Proposed
National Objectives, Principles and Standards for Water and Related Resources Implementation Studies

December 3, 2009

Proposed
National Objectives for Water Resources Planning

These National Objectives and the supporting Planning Principles and Standards are established pursuant to the Water Resources Planning Act of 1965 (Public Law 89-8), as amended (42 U.S.C.1962a-2) and consistent with Section 2031 of the Water Resources Development Act of 2007 (Public Law 110-114). They supersede the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies dated March 10, 1983.

1. Purpose

These National Objectives and the supporting Planning Principles and Standards establish the National water resources planning policy and the framework for the planning process that supports decisions regarding the Federal implementation of solutions to water resources problems, needs and opportunities.

2. Applicability

These National Objectives, Principles and Standards apply to Federal water and related resources implementation studies completed 180 days after the publication of the supporting Interagency Guidelines. Such studies investigate and recommend Federal implementation of site-specific projects and project modifications to address water resources problems, needs and opportunities.

3. National Objectives of Water Resources Planning

Federal water resources planning and development should both improve the economic well-being of the Nation for present and future generations and protect and restore the environment. America's water resources – streams, rivers, wetlands, estuaries, lakes, and coasts – are at the heart of our economy, our environment and our history. These water resources support billions of dollars in commerce, provide drinking water for millions of Americans and supply needed habitat for fish and wildlife and other benefits. The National Objective for water resources planning is to develop water resources projects based on sound science that maximize net national economic, environmental, and social benefits. Consistent with this objective, the United States will demonstrate leadership by modernizing the way the Nation plans water resources projects by:

(1) protect and restore natural ecosystems and the environment while encouraging sustainable economic development;

(2) avoiding adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts; and

(3) avoiding the unwise use of flood plains, flood-prone areas and other ecologically valuable areas.

4. Approval

The National Objectives of Water Resources Planning and the accompanying Planning Principles and Standards are hereby approved.

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President of the United States

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Date

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Chapter I – Planning Principles

1. Principles

Water is a valued and limited natural resource that is an absolute requirement for life and vital to human health and our natural environment. The quality and quantity of water resources affect all levels of our society from the national to the individual citizen. Water resources support our local and national economies, provide environmental security, and support this Nation's vast cultural diversity. We depend upon these resources for a myriad of purposes including, drinking water, ecosystem services, irrigation, hydropower, manufacturing, recreation, fish and wildlife, sanitary waste disposal systems, transportation, and public health and safety. Equally important are the management of water to reduce flood risk and storage of water for future use. Therefore, the following principles are established to guide water resources implementation studies. It is the policy of the United States that all Federal water resources implementation studies shall:

A. Protect and restore natural ecosystems and the environment while encouraging sustainable economic development;

B. Account for ecosystem services;

C. Avoid the unwise use of floodplains, flood-prone areas and other ecologically valuable areas;

D. Utilize watershed and ecosystem based approaches;

E. Utilize best available science, practices, analytical techniques, procedures and tools;

F. Apply a level of detail commensurate with the potential decisions;

G. Account for the benefits and costs in appropriate monetary and non-monetary terms;

H. Account for significant effects and mitigate any unavoidable adverse impacts to natural ecosystems;

I. Address risk and uncertainty, including the effects of climate change and future development;

J. Incorporate public safety;

K. Ensure environmental justice for low income, tribal and minority communities;

L. Ensure the planning process is fully transparent; and

M. Collaborate implementation study activities broadly.

2. Overview of the Planning Process

The above Principles shall be implemented in a deliberate planning process. The major steps in the planning process shall include:

A. Identify the study objectives and ensure that Federal participation in the study is warranted based on the likelihood of fulfilling the National Water Resources Planning Objectives;

B. Identify and assess the water and related resources problems, needs, and opportunities relevant to the planning setting associated with the study objectives;

C. Inventory, analyze, and determine the existing and most likely future water and related resources conditions within the study area relevant to the identified problems and opportunities;

D. Formulate alternatives, including identifying the No Action alternative, as well as nonstructural and structural alternatives, and combinations of nonstructural and/or structural measures to ensure that all reasonable solutions are considered;

E. Evaluate the potential effects of all reasonable and viable alternatives;

(1) Evaluate the potential effects, positive and negative, on the significant resources relative to the most likely conditions without action, and

(2) Evaluate and display the potential effects of alternatives in a systematic manner.

F. Compare alternatives; and

G. Select and recommend the plan that:

(a) Complies with existing statutes including, but not limited to, Clean Water Act, Endangered Species Act, National Environmental Policy Act, Fish and Wildlife Coordination Act, National Historic Preservation Act, Wild and Scenic Rivers Act; authorities; and policy; and

(b) Provides the greatest net overall contribution to the National Water Resources Planning Objectives considering both monetary and non-monetary effects.

3. Planning Guidelines and Procedures

The Council on Environmental Quality (CEQ), in cooperation with the Water Resources Council, shall issue Interagency Guidelines to implement these Principles and Standards. The Guidelines shall require that all Federal agencies conduct water resources implementation studies in a generally common manner and enable the public to comprehend and evaluate those studies. Each Federal agency shall develop and apply Agency-Specific Procedures to implement the Principles, Standards and Guidelines as needed for its respective water resources missions.

Chapter II – Planning Standards

1. Implementation Studies

A. Water and related resources implementation studies covered by these Principles and Standards investigate and recommend Federal implementation of site-specific projects and project modifications. "Projects" include significant structures and landform changes, and any nonstructural plans that might be implemented. Modifications include the reevaluation of implemented projects, as well as those authorized but not yet implemented. Modifications also include significant changes in features or operations that materially affect project impacts, rehabilitation, safety, reallocation, termination, and removal. Implementation studies include pre- and post authorization project formulation or evaluation studies undertaken by Federal agencies.

Implementation studies conducted by the following agencies to develop water resources project plans are explicitly covered by these Principles and Standards:

(a) U.S. Army Corps of Engineers (Civil Works);

(b) Bureau of Reclamation;

(c) Tennessee Valley Authority;

(d) Natural Resources Conservation Service; and

(e) Any other Federal agency studies meeting the general criteria presented above.

