

IMPROVING WATERSHED PLANNING AND MANAGEMENT THROUGH INTEGRATION: A CRITICAL REVIEW OF FEDERAL OPPORTUNITIES

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PREFACE

The work presented in this report was conducted as part of the Investment of Management Decision Making Research Program, part of the Integrated Technologies for Decision Making research area. The Program is sponsored by the Headquarters, U.S. Army Corps of Engineers (USACE) and is assigned to the Institute for Water Resources (IWR), Decision Methodologies Division. Mr. Darrell Nolton is Program Manager of the Investment and Management Decision Making Research Program. Mr. Harry Kitch, Planning Division; Mr. Jerry Foster, Engineering Division; and Mr. Bruce Carlson, Planning Division are the Headquarters' Program Monitors. Field Review Group Members that provide overall Program direction include: Mr. William Fickel, Fort Worth District; Mr. Martin Hudson, Portland District; Mr. Matt Laws, Charleston District; Mr. Dan Sulzer, Los Angeles District; and Ms. Teresa Kincade and Mr. Kenneth Barr, Rock Island District. This paper was prepared under the general supervision of Mr. Kenneth Orth, Chief of the Decision Methodologies Division, IWR and Mr. Robert Pietrowski, Director of IWR. Ms. Joy Muncy of IWR is the Project Manager.

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LIST OF ACRONYMS

Acronym	Definition
ADG	Alternatives Development Group
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CAMP	Comprehensive Adaptive Management Plan
CWA	Clean Water Act
CWAP	Clean Water Action Plan
DoD	Department of Defense
DOI	Department of Interior
EMAP	Environmental Monitoring and Assessment Program
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FS	Forest Service
FWCA	Fish and Wildlife Conservation Act
FWS	Fish and Wildlife Service
GAP	Gap Analysis Program
GIS	Geographical Information System
NED	National Economic Development
NEPA	National Environmental Policy Act
NGO	Non-government Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
TMDL	Total Maximum Daily Load
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WRC	Water Resources Council
WRDA	Water Resources Development Act
WRPA	Water Resources Planning Act
WRPP	Water Resources Project Planning

I. INTRODUCTION

While rapidly gaining popularity, watershed planning can be difficult because of the complex array of interactive physical and social forces that are modeled, optimized or managed (National Research Council [NRC] 1999a). The numerous disparate programs supported by Federal and state resources agencies that are put forth to promote and implement watershed level planning and management can serve to complicate watershed-planning initiatives. With the goal of creating a more robust watershed-planning framework for the U.S. Army Corps of Engineers (USACE), this study is a literature-based review of watershed-planning issues, practices and policies. This study emphasizes the watershed planning and management experience of the Federal resource agencies other than the USACE, including their interactions with USACE project planning.. It is through this discussion of agency involvement that a better understanding of the USACE role can be described. Furthermore, this study supposes opportunities for integrating the prevalent Federal programs in a way that effective watershed planning and management can be performed. Scientific issues are described, as are technical needs for improved watershed planning. Likewise, institutional and other social topics are addressed in this review. Reactions to preliminary findings of this study were solicited from the USACE field planners through a series of focus groups. The focus group results support several of the elements described in the proposed integrated framework.

While the primary audience for this study is those intimate with watershed planning in the USACE, a more general reader can benefit from the historical overview of the Federal agencies in watershed planning as reference. The later sections that discuss integration potential of the existing planning and management frameworks will interest those close to Federal programs and who are on a quest for improving those programs. The underlying theme throughout this report is that the basis for effective watershed planning is in place and that Federal recognition of how these pieces can be integrated would bring significant value added to the field. Armed with this discussion, the USACE leadership can strategically formulate the USACE role in future watershed planning and management. Specific suggestions for further investigation are offered to the USACE research community that would continue pursuit of effective watershed planning and management.

STUDY BACKGROUND

Since 1986, and until recently, most USACE project planning deemphasized the watershed approach and emphasized a more localized project-area focus favored by local sponsors (NRC 1999b). This change in planning perspective away from an earlier river basin and watershed approach came about just as water professionals were beginning to call for a renewal of a watershed basis to water resources management (Shabman 1993, Naiman et al. 1995, Schad 1998). After a thorough review, the NRC concluded in its report *New Strategies For America's Watersheds* (NRC 1999a) that “managing water resources at the watershed scale, while difficult, offers the potential of balancing the many, sometimes competing, demands we place on water resources.” Several states have taken interest in a watershed basis for formulating policies and coordinating management pertaining mainly to water quality issues. During the past decade, the U.S. Environmental Protection Agency (USEPA) has invested extensively in a watershed

management approach to facilitate state-administered attainment of water quality standards under the Clean Water Act (CWA). Other Federal agencies, including the Fish and Wildlife Service (FWS) and Forest Service (FS), link watershed planning to their new emphasis on ecosystem management. A number of non-government organizations (NGOs) use watershed-based approaches in their aquatic programs, including the Nature Conservancy, World Wildlife Fund and National Wildlife Federation. In a review of the USACE water resources planning process, the NRC (1999b) reiterated the importance of long-held, water resources planning principles, including explicit recognition of the “inherent linkages in hydrologic systems that extend throughout watersheds.” The NRC (1999b) also recommended that the USACE use watersheds where appropriate as “basic spatial units in planning” and take the lead in a coordinated Federal effort to improve and quantify the “basin-wide implications of water projects.”

