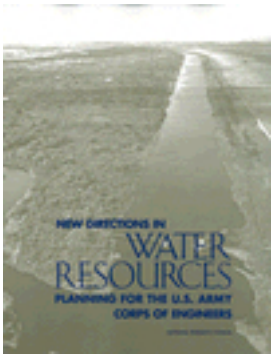
# Free Executive Summary

## New Directions in Water Resources Planning for the U.S. Army Corps of Engineers




Committee to Assess the U.S. Army Corps of Engineers Water Resources Project Planning Procedures, National Research Council

ISBN: , 120 pages, 8.5 x 11, paperback (1999)



*The U.S. Army Corps of Engineers has long been one of the federal government's key agencies in planning the uses of the nation's waterways and water resources. Though responsible for a range of water-related programs, the Corps's two traditional programs have been flood damage reduction and navigation enhancement. The water resource needs of the nation, however, have for decades been shifting away from engineered control of watersheds toward restoration of ecosystem services and natural hydrologic variability. In response to these shifting needs, legislation was enacted in 1990 which initiated the Corps's involvement in ecological restoration, which is now on par with the Corps's traditional flood damage reduction and navigation roles. This book provides an analysis of the Corps's efforts in ecological restoration, and provides broader recommendations on how the corps might streamline their planning process. It also assesses the impacts of federal legislation on the Corps planning and projects, and provides recommendations on how relevant federal policies might be altered in order to improve Corps planning. Another important shift affecting the Corps has been federal cost-sharing arrangements (enacted in 1986), mandating greater financial participation in Corps water projects by local co-sponsors. The book describes how this has affected the Corps-sponsor relationship, and comments upon how each group must adjust to new planning and political realities.*

# Executive Summary

The U.S. Army Corps of Engineers has long been the primary federal agency responsible for developing the nation's harbors, waterways, and water resources, having planned and built structures for flood damage reduction and navigation enhancement for nearly 200 years. In its efforts to address the nation's water-related problems and to meet larger social and environmental goals, the Corps has developed a standard set of project planning procedures. Through much of its history, funding for Corps studies and projects was often entirely provided by the federal government. With passage of the federal Water Resources Development Act of 1986 (WRDA '86), however, matching funds from local sponsors were required for most Corps projects.

Planning and construction of Corps projects is complex and thus has always been lengthy. The average planning time of a Corps project today is roughly 5.6 years. When WRDA '86 mandated that local sponsors make significant monetary investments in Corps studies and projects, this increased financial stake brought a desire to see results more quickly and at a lower cost. Local project sponsors have voiced some of the stronger complaints that the Corps' planning procedures take too long.

To help streamline its planning, the Corps requested the Water Science and Technology Board of the National Research Council to form a study committee to identify ways to shorten the planning period and improve results. The committee's charge identified four broad tasks:

1. Assess the Corps' project planning process to determine if all steps are necessary and if the process can be streamlined. Is the Corps' planning effort reasonable, given the level of investment?
2. Consider the necessity for a major evaluation of the *Principles and Guidelines*. Can this process be streamlined without undue harm to land and water resources?
3. Consider how the cost-sharing requirements of the 1986 Water Resources Development Act have affected the potential development of new Corps water projects. This should address the number and size of projects, as well as effects on study duration and timing.
4. Consider how the requirement to include risk and uncertainty analysis has affected project planning, development, and the range of alternatives considered.

Various federal, state, and local laws, such as the Endangered Species Act

(ESA) and the National Environmental Policy Act (NEPA) at the federal level, and complementary acts at the state level, affect the Corps' planning process. Local sponsor plans and perceptions also influence the Corps, although these are primarily external to the Corps' internal planning procedures. This study's findings and recommendations address the task statement from two levels of analysis: issues internal to the Corps' organizational structure and issues that go beyond and are external to the Corps.