B. The Principles and Standards do not apply to routine project operations, basic maintenance and minor repairs, or watershed plans or regulatory activities. Additionally, the Principles and Standards do not apply to grants, technical assistance, and other financial assistance or authorization for work implemented by non-Federal entities on facilities to which the United States does not hold title.

2. Planning Standards

The following standards are established to implement the Principles by further defining and guiding the conduct of Federal water resources implementation studies, which shall:

A. Protect and Restore Natural Ecosystems and the Environment while Encouraging Sustainable Economic Development

Federal water resources implementation studies shall seek to protect and restore natural ecosystems and the environment while encouraging sustainable economic development. Proposals developed through such studies shall assure the appropriate use of these limited resources and avoid their unwise use. The appropriateness of modifying water resources shall be based on evaluations of the services gained and lost, and only those actions that provide a net national gain shall be considered further or selected. This is best done in accordance with the National Objectives by determining both economic and environmental outputs, as well as the likely impacts of one upon the other. The economic and environmental outputs are inextricably linked and both must be considered if the desired outputs are to be sustained.

B. Account for Ecosystem Services

Ecosystem services are the direct or indirect contributions that ecosystems make to the environment and human populations. Ecosystems provide not only goods and services directly consumed by society such as food, fish and game, timber, and water, but also services such as flood and storm abatement, disease regulation, pollination, and disease, pest, and climate control. Ecosystem processes and functions contribute to the provision of ecosystem services, but they are not synonymous with ecosystem services. Ecosystem processes and functions describe biophysical relationships that have value regardless of whether humans recognize the benefits.

Consideration of ecosystem services can play a key role in evaluating water resource alternatives. Using the best available methods in the ecological, social, and behavioral sciences to develop an explicit list of the services derived from an ecosystem is the first step in ensuring appropriate recognition of the full range of potential impacts of a given alternative. This can help make the formulation and the analysis of alternatives more transparent and accessible and can help inform decision makers of the full range of potential impacts stemming from different options before them. The second step is establishing the significance or value of changes in the quality or quantity of services over time, with and without the effects of proposed alternatives on ecosystem services.

The concept of ecosystem services provides an approach to evaluating the ways in which ecological systems, and changes to those systems induced by human actions, affect human well-being. Ecosystems, however, can also be valued not only for the services they provide to humans directly or indirectly, but for other reasons, including intrinsic natural values such as biodiversity.

In the context of these Standards, evaluations shall focus on identifying ecological service and intrinsic natural value ***changes*** and the significance of those changes, rather than attempting to assess the value of entire ecosystems.

C. Avoid the Unwise Use of Floodplains and Flood-prone Areas

Water resources implementation studies, especially when seeking to reduce the Nation's vulnerability to floods and storms, must recognize floodplains as critical components of watersheds. Studies shall evaluate proposed alternatives for potential direct and indirect adverse effects on floodplain functions. Studies shall give full and equal treatment to nonstructural approaches that avoid and minimize actions and changes that are incompatible with or adversely impact floodplain functions. Studies shall further reflect sound floodplain management by formulating alternatives to:

(1) Preserve and restore the hydrologic and natural resources functions and the integrity of floodplains to the extent practicable by avoiding and minimizing actions and changes, including induced development, that are incompatible with floodplain functions;

(2) Help communities to move damageable properties and critical infrastructure out of flood-prone areas to reduce repetitive losses and risks to life;

(3) Inform the public about floodplain impacts and the associated risks to life, health and property, including descriptions of historical and probable future flood and storm events, and how climate change may affect these events; and

(4) Encourage communities to develop and use floodplain management and hazard mitigation plans in their community planning and decision making.

D. Utilize Watershed and Ecosystem Based Approaches

(1) Watershed Perspective. Watershed planning addresses resource conditions and needs based on water and land uses, and multiple stakeholder interests throughout a watershed. By definition, watershed planning focuses on a watershed, a geographic area that is defined by a drainage basin. Most frequently this geographic area is described using hydrologic cataloging units. Watershed planning shall address a geographic area large enough to ensure that

plans address the cause and effect relationships among affected resources and activities that are pertinent to achieving the study objectives; i.e., evaluate the resources and related demands as a system. The scope and degree of evaluations across a watershed shall reflect the nature of these relationships and the study objectives. All aspects of a watershed may not necessarily require the same detailed level of analysis. Once a relationship is established as non-existent or insensitive, further analysis of that relationship may not be necessary. Also, while a watershed is generally the appropriate study area, individual analyses within a study may utilize other boundaries where appropriate. For example, political boundaries may be pertinent when evaluating regional impacts. The intent is to address watershed stressors and solutions in a rational and efficient manner rather than focus on a single waterbody segment or other narrowly defined areas, which would preclude a more holistic analysis. The scale selected shall also consider the probability of involvement by key stakeholders. As such, in some cases, aspects other than hydrologic interaction may contribute to defining the "study area." For example, the study area associated with an inland waterway or port project is likely to include the regional transportation sector, especially alternate modes of transportation, as well as other affected ports. If a species of interest is identified for a restoration plan, the ecoregion that defines the species habitat throughout its life cycle may not coincide with a watershed definition.

The watershed approach provides a flexible perspective for managing water resource quality and quantity within affected drainage areas or watersheds. The watershed approach allows problems, needs and opportunities to be addressed in a holistic manner, including the interdependency of water uses, competing demands, and the desires of a wide range of stakeholders. The watershed approach is based on:

(a) Sustaining water resources;

(b) Integrating water and related resources management;

(c) Considering future water resources demands;

(d) Coordinating planning and management;

(e) Collaborating among governmental entities at all levels and ensuring broad stakeholder participation;

(f) Evaluating monetary and non-monetary trade-offs;

(g) Utilizing interdisciplinary teams;

(h) Applying principles of adaptive management; and

(i) Using sound science and data.

