as a project purpose. Guidance on this application is under development. If the need for a cost allocation analysis for this type of project is foreseen, contact CECW-PD for additional guidance, preferably during the early phases of the study.

3-10. Other Authorities.

a. Continuing Authorities Program (CAP). The planning principles, guidelines and process described in previous chapters also apply to studies conducted under the Continuing Authorities Program. Specific guidance and planning requirements for studies conducted under each section included in the Program is provided in Appendix F. The following sections are included under the Continuing Authorities Program:

- Section 14, Flood Control Act of 1946, as amended, for emergency streambank and shoreline protection for public facilities and services
- Section 103, River and Harbor Act of 1962, as amended, for protecting the shores of publicly owned property from hurricane and storm damage
- Section 107, River and Harbor Act of 1960, as amended, for navigation
- Section 111, River and Harbor Act of 1968, as amended, for mitigation of shoreline damage caused by Federal navigation projects
- Section 204 of Water Resources Development Act of 1992, as amended, for beneficial uses of dredged material
- Section 205, Flood Control Act of 1948, as amended, for flood damage reduction
- Section 206 of Water Resources Development Act of 1996, as amended, for aquatic ecosystem restoration
- Section 208, Flood Control Act of 1954, as amended, for snagging and clearing for flood damage reduction
- Section 1135 of Water Resources Development Act of 1986, as amended, for project modifications for improvement of the environment

b. Review of Completed Projects. Section 216 of the River and Harbor and Flood Control Act of 1970 authorizes investigations for modification of completed projects or their operation when found advisable due to significantly changed physical or economic conditions and for improving the quality of the environment in the overall public interest. Initial appraisal reports are prepared under Section 216 using operations and maintenance (O&M) funds. The cost of preparing the initial appraisal report is limited to \$20,000. Results from this report can be used to support initiation of a reconnaissance study through normal budgetary process. Following the initial appraisal, the 216 study process is of the same as a normal General Investigations study. A feasibility study under Section 216 authority would be appropriate for large scale ecosystem restoration projects linked to existing Civil Works projects, but whose costs would be too large for Section 1135, Section 206, or Section 204 authorities. Additional guidance can be found in [ER 1165-2-119](#).

c. Planning Assistance to States (PAS). The PAS Program is carried out in accordance with the provisions of Section 22 of the WRDA of 1974 as amended. This law authorizes the Chief of Engineers to cooperate with states, the District of Columbia, the Commonwealth of Puerto Rico, the US Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and Federally recognized Native American (Indian) Nations in preparing plans for the development, utilization, and conservation of water and related land resources of drainage basins, watersheds or ecosystems located within the boundaries of the State or Indian lands. Assistance is provided on the basis of specific requests rather than through Congressional study authorization. (See Appendix G for details on the implementation of this program).

d. Flood Mitigation and Riverine Restoration. Section 212 of the WRDA of 1999 provides programmatic authority for the Secretary of the Army to implement projects that reduce flood hazards and restore the natural function and values of rivers within certain specified limits. The program emphasizes the use of nonstructural approaches to flood damage reduction and coordination with FEMA and other Federal, State, and local agencies, and Native American Nations. Projects must significantly reduce potential flood damages, improve the quality of the environment and be justified considering all costs and beneficial outputs. Funds are authorized to be appropriated in fiscal years 2001 through 2005. Additional guidance for this program is under development.