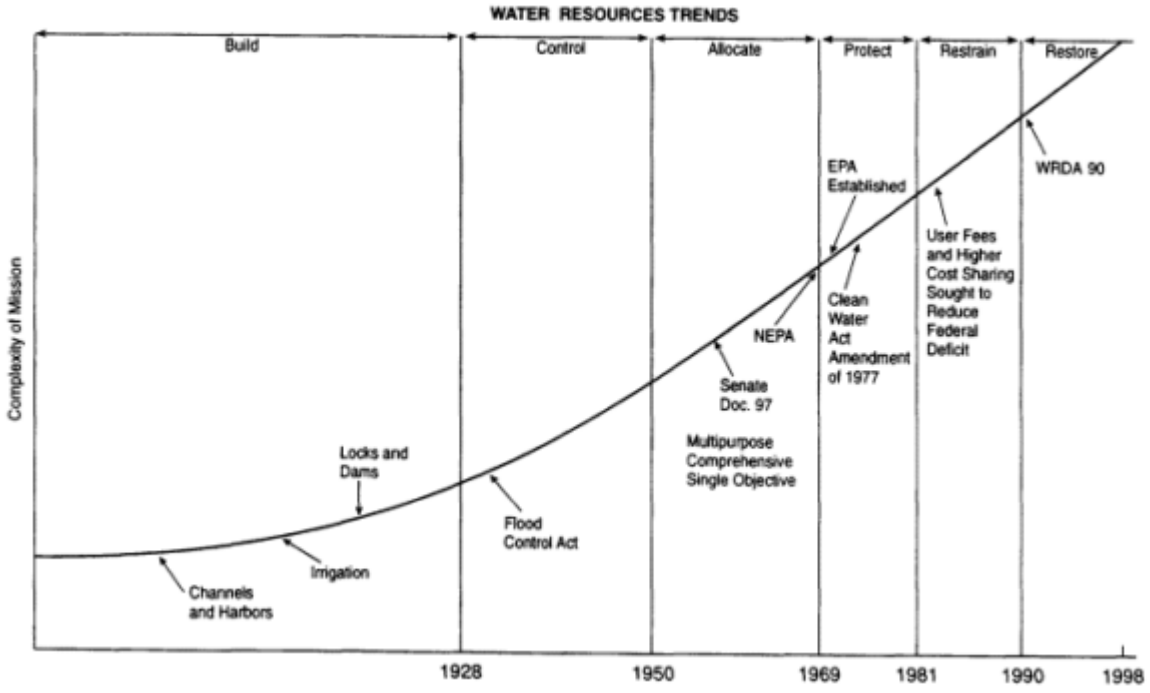
The Corps of Engineers project planning process is divided into two stages, a reconnaissance study and feasibility study, which together require an average of 5.6 years to complete. Corps reconnaissance studies, which are conducted by the Corps' district offices, are today required to be completed within 12 months. There is then often a lag between the end of project reconnaissance and the start of a feasibility study. Between 1985 and 1996, the average length of this gap was roughly one year. Feasibility studies between 1985 and 1996 averaged 3.6 years.

The committee investigated in detail the length of various components of the planning process and the means by which they might be shortened. Although the Corps recently has made considerable progress in streamlining its planning, it could take other steps. For example, the committee recommends that **when it appears to the Corps and the local sponsor that a reconnaissance study will have a favorable outcome, they should immediately begin the steps required for the next planning phase, the feasibility study. The committee also recommends that a negotiated preconstruction engineering and design (PED) cost-sharing agreement be completed at the same time as the division (chief) engineer's report is released to Corps headquarters.**

The committee generally agrees with the current requirement that the Corps consider a broad range of alternatives during project planning. **However, the Corps should develop a simple procedure that allows for the omission of analysis of expensive alternatives that are unlikely to be adopted, and stages of review for small projects for which a broad consensus exists.**

Some of this committee's suggestions for *improving* the planning process—such as greater consultation with local sponsors and more thorough analysis of complex restoration projects—will not result in *shortening* that process. Thorough, careful water resources planning is a complicated undertaking. Water projects have become more complex as our knowledge of physical and biological systems has increased, and as planning requirements (such as environmental impact statements, biological models, and consideration of basinwide biophysical impacts) have become greater (Figure ES.1). It is not unusual for private-sector water projects, such as the planning of a water supply system, to take several years. Such private-sector projects are often simpler, have more localized effects, face fewer regulatory requirements, and serve a narrower range of clients than does a Corps of Engineers project. Expectations of the Corps' ability to reduce further the time required in its planning should be realistic. While the Corps may be able to trim several months from its project planning procedures, it would be unreasonable to expect years to be trimmed from the process.

The committee was requested to consider the necessity for a review of the main document that guides federal water planning, the *Principles and Guidelines for Water and Related Land Resources Implementation Studies*, which were approved in




ES.1
Trends in the evolution of the Corps of Engineers responsibilities and approaches.
Source: Adapted from Steinberg, 1984.

1983. Often called the *P&G*, these guidelines are based on the original *Principles and Standards for Planning Water and Related Land Resources* (the *P&S*, which were approved in 1973 and repealed in 1982). The *P&G* provide comprehensive guidance on decision making and analytical procedures and are used by the Corps and three other federal agencies: the Bureau of Reclamation, the Natural Resources Conservation Service, and the Tennessee Valley Authority.