A watershed perspective facilitates evaluation of a more complete range of potential solutions and is more likely to identify the most environmentally preferable, technically sound and economically efficient means to achieve multiple goals over the entire watershed.

(2) Ecosystem-Based Management. Ecosystem-based management seeks to maintain an ecosystem in a healthy, productive, and resilient condition so that it can sustain necessary ecosystem services. Ecosystem-based management differs from approaches that usually focus on a single species, sector, activity, or concern; it considers the cumulative impacts of different sectors. Specifically, ecosystem-based management:

(a) Emphasizes the protection of ecosystem structure, functioning, and key processes;

(b) Is place-based in focusing on a specific ecosystem and the range of activities affecting it;

(c) Explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species;

(d) Acknowledges interconnectedness among systems, such as between air, land and sea; and

(e) Integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences.

Ecosystem-based management focuses on sustaining the ability of any given ecosystem to continuously provide essential ecosystem services. It recognizes that natural ecosystem boundaries are more important for consideration in management efforts than political jurisdictions and that ecosystem boundaries are porous (that is one system overlaps into another). It also requires accounting for the cumulative human effects on ecosystems via explicit considerations of impacts and tradeoffs.

(3) Spatial or Geographic Integration. It is important to define the geographic boundaries to encompass areas that are potentially affected by or that could affect candidate solutions so the solutions can be examined appropriately. The watershed is an appropriate geographic area to begin with because it usually encompasses the significant upstream and downstream impacts of an alternative. However, the larger the spatial zone of consideration – for example,

a coastal zone or ecoregion – the more likely it becomes possible to examine the full potential for water resources synergies and tradeoffs among all relevant resource elements.

(4) Information Needs. The Agencies shall recognize the difficulty in obtaining watershed-related information and acknowledge that a balanced approach is needed to address this concern and challenge. However, reasonable efforts must be made to obtain and analyze relevant data, even where available data at the outset may be limited. In addition, watershed planning is an interactive and adaptive process and thus preliminary information may need to be updated over the course of an evaluation where appropriate and accompanied by mid-course corrections.

E. Utilize Best Available Science, Practices, Analytical Techniques, Procedures and Tools

(1) Water resources planners and decision makers shall utilize the best available principles, data, analytical techniques, procedures, and tools in hydrology, engineering, economics, biology, risk and uncertainty, and other sciences. Water resources planning shall use contemporary water resources paradigms such as integrated water resources management and adaptive management, and consider the effects of climate change. Planners shall continuously seek to modernize tools and analytical techniques and not simply rely upon those used in the past because they are familiar. The data used shall be the best available. No data over five years old, other than long-term data sets used to establish historical events, trends and patterns, shall be used to portray existing and future conditions, unless the data are clearly shown to remain valid and representative of current conditions, or unless no other data are available or can be reasonably developed.

(2) Peer review of applied science and analytical techniques is a particularly valuable practice integral to successful water resources planning. Each agency shall adopt specific guidance on the type, scope and timing of peer review based on their respective types of studies and consistent with peer review standards in the community of practice. The levels of peer review may vary from internal reviews within local offices to fully independent external reviews conducted by third parties, such as the National Academy of Sciences.

F. Apply a Level of Detail Commensurate with the Potential Decisions

The level of detail applied in implementation studies may vary, but shall not be greater than needed to inform the decision efficiently and effectively. The level of detail, scope and complexity of analyses shall be commensurate with the scale, impacts, costs, scientific complexities, uncertainties, risks, and other sensitivities

(e.g., public concerns) involved in potential decisions. Each agency shall develop procedures to specify the level of detail for the types of implementation studies that they typically undertake.

G. Account for the National Benefits and Costs in Appropriate Monetary and Non-monetary Terms

The identification and enumeration of potential national benefits and costs are crucial in determining the feasibility of alternatives and selecting plans. In addition to fully documenting both monetary and non-monetary effects, planners shall strive to monetize currently non-monetized units to the extent possible as the ability to monetize various services becomes more well-established. Any application of non-monetary parameters must utilize consistent metrics in order to understand and compare alternatives.

H. Account for Significant Effects and Mitigate Unavoidable Impacts to Ecosystem Services

In the evaluation of alternatives (see paragraph 3.I. below), the following requirements for mitigation analyses shall be met:

(1) Detailed alternatives shall not be considered viable unless they comply with all applicable environmental laws and authorities, including protection of the nation's environment by mitigation of the adverse effects as defined in the Code of Federal Regulations for Compensatory Mitigation for Losses of Aquatic Resources. Key laws on mitigation include, but are not limited to, Section 906(d) of the Water Resources Development Act of 1986, Section 404 of the Clean Water Act, and Section 2036 of the Water Resources Development Act of 2007, all as may be amended. Accordingly, each alternative shall include mitigation developed in coordination with responsible natural resource management authorities and determined to be appropriate by the decision maker. Adaptive management shall be evaluated and incorporated into alternatives to the greatest extent possible when it helps to further avoid and minimize adverse impacts and ensure that any required mitigation performs as intended.

(2) The following sequence shall be followed to address adverse impacts to ecosystem services:

(a) Avoid – Wherever possible, avoid adverse impacts by modifying the alternative or applying another practicable alternative with less adverse impact.

(b) Minimize - If adverse impacts cannot be avoided, then minimize those impacts by modifying the alternative to the extent appropriate and practicable.

(c) Compensate – If unavoidable adverse impacts remain, then compensatory mitigation is required to the extent practicable. Compensatory mitigation may not substitute for avoiding and minimizing impacts.

(3) Compensatory mitigation shall be implemented, to the maximum extent practicable, in advance of or concurrent with the activities causing the impacts. In the rare instances where mitigation cannot be practicably implemented in advance or concurrently, then the reasons are to be presented in the decision document, including why other alternatives cannot more effectively avoid and minimize adverse impacts. The alternative shall show that mitigation will be implemented at the earliest opportunity.

I. Address Risk and Uncertainty, Including the Effects of Climate Change and Future Development

Decisions shall be made with knowledge of the degree of reliability of the available information; recognizing that even with the best available engineering and science, risk and uncertainty will always remain. Risks and uncertainties shall be identified and described in a manner that allows the public and decision makers to understand. This includes quantifying and describing the nature, likelihood, limitations, and magnitude of risks and uncertainties associated with key supporting data, projections, and evaluations for competing alternatives. This shall also include a concise discussion of what must happen, including the related probability or likelihood, in order to realize any projections. When uncertainties are about an alternative's ability to function as desired and/or to produce the desired outputs or other potential undesired outputs, and thus potentially affect the justification, selection, and/or acceptability of the alternative, improved data, models, and analyses should be pursued. Adaptive management measures should also be evaluated as part of the alternative in order to further reduce such uncertainty, particularly when more detailed information and better tools are not readily available.

Climate change represents persistent uncertainty that should be addressed in the planning process. The increased variability in temporal and spatial patterns of precipitation and water availability will challenge water systems serving all human needs. From specification of existing problems and opportunities to the formulation, evaluation and selection of plans, the accelerating changes in aquatic systems caused by a changing climate should inform our understanding of what our water resource needs are and how we can realistically respond to those needs.

J. Incorporate Public Safety

Threats to people, both loss of life and injury, from natural events must be assessed in the determination of existing and future conditions. Alternative solutions, including structural and nonstructural elements, must avoid, reduce and mitigate the risks of

such threats to the extent practicable. Alternatives shall include measures to manage residual risks. The impact and reliability of alternatives on these threats must be evaluated and shared with the public and decision-makers in an understandable manner.

K. Ensure Environmental Justice for Low Income, Tribal and Minority Communities

Evaluation methods shall eliminate any biases in analyzing projects affecting low-income communities by fully reflecting the benefits and costs (monetized and non-monetized) of alternatives to low-income communities.

Planning studies shall identify any disproportionately high and adverse public safety, human health or environmental effects of projects on minority, tribal and low-income populations and decision makers shall seek solutions that would eliminate or avoid disproportionate adverse effects on low income, tribal or minority communities. In addition, specific efforts shall be made to provide opportunities for effective participation by minority and low-income communities in the planning process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, documents, and notices.

L. Ensure the Planning Process is Fully Transparent

Planning study results shall be provided to the public in a clear, concise, and timely manner during the planning process in order to ensure public understanding and both enable and solicit public participation. This is intended to ensure that studies reasonably address the needs, interests and concerns of stakeholders, Tribal governments, affected agencies, non-governmental organizations, and individuals; and provide adequate opportunities for all to participate throughout the planning process. The presentations shall summarize and explain the decision rationale leading from the identification of need through the recommendation of a specific alternative. This shall include the steps, basic assumptions, analysis methods and results, criteria and results of various screenings and selections of alternatives, peer review proceedings and results, and the supporting reasons for other decisions necessary to execute the planning process. The information shall enable the public to understand the decision rationale, confirm the supporting analyses and findings, and develop their own fully-informed opinions and/or decisions regarding the validity of the study and its recommendations. Opportunities shall be provided for public reaction and input prior to key study decisions, particularly the tentative and final selection of recommended plans. The above information shall be presented in a decision document or documents, and made available to the public in draft and final forms. The document(s) shall demonstrate compliance with the National Environmental Policy Act (NEPA) and other pertinent Federal statutes and authorities.

M. Collaborate Implementation Study Activities Broadly

Federal agencies shall collaborate fully on water resources studies with other affected Federal agencies, and with Tribal, regional, state, local, and non-governmental entities to realize more comprehensive and better informed problem resolutions. The method and scope of the collaborative effort shall be driven by the nature of the study, problems, and likely solutions.

Collaboration in the Federal water resources planning process may include:

(1) Sharing of data, analytical tools, or expertise unless protected from release by law;

(2) Inclusion on interdisciplinary or inter-agency study teams;

(3) Participation in independent or peer review of the study products;

(4) Development and implementation of complementary projects and programs by others; and

(5) Post-project review and development of adaptive management.

3. Overview of the Planning Process

Planning is an orderly and systematic process for solving problems and reaching a rational, unbiased, and fully-informed recommendation for decision makers. Performed transparently, it enables the public to understand the rationale and critical information supporting the recommended decision, and in turn help inform the decision makers. The process is enduring and useful for virtually any public planning activity. The following framework outlines the planning process for Federal water resources implementation studies. It must be applied to ensure recommendations for Federal action are viable and warranted.

The planning process is a dynamic and iterative step-by-step process. Each step confirms, modifies or adds to the information developed in prior steps. New information, regardless of source, may cause prior steps to be reconsidered and revised at any point in the process. This includes adding and modifying objectives and alternatives as well as the many other aspects of studies. Agencies shall consider repeating any of the various steps when potential revisions are likely to significantly change the selection, composition and/or effects of the recommended plan.

A. Initiating Implementation Studies

The efforts preceding the initiation of a Federal water resources implementation study generally result in preliminary information to help guide the formation of a study. These efforts may include prior studies, coordination within the watershed, and efforts to secure the authorization and/or appropriations for a study. This preliminary information provides a basis for setting the initial study area, objectives, scope, scale, timeframe, tasks, topics for special attention, and sometimes potential solutions necessary to successfully complete a study.

Agencies are responsible, throughout the study process, for ensuring that each study warrants their continued participation based on their authorized missions, Executive Branch priorities, and Congressional directions.

B. Scoping Process

Shortly after initiating the study, pertinent preliminary information regarding the study shall be shared with affected Federal, State, and local agencies, Tribal governments, and other interested groups or persons in an open forum. As a minimum, the forum shall address the tentative study area, problems and opportunities, any related current or future planning or implementation by the agency or others that is not part of the study, needed environmental assessments and consultations, and schedules for the study and decision-making. Input shall be solicited to identify likely significant issues and decision factors, and to help ensure unneeded studies are not undertaken. Plans for executing the study shall be revised as needed in response to this input. This process shall be conducted to fulfill the scoping process requirements described in CEQ's NEPA regulations.