While they were in effect, the *P&S* were consistently reviewed and updated by federal and other water planning specialists. By contrast, the *P&G* have not received the same degree of attention and, as a result, do not adequately reflect contemporary water resource planning principles and practices. Although these guidelines have proven useful to the Corps since the document was developed in 1983, there have since been substantial advances in environmental evaluation methods and significant changes in the typical Corps of Engineers project. It is thus time for a comprehensive revision. Examples of specific revisions to the *P&G* which the committee recommends include:

1) movement away from consideration of the National Economic Development (NED) account as the most important concern. Today, ecological and social considerations are often of great importance in project planning and should not necessarily be considered secondary to the maximization of economic benefits. Strict adherence to the NED account may discourage consideration of innovative and nonstructural approaches to water resources planning. Furthermore, any water development alternative that does not meet environmental criteria and regulations—even though it may maximize monetary benefits—cannot be implemented.

   The notion of NED as formulated in 1983 may not fit contemporary planning and social realities. The Corps is aware of these issues, as evidenced in a recent Corps document. A Corps draft guidance dated 31 October 1997 (an updated draft version of the Corps' other key planning document, ER-1105-2-100) describes how an "NER" (national ecological restoration) account could be used, as well as an "optimum trade-off plan" designed to reasonably maximize the sum of NED and NER.
2) legislation passed after 1983 mandated new responsibilities for the Corps' in the areas of environmental improvement and restoration. Many aspects of these environmental programs are exempt from meeting some of the *P&G* requirements because they were enacted after the *P&G* were passed. The *P&G* should be updated to reflect these new and important Corps programs.
3) new techniques in risk and uncertainty analysis have been developed since 1983 and incorporated in Corps planning guidance. The *P&G* should be updated to reflect these new advances.
4) nonstructural approaches to flood damage reduction have gained much wider acceptance since 1983. The *P&G* should be updated to eliminate biases or disincentives that work against nonstructural approaches, and to ensure that the benefits of flood damages avoided by nonstructural projects are consistently and uniformly considered.

In summary, the committee recommends that **the federal *Principles and Guidelines* be thoroughly reviewed and modified to incorporate contemporary**

**analytical techniques and changes in public values and federal agency programs.** The executive branch, which approved the *P&G* in 1983, should take the necessary steps to update the guidelines so that they reflect contemporary planning principles and methods and address the full range of responsibilities in the Corps' work program.

The *P&G* were written by the Water Resources Council (WRC), an executive level body created in the mid-1960s to coordinate the formulation and execution of federal water policies. Today, however, the WRC lies dormant due to lack of funding and the *P&G* are currently administered by the Office of Management and Budget (OMB). Given the WRC's current status, the procedures for modifying the *P&G* are not clear. This lack of procedural clarity, however, should not be allowed to delay a review and update of the *P&G.* The executive branch should use its authority to find the means to modernize the *P&G* so that the document better reflects contemporary water planning theories and practices.

The committee was also requested to review implications of the Water Resources Development of 1986, significant for the cost-sharing criteria it enacted. Cost-sharing is not a new requirement, as some federal-nonfederal cost-sharing arrangements date back several decades. But the requirements initiated in WRDA '86 brought tremendous changes to project funding arrangements. A general result of WRDA '86 was to increase the funding responsibilities of local sponsors. With these greater financial requirements, local sponsors requested and received a greater voice in project planning and design considerations. The Corps has also become more receptive to local sponsor participation.

The emphasis on local projects and cosponsors may be pulling the Corps in opposite directions, however. On one hand, WRDA '86 mandates the Corps to work closely with local cosponsors, effectively providing a service to local communities. On the other hand, the Corps is charged to promote the national interest in its water planning activities. Promoting this national interest may require integrating plans and programs throughout a large river basin system (especially an interstate basin), which may be incompatible with providing specific water projects tailored to local—not basinwide—interests.

To promote efficient plans and projects across the nation's river basin systems, **the Corps should use the watershed or river basin, estuarial region, and coastal unit as the basic spatial units in water project planning, when and where it is appropriate and circumstances allow.** The use of such hydrologic units for planning can help account for downstream effects of flood damage reduction projects, for example, or provide a system to account for cumulative effects of Corps projects. Most of the nation's large river basins cross state lines, suggesting the need for federal involvement in data storage and management, hydrologic modeling, and analysis of systemwide impacts. The national interest in estuaries and coastlines also suggests the need for Corps planning in these systems. The Corps is a logical agency to provide these types of support: it has a long history in interstate basin planning, is currently involved in several interstate basin programs, and possesses basinwide modeling capabilities. The Corps should take the lead in improving and quantifying the basinwide implications of water projects. These activities should be coordinated with other relevant federal agencies, such as the U.S. Geological Survey and the

Environmental Protection Agency. The Corps should examine its rules and regulations and legislative mandates and recommend changes to promote long-term project planning in a spatially integrated manner.