C. Define the Study Area

The study area shall encompass the significant resources affecting the potential need for action or likely to be affected by those potential actions, both directly and indirectly. The watershed, and its surrounding and connected ecosystems, including the coastal and ocean waters into which the watershed may be connected, is generally the most appropriate geographic area. The study area shall be extensive enough to consider synergies and tradeoffs among affected resources, and interactions among existing water resources projects and programs, including watershed planning efforts. This includes any current or future planning by the agency or others and expected implementation that is related to but not part of the study under consideration.

D. Determine Existing and Future Conditions

A determination of the existing conditions within the study area provides the basis for confirming the problems, needs, and opportunities to be addressed in the study, as well as the subsequent steps. Depictions of existing conditions shall be based on inventories and analyses of the quantity and quality of water and related resources in the study area. Aspects include significant hydrologic (surface and subsurface), topographic, geomorphic, economic, ecological, climatic, social, cultural, historic, and aesthetic conditions, including pertinent existing infrastructure. Inventories should include resources pertinent to the study, but not necessarily exhaustively list all resources in the area. They provide an opportunity to identify potential alternative solutions, including preserving and restoring the various resources. This step corresponds to the NEPA requirement to identify the affected environment.

The depiction of existing conditions provides the basis for projecting the future conditions that are the most likely to occur during the period of analysis – without the implementation of any alternatives considered in the study. The most likely without-plan future condition must be identified based on measurements, statistics, observations, and other evidence. Professional judgment may be applied where data are lacking, as long as the rationale and assumptions are displayed. The most likely without-plan future condition shall serve as the basis for evaluating and comparing the incremental effects of alternative solutions. The basis for projecting the changes from the existing condition to the most likely without-plan future condition, including what must happen and the probability or likelihood to realize the expected future condition must be transparent. The most likely without-plan future condition is synonymous with “No Action” as used in NEPA and the CEQ NEPA regulations.

Because the future is uncertain, alternative without-plan future conditions may be identified as separate scenarios. The scenarios shall only be used as sensitivity tests to assess the robustness of competing alternatives, inform the plan selection, and more fully depict the potential performance of the selected plan. The probability or likelihood of each future condition and its affects shall be presented. Key uncertainties for both existing and future conditions shall also be disclosed, such as uncertainties in the water and related resources, climate change, human activities, or in limited understanding of hydrologic, geomorphic or ecological processes. Such information will help establish the soundness of the study’s recommendations.

E. Identify and Describe Problems and Opportunities

Based on the most likely without-plan future conditions, identify the specific problems and opportunities to be addressed by the study. The problem and opportunity statements provide much of the basis for the study objectives and any study constraints developed below. The statements shall address the full range of

significant water and related resources problems and opportunities in the study area, particularly those declared to be in the National interest by the Congress or the Executive Branch. They shall reflect the perspectives of the scoping process participants. Statements shall be considered to address whether existing agency owned and operated projects or systems within the study area serve contemporary needs or may warrant modifications. This step corresponds to the requirement in the National Environmental Policy Act (NEPA) to define the purpose and need.

F. Specify the Study Objectives

Study objectives stating desired effects shall be specified to direct and focus study activities. One or more of the study objectives must clearly contribute to the National Objectives and one or more of the agency's missions. The study objectives must be broadly defined to avoid dictating a specific or narrow range of alternatives. They shall reflect the specific effects that are desired by groups and individuals external to the agency as well as any declared to be in the National interest by the Congress or the Executive Branch.

G. Specify the Planning Constraints

Constraints on the planning effort shall be specified. They may include resource constraints, agency policy and mission constraints, legal constraints, actions or effects that must be excluded or avoided, and other limitations.

H. Formulate Alternatives

(1) Alternative solutions or plans shall be formulated in a systematic manner to address the stated study objectives, consistent with the planning constraints. The range of alternatives must allow due consideration of all reasonably practicable solutions, including a full range of potential contributions, and ensure the one with the greatest net contribution to the National Objectives is identified. This includes consideration of incremental differences in scale and measures, and contributions to various mixes of the objectives.

(2) The most likely without-plan future condition shall be automatically included as the "No Action" Alternative. At least one alternative with nonstructural measures shall be formulated and identified as the "*primarily nonstructural alternative*." Various combinations of structural and nonstructural elements shall be formulated when reasonable to ensure the best alternative is identified. In some cases, a technically and environmentally viable, primarily non-structural alternative might not exist. If so, the study shall document efforts to identify such an alternative and explain why no such alternative other than the No Action

alternative could be formulated. Various schedules for implementing alternatives must be considered in order to further maximize net contributions to the National Objectives. Existing water and related resources plans developed by others, such as State water resources plans and watershed plans, shall be included as alternatives when reasonably consistent with the study objectives. Alternatives shall also be formulated as needed to adequately address other Federal, State, Tribal, local, and international concerns. If any reasonable and viable alternative is determined to be "*environmentally preferable*", then the appropriate NEPA documentation must identify it as such.

(3) All alternatives shall be formulated to fulfill the following criteria: completeness, effectiveness, efficiency, and acceptability. An alternative must include appropriate compensatory mitigation in accordance with paragraph 2.H. above before it may be considered complete.

(4) Potentially viable alternatives must also comply with existing Federal statutes, authorities, and policy including, but not limited to the Clean Water Act, Endangered Species Act, and the NEPA, or include proposed changes in any statutes, authorities, or policy that would otherwise preclude implementation. When a law or other institutional barrier would prevent implementation of an otherwise reasonable alternative, the alternative may include a proposal with supporting rationale to remove the barrier.

(5) Each alternative shall be described in sufficient detail to permit the evaluation of effects described in paragraph 3.I. below. Each description shall discuss how the alternative meets the four formulation criteria described in paragraph 3.H. (3) above in this Section. When alternatives include elements that could be implemented collaboratively by other Federal agencies, State, local, and Tribal governments, and/or nongovernmental entities, the description shall identify each element, the implementing entity, and its respective role.