To further help improve the planning process, **the Corps should be given more extensive authority to engage in regional planning activities that include multiple water projects,** such as in the Upper Mississippi River basin or the Everglades. Such regional activities will allow the Corps to coordinate project planning and construction more efficiently and at lower cost, schedule its contractors' resources and timetables more efficiently, and generally reduce instances of administrative duplication.

The WRDA '86 initiated a significant shift in water project financing. Though the Corps has subsequently become more attentive to the needs of project cosponsors, it is important that all parties who stand to be affected by a Corps project be kept fully informed. A poorly informed local sponsor can contribute to delays in the planning process.

To clearly delineate the respective responsibilities of the Corps and local sponsor, and to expedite planning procedures, **the Corps should provide improved guidance to local sponsors to help them identify project alternatives before a specific project is proposed. This guidance should require local sponsors to demonstrate that they have identified the alternatives proposed by all interested stakeholders before asking the Corps to begin project reconnaissance.**

The Corps is shifting an increasing portion of its resources into its restoration programs. Ecological restoration makes up about 17 percent of the Corps' current civil works budget, and this figure is likely to increase. This relatively new emphasis on restoration is appropriate, but the committee notes that Corps projects have always had environmental impacts, though the ecological implications of its past projects often were not explicitly accounted for in project planning.

Understanding and predicting the effects of interventions in ecological systems is a complicated venture, requiring expertise in ecosystem sciences. The Corps has accordingly broadened its traditional emphases in hydrology, hydraulics, and structural engineering by hiring life scientists and environmental engineers throughout the organization. **The Corps should continue to strengthen its staff expertise in the biological and ecological sciences.**

**All large Corps projects should include long-term monitoring capability. To the extent that long-term monitoring is critical to a project's successful management, the costs of monitoring should be part of overall project costs.** As the Corps continues to alter the nation's watersheds, estuaries, and coasts (albeit moving away from large engineering structures and toward restoring ecosystem functions), those regions will experience a variety of ecological changes. Some of these effects will become clear after a short time, whereas others may take years or decades to manifest themselves. Long-term monitoring will allow the Corps to learn more about natural systems and allow it to adjust design and management practices as understanding of these systems increases.

Contemporary concepts of "adaptive management" stress the importance of small-scale pilot projects, data gathering and monitoring of those projects, use of those data in future planning, and avoiding large, irreversible decisions. Projects are viewed not only as ends in themselves, but as carefully designed experiments in

which knowledge of project outcomes is used in future planning and decision making. As opposed to a "trial-and-error" approach, management decisions are carefully and consistently monitored. Adaptive management does not preclude initial design that utilizes all available knowledge to obtain success; it is a method of adding to that knowledge and working toward more desirable results. Adaptive management means that project planning does not end when construction is finished, but rather is an ongoing, iterative process that makes appropriate adjustments as environmental and social conditions change. **When appropriate, the Corps should adopt an adaptive management approach to project management.**

The Corps' restoration programs also represent new challenges in the economic valuation of water project outputs. Traditional Corps projects such as levees, dams, and navigation facilities typically have monetized, economic benefits that are used in a project's benefit-cost calculation. The process of identifying and quantifying the benefits and costs from such projects is complicated, and the Corps has taken its share of criticism regarding its past use of benefit-cost analysis. But the economic benefits of a habitat restoration project are even more difficult to identify and quantify. Furthermore, restoration projects may be constructed to provide benefits increasingly valued by our society, such as aesthetic values, that defy monetization. Attempts to capture these values can be made through a variety of economic techniques, such as contingent valuation methods, which, though widely used, remain controversial. **The Corps should strive to improve and further develop analytical methods for valuing the environmental benefits/detriments associated with its water projects. The committee recognizes that the tools currently available are inadequate for the Corps' purposes and that a substantial, sustained effort will be required to develop a standardized set of tools, including benefit-transfer models and programs, to help quantify environmental benefits and costs associated with its restoration, flood damage reduction, and navigation projects.**