(6) The NEPA process and alternative formulation are integrally related. As alternatives are developed in the planning process, they must be evaluated for reasonableness under NEPA as well as these standards. Even though alternatives are evaluated based on meeting the stated problems, needs, and opportunities as well as the Federal purposes related to the proposed action, alternatives do not need to be formulated specifically for each of the evaluation categories described below (e.g., Monetary Effects Category, Regional Economic subcategory, Natural Resources Subcategory, etc.). The evaluation categories are used to provide information for the alternative comparison and recommendation process, however, no single category shall be the principal driving factor considered in alternative formulation.

I. Evaluate the Potential Effects of the Alternatives

Each alternative shall be evaluated for its effectiveness, completeness, acceptability, and efficiency in contributing to the National Objectives and each of the other study objectives in accordance with the following standards:

(1) Evaluate the incremental effects of each alternative as the differences between the most likely future conditions with the alternative and the most likely without-plan future conditions (the No Action alternative);

(2) To the extent practicable, quantify benefits and costs and express them in monetary terms and for quantified effects that are not monetized utilize metrics that allow comparisons and tradeoffs to be made evident;

(3) Estimate the net overall contribution to each of the study objectives, quantitatively when possible; and

(4) Report the scope and results of the evaluations in the categories described below. Report the positive and negative effects, including determinations of “no effect.” The categories are organized by benefit type, either monetary or non-monetary. All monetized effects shall be included in the monetary category and excluded from the non-monetary category to avoid double-counting any effect, even when the effects were not ordinarily monetized in the past, such as many environmental effects. The use of standardized categories will assure consistency of displaying and reporting among the agencies, which will in turn make it easier to review documents and compare alternatives, plans and projects. The categories encompass all significant effects of an alternative on the human environment as required by NEPA. They also encompass social well-being as required by the Flood Control Act of 1970.

(a) Monetary Effects Category. Monetary effects include the part of the NEPA human environment that identifies effects on the economy. The monetary effects are the beneficial and adverse effects on the economy that can be measured as changes in the value of the output of goods and services, and expressed in monetary units. These can include methods for monetizing non-market goods and services such as ecosystem services and other social effects. “Opportunity cost" is the appropriate concept for valuing both benefits and costs. The principle of "willingness-to-pay" (WTP) captures the notion of opportunity cost by measuring what individuals are willing to forgo to enjoy a particular benefit. Willingness to pay for changes in the quantity or quality of a good or service may be estimated using both revealed and stated preference estimation methods that are theoretically correct in the economics valuation literature. When other considerations are equal, revealed preference data shall be used over stated preference data because revealed preference data are based on actual decisions, where market

participants enjoy or suffer the consequences of their decisions. (See OMB Circular A-4 for further discussion).

Other monetary effect considerations include:

1. For convenience of measurement and analysis, monetary costs shall be classified as implementation outlays, associated costs and other direct costs.

2. The monetary effects shall include the incidental direct effects of an alternative that increases economic efficiency and are not otherwise accounted for in the evaluation.

3. Each monetary effect, including any monetized ecological service or other social effects shall be displayed in one or both of the following categories:

a. National Economic Subcategory. This subcategory includes the changes in the economic value of the output of goods and services, both market and non-market, and the value of using otherwise unemployed or under-employed labor resources. Adverse effects include the opportunity costs of resources used in implementing an alternative; i.e., implementation outlays, associated costs, and other direct costs. Beneficial and adverse effects on the National economy shall be determined and shall be displayed separately from regional monetary effects.

b. Regional Economic Subcategory. This subcategory includes the changes in the distribution of regional monetary effects that result from each alternative shall be displayed when they are significant to local, state, and regional decision making, or needed to address other concerns of the public. A region may be defined as needed to address these concerns. Regional effects include the National effects that accrue within the region, plus transfers of income into or out of the region relative to the rest of the Nation. The monetary effects of an alternative not occurring within the defined region shall be displayed in a “Rest of Nation" category. Regional changes include National effects, income transfers, and employment effects.

(b) Non-Monetary Effects Category. Non-monetary effects include that part of the NEPA human environment that identifies effects on ecological resources and attributes, risks to humans from natural disasters, and other types of social effects including aesthetics, cultural resources, and the portion of ecosystems that are not successfully monetized.

1. Natural Resources Subcategory. This subcategory shall display the effects of alternatives on significant ecological resources and attributes of the NEPA human environment. Effects shall be measured as favorable and unfavorable changes in significant natural resource quality and quantity. Value is indicated by the scarcity and significance of ecosystem components. Significance shall be based on scientific, technical, institutional and other indication of public desire for certain ecological conditions.

Relationships between short-term use of the human environment and the maintenance and enhancement of long-term productivity shall be displayed in this category. Any irreversible or irretrievable commitments of resources shall be displayed.

2. Public Safety Subcategory. This subcategory shall display the effects of alternatives on risks to humans from floods, storms and droughts. These effects include changes in residual risk, the frequency or intensity of natural hazards, reliability of risk management measures, the number of people at risk in hazardous events, the number of potential fatalities that could result from the hazard, and the ability and means for affected people to evacuate or otherwise avoid injury and loss of life. This subcategory shall display all beneficial and adverse Public Safety effects for each alternative, particularly residual risks and measures necessary to address and communicate residual risks to the affected population. These effects shall generally be expressed numerically.

3. Other Social Effects Subcategory. This subcategory displays effects that are not addressed monetarily or in the other two categories immediately above. These effects may be evaluated in terms of their impacts on separate regions and communities. They shall be expressed in numeric units, or non-numeric terms. This subcategory includes:

- The Urban and Community impacts include effects on human population groups that are not addressed in the other subcategories, such as income distribution; employment distribution; population distribution and composition; the fiscal condition of the State, Tribal, and local governments; and the quality of community life, including community cohesion. It shall address any disproportionately high and adverse human health or environmental effects on minority populations. Effects on low-income populations shall be addressed in order to assure environmental justice. This category shall demonstrate that the alternatives would not exclude people (including populations) from participation or benefits, or subject them to discrimination because of their race, color, or national origin. Types and locations of significant impacts, broken down by salient population groups and geographic areas, may be reported here. It shall address the relative

value of alternatives to any potentially affected low-income communities.

- The Life and Health impacts include effects on the quality of life and health as a result, for example, of potential loss of property and essential public services, and other environmental effects such as changes in air and water quality, as well as soil and solid waste not reported in the other categories. It also encompasses social well-being, as required by Section 122 of the Flood Control Act of 1970 (Public Law 91-611, 84 Stat. 1823).

- Displacement includes the displacement of people, businesses, and farms.

- Long-Term Productivity includes sustaining and enhancing the productivity of resources, including the maintenance of ecosystem services, processes, and biodiversity,, for use by future generations.

- Cultural and Historic Resources include effects on cultural and historic resources, including traditional cultural properties, and describe measures to preserve such resources and the mitigation of unavoidable adverse impacts.

- Aesthetics include effects on perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation, including sights, sounds, scents, tastes, and tactile impressions and the interactions of these sensations, of and with natural, cultural and historic resources.

(5) Alternatives shall be evaluated for their degree of integration with and contribution to established Federal, State, Tribal, and local watershed plans.

(6) Other information that is required by law or that would have a material bearing on the decision making process shall be included within the above categories or in some other appropriate format used to organize information on effects.

(7) Each category shall summarize the available assessments of risk or uncertainty regarding any of the effects addressed within the category in order to convey the likelihood that the alternative will actually produce the predicted effects and achieve the National Objectives and the rest of the study objectives.

(8) An effect may be shown only once within a given category except that the Other Social Effects category may address an effect from more than one point of view. Beyond this exception, claiming the same benefit, cost, or effect more than

once in a given category would constitute double counting, which is unacceptable.

(9) The period of analysis shall be the same for all alternatives, and shall reflect the period of time that alternatives would produce significant beneficial or adverse effects. The period of analysis begins when alternatives begin to produce substantial benefits, typically when basic implementation is completed.

(10) All monetary values shall be converted to a common time basis. Cost estimates shall be presented as present values. Costs and benefits shall be presented as average annual equivalent values. Costs and benefits shall be discounted using rates prescribed by law or executive order.

J. Compare and Screen Alternatives

(1) Alternatives shall be compared and, based on the differences in effects as determined in the evaluation phase above, either selected for further analysis or selected as the recommended plan for approval and implementation. Alternatives are considered potentially viable if they fulfill all of the criteria cited above – completeness, effectiveness, efficiency, and acceptability. Only potentially viable alternatives shall be carried through screening and selection steps. Alternatives may be reformulated and reevaluated as needed to help meet these criteria and the study objectives. A stepwise screening process to limit the alternatives subjected to more detailed analyses may reduce study time and cost. Any screening or selecting of alternatives shall apply common criteria and use a similar level of detail of information for all alternatives under consideration. When an alternative is added or altered, any prior screening or selection steps must be updated to reconfirm those actions. The criteria and other information used in comparisons shall be displayed to aid decision making and ensure transparency. The effects and related tradeoffs among the alternatives shall be clearly displayed using the five categories outlined in paragraph 3.I. above.

(2) Multiple alternatives shall be carried forward into subsequent analyses if the choice of any alternative requires a significant tradeoff among the problems and opportunities to be served. The alternatives that could be recommended for implementation are identified as the final array of alternatives. As a minimum, the final array shall include the No Action alternative, the primarily nonstructural alternative, and the environmentally preferable alternative. The No Action and environmentally preferable alternatives may be the same.

(3) The comparison, screening, and selection of alternatives shall consider both monetary and non-monetary impacts, including significant impacts that are not quantified. Trade-offs across all impacts should be fully displayed and explained to support all screening and selection decisions. In situations involving impacts

with different units of measurement and/or impacts that are not quantified, threshold or break-even analyses should be applied as needed to help compare alternatives and support tradeoff decisions. This includes the analysis and display of incremental changes in the various impacts due to incremental changes in the scale and composition of alternatives. Decisions to select alternatives for further consideration should emphasize contributions to the National Objectives and areas of special consideration, including achieving public safety, environmental justice, equal treatment for low income and minority communities, and the application of nonstructural solutions. When nonstructural alternatives or alternatives that would achieve environmental justice or equal treatment for low income and minority communities are screened from further consideration, the rationale shall be fully explained and highlighted in the decision document.

K. Recommend a Plan

(1) The decision maker shall recommend the alternative for implementation that provides the greatest net combined contribution to the National Objectives, subject to the following:

(a) The recommended plan must provide combined beneficial effects for the Nation that outweigh the combined adverse effects considering all significant monetary and non-monetary impacts, both quantified and unquantified;

(b) If the recommended plan is not a primarily non-structural alternative, the decision maker must explicitly address the reasons why these objectives are not reasonably achievable; and

(c) The recommended plan must not preclude other non-Federal plans that would likely be undertaken in the absence of the Federal plan and/or that would more effectively contribute to the National Objectives;

(2) The Secretary or Independent Agency Head may grant an exception to allow the decision maker to recommend an alternative that does not provide the greatest net overall contribution to the National Objectives where there are overriding reasons for recommending another alternative, including other Federal, State, Tribal, local and international concerns, and to address environmental justice issues.

(3) The basis for selection of the recommended plan shall be fully reported and documented, including the criteria and considerations used in the selection and the overriding reasons for any exception granted as described immediately above, to ensure the basis for the recommendation is fully transparent.

4. Glossary

Acceptability is the viability and appropriateness of an alternative from the perspective of the Nation's general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

Adaptive Management is a deliberate, iterative, and scientific based process of designing, implementing, monitoring and adjusting a measure or project to reduce uncertainty and maximize one or more resource objectives over time.