Water management responsibilities at the federal level are greatly fragmented, with 34 federal agencies involved in some manner of water planning, development, or regulation. The relations between these agencies (including the Corps) and the states must be better defined and coordinated. When it existed, the Water Resources Council attempted to help coordinate federal-level water policies. Although the WRC was not without its problems (most of which were beyond the WRC's control), the committee concluded that implementation of coherent and effective federal water policies is severely hampered by the lack of strong involvement of an executive-level body to coordinate agency policies and programs. **This committee thus recommends the creation of a group within the Executive Office of the President to formulate national water policy and coordinate and promote interagency collaboration.** This body might start its program by promoting coordination of information and analytical techniques. The Office of Science and Technology Policy (OSTP) might, for example, be responsible for coordinating environmental and hydrological models among the various federal agencies that employ them. This body could also revise the *P&G*. This is not a call for another major federal agency, but rather a recommendation to establish some mechanism to coordinate the guidance for federal water project planning.

The committee also discussed Corps activities that could reduce economic damages in the nation's floodplains, and simultaneously preserve and enhance habitats and processes in river-floodplain ecosystems. It was particularly interested in the Corps' nonstructural approaches to reducing damages from floods, including the permanent evacuation of vulnerable structures from floodplain areas. Relocating residents and structures from frequently flooded low-lying areas permanently avoids flood damages and (expensive) disaster assistance payments. In such programs, the benefits of flood damages avoided should be explicitly accounted for in calculating project benefits. However, the *P&G* do not allow for the benefits of primary flood damages avoided to be claimed as benefits in all nonstructural projects. **The committee recommends that the benefits of flood damages avoided be included in the benefit-cost analysis of all flood damage reduction projects—including all nonstructural projects—and that these benefits be calculated in a uniform and consistent fashion.**

There appears to be a large and increasing demand for Corps-sponsored nonstructural flood damage reduction projects. The federal government, local stakeholders, many nongovernmental organizations, and the Corps itself have all promoted the economic and environmental virtues of nonstructural projects. There is an apparent mismatch, however, between this perceived demand and the federal response. The reasons for a relative lack of Corps-sponsored nonstructural projects are not clear. This may be a result of skewed benefit calculation procedures; it may be imbedded in an institutional bias against nonstructural projects; it may be that Congress and the Office of Management and Budget do not see a federal interest in local nonstructural projects. The issues are complicated, and several different avenues may be worthy of investigation. **The committee recommends a study of a representative sample of the Corps' flood damage reduction projects to determine whether nonstructural alternatives have been adequately considered, and whether there are any systematic biases in the way the Corps treats nonstructural alternatives.**

The Corps is making strong efforts to respond to conditions imposed by numerous acts of Congress. These conditions, including increased involvement with sponsors and stakeholders, overlapping agency interests, and the complexities of sound water resources planning, are the principal reasons that Corps planning studies are costly and time-consuming.

The Corps has been responsive to its local sponsors' complaints, moving to shorten the planning process in many ways, especially over the past two years. This report provides several recommendations that, taken together, should help the Corps further shorten the planning process. Beyond these recommendations, however, further reductions may be neither reasonable nor desirable. **The Corps' planning process is not significantly more time-consuming than the planning of a private-sector water project. Given the many considerations of such planning, the length and cost of the Corps planning process are generally reasonable.**

Not all of the committee's recommendations to the Corps are aimed at cutting the time and cost of planning. On the contrary, some suggestions may actually expand the process. Clearly, the Corps should not aim solely to produce planning studies and projects as cheaply and quickly as possible. Long-term project monitoring, improved analytical techniques, and studies of a project's basinwide

implications all tend to lengthen the planning process. To maintain the high quality of its planning studies, the Corps must stay abreast of and use contemporary planning theories and methods, even if these add time to the planning process.

As a federal steward of the nation's water resources, the Corps promotes projects in the national interest and constructs projects consistent with the nation's economic and environmental statutes and goals. Not only does this require thorough and sometimes lengthy studies, but these larger concerns may conflict with local plans and projects. This clearly represents a conundrum for the Corps: to protect the federal interests or to promote local interests? Maintaining a responsiveness to local sponsor concerns and desires—which are often justified and understandable—while assuring that those local concerns are consistent with federal and basinwide goals, will present a great challenge to the U.S. Army Corps of Engineers in the early 21st century.

# NEW DIRECTIONS IN WATER RESOURCES PLANNING FOR THE U.S. ARMY CORPS OF ENGINEERS

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Water Science and Technology Board

Commission on Geosciences, Environment, and Resources

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1999