Associated Costs are the costs, in addition to implementation outlays, for measures needed to achieve the benefits claimed during the period of analysis.

Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others.

Cost Effectiveness is the extent to which an alternative achieves a set of objectives at the least cost.

Ecological Attributes are components of the environment and the interactions among all of its living (including people) and nonliving components that directly or indirectly sustain dynamic, naturally diverse, viable ecosystems. This includes functional and structural aspects that require special consideration.

Ecological Resources are natural forms, processes, systems, or other phenomena that are related to land, water, atmosphere, plants, or animals; and have one or more ecological attributes.

Ecoregion is a large area of land or water that contains a geographically distinct assemblage of natural communities that share a large majority of their species and ecological dynamics; share similar environmental conditions, and; interact ecologically in ways that are critical for their long-term persistence (from World Wildlife Fund).

Ecosystem is the dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a system.

Ecosystem-Based Management is an integrated approach to management that considers the entire ecosystem, including humans.

Ecosystem Functions are the interactions among organisms and between organisms and their environment.

Ecosystem Services are the direct or indirect contributions that ecosystems make to the environment and human populations.

Effectiveness is the extent to which an alternative alleviates the specified problems and achieves the specified opportunities.

Efficiency is the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost.

Floodplain Functions include, but are not limited to: a) water resources (natural flood, sedimentation and erosion control, water quality maintenance, groundwater recharge); b) living resources (fish, wildlife, plant resources and habitats); c) societal resources (open space, natural beauty, scientific study, outdoor education, archaeological and historic sites, recreation); and d) cultivated resource values (agriculture, aquaculture, forestry).

Implementation Outlays are the financial outlays (including operation, maintenance and replacement costs) incurred by the responsible Federal entity and by other Federal or non-Federal entities for implementation of the alternative in accordance with sound management principles. These costs do not include transfer payments such as replacement housing assistance payments as specified in 42 U.S.C. 4623 and 4624.

Incidental Direct Effects are National Economic effects that increase economic efficiency but are not otherwise accounted for in the evaluation. They are incidental to the purposes for which the alternative is formulated. They include incidental increases in output of goods and services and incidental reductions in production costs.

Incremental Cost Analysis compares the incremental costs of measures to their incremental outputs in an orderly manner to identify the optimal scale or combination of measures. Increments continue to be added as long as the incremental benefits are judged to exceed the incremental costs. When the incremental costs are judged to exceed the incremental benefits, no further increments are added. The outputs may be monetary or non-monetary. When used in conjunction with cost effectiveness information, an incremental cost analysis can help decision makers compare alternatives and determine the most desirable level of output relative to costs and other decision criteria.

Integrated Water Resources Management is a deliberate, systematic and balanced approach to making management and development decisions for water resources. It considers potential effects on all of the different yet interdependent uses of water resources. It accounts for the needs of a sustainable environment and the many different and competing social and economic interests.

No Action Alternative is the set of future conditions that are the most likely to occur during the period of analysis without the implementation of any alternatives considered in the study; i.e., the most likely without-plan future condition.

Nonstructural Measures generally avoid or minimize adverse changes to the existing hydrologic, geomorphic, and ecological processes, particularly for floodplain functions and the aquatic environment, by altering the use of existing infrastructure or by altering human activities (for example, revised operation plans, congestion pricing or green infrastructure techniques). Nonstructural measures include, but are not limited to, modifications in public policy, management practice, regulatory policy, and pricing policy.

Operation and Maintenance is the daily and annual routine work necessary for the safe and efficient functioning of a project to produce the benefits set forth in its authorization.

Other Direct Costs are the costs of resources directly required for an alternative, but for which no implementation outlays are made. These costs are uncompensated, unmitigated National Economic losses caused by the installation, operation, maintenance, or replacement of an alternative's measures.

Period of Analysis is the time duration used in the evaluation of impacts of the alternatives, particularly the economic costs and benefits. It normally begins on the date construction would end and/or the alternative would begin to produce a significant portion of its intended benefits. A period of analysis is not the service life, which may be longer or shorter, or the life of the project, which is generally indefinite for specifically authorized projects; i.e., until Congress deauthorizes the project and subsequent removal, abandonment, and/or divesture actions are completed.

Practicable alternative, project or plan is if it is available and capable of being done after taking into consideration cost, existing technology and logistics in light of the project purpose.

Study Objectives are statements to alleviate specific problems and/or realize specific opportunities; i.e., achieve certain effects. They are statements of the study purpose and are intended to focus the study activities.

Preserve is to protect ecosystem resources from harm and destruction.

Primarily Nonstructural Alternative consists primarily, if not entirely, of nonstructural measures.

Reallocation is the reassignment of a resource, such as storage space in a reservoir, from one purpose to another, generally with measurable impacts on various resource users.

Rehabilitation refers to the activities necessary to bring a deteriorated project back to its original condition.

Repairs entail those activities of a routine nature that maintain the project in a well kept condition.
Replacement covers those activities taken when a worn-out element of a project or a portion of an element is replaced.

Restore means to return to a less degraded state.

Separable Element is any part of a project which has separately assigned benefits and costs, and which can be implemented as a separate action (at a later date or as a separate project). A separable element has independent utility.

Significance means likely to have a material bearing on the decision making process. Significant non-monetary resources, attributes and/or effects are institutionally, publicly, and/or technically recognized as important to people. The criteria for significance may vary by resource, location and perspective.

Structural Measures are those that intentionally modify existing hydrologic and/or geomorphic processes, often by constructing or modifying a hydraulic control structure such as a dam, levee or pumping plant.

Sustainable means to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations of Americans (Executive Order 13423, January 26, 2007).

Unwise Use is any action or change that is incompatible with or adversely impacts one or more resources to the extent that it or they are no longer self-sustainable. For floodplains this includes floodplain functions.

Watershed means a land area that drains to a common waterbody, such as a stream, lake, estuary, wetland, or ultimately the ocean.