The USACE planning guidance has responded to these changes in perspective of environmental planning and management and now states (ER 1105-2-100) that planning “should incorporate a watershed perspective, whether that planning involves a project feasibility study or a more comprehensive watershed study” and “every effort shall be made to assure that both economic and environmental value is added to watershed resources.” This is further supported in the USACE Strategic Plan (2002) that calls for integrated and balanced management of the Nation’s water resources.

Civil works planning (ER 1105-2-100) “should consider the sustainability of future watershed resources, specifically taking into account environmental quality, economic development and social well-being.” This study recognizes sustainability as an important element to watershed planning, but due to the added complexity of defining/achieving sustainability in a watershed, we do not discuss the subject at length, purposefully leaving it for presentations elsewhere. Joining other Federal agencies, the USACE recently agreed to a unified Federal policy for ensuring a watershed approach to management (Federal Register 2000a). The most recent Water Resources Development Act (WRDA 2000) augments past the USACE watershed planning authority to assess water resources needs of the U.S. watersheds across the full array of the USACE water resources authorities. The USACE planning process also emphasizes the need for a planning framework that includes all of the affected stakeholders and partners necessary for completing comprehensive watershed planning, implementing measures, monitoring and adaptive planning and management. Many of these concepts form the basis of the USACE Environmental Operating Principles, which are to be applied to all the decision-making and program development.

For the purposes of this study of the general watershed planning process and its development, we sought a broad definition of watershed planning inclusive enough to accommodate the range of diverse management purposes that might be encountered in a watershed of moderate to large size. A broad basis for defining watershed planning is found in the definitions of watershed management and watershed provided by the NRC (1999a): “Watershed management is a broad concept incorporating the plans, policies and activities used to control water and related resources and processes in a given watershed.” This NRC definition of watershed management is based on a common dictionary definition of the watershed as “a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.” Building from these definitions, we propose that *watershed planning establishes a vision of desired watershed resources and processes as well as the management measures needed to realize those conditions in a given watershed, including monitoring, analysis of results and adaptive management.*

This definition of watershed planning focuses on management of watershed processes for any of a wide variety of water supply, water quality, flood damage reduction, navigation, recreation, ecosystem protection, habitat preservation and other purposes. Once a general definition of watershed planning is incorporated into the management purposes of specific organizations, the anticipated results usually become more narrowly defined in keeping with different organizational missions and goals. Indeed, this narrowing of focus can complicate effective watershed planning in watershed domains of diverse and complex private and public interests. These differences in purpose emerge in our descriptions of watershed planning by the Federal agencies in Appendix A.

STUDY APPROACH AND REPORT CONTENTS

Using both published literature and agency reports, we first reviewed the watershed-related planning activities of Federal agencies other than the USACE. This information is summarized and provided in Appendix A. This basic literature review is especially useful for readers not familiar with the diverse agency experience in the watershed planning process. From the literature review, we extracted a brief chronological and topical portrayal of watershed planning, which forms that basis of the early chapters of this report. A discussion of the common watershed planning issues, constraints and measures used to deal with them in the Federal agencies is provided in Chapter III.

While Chapters II and III basically summarize what is provided in the literature, the later chapters take on more of an interpretive tone based upon what the literature reveals and accommodating the goal of instilling creative thinking for the USACE watershed planning and management. Common watershed planning themes are described in Chapter IV, as are opportunities for developing a more integrated approach to watershed planning. A basic description of a flexible watershed-planning framework, which integrates across three commonly encountered frameworks, including the six-step water resources project-planning (WRPP) process (e.g., Water Resources Council [WRC] 1983, Yoe and Orth 1996) is described in Chapter V. It offers the basis for a more integrated and comprehensive watershed-planning framework, which can be developed in detail in subsequent studies.

Given the aim of improving watershed planning for the USACE, it was useful to get feedback on our preliminary ideas from the USACE field offices. Critical insights from four District focus group panels pertaining to the results presented here are summarized in Appendix B. The goal of these focus groups was to solicit reactions to the basic ideas that we were developing. District participants generally provided commentary in agreement with these themes and provided examples from their respective operations that added a dimension of pragmatism to the integrated framework that is proposed. Furthermore, the District participant provided important insights on priorities for further development of a watershed planning and management framework for the USACE.

Chapter VI contains concluding remarks and suggestions for further investigation. These comments set the stage for the next increment of research or inquiry based upon the basic principals surfaced in the present literature review and the direction offered through the focus groups of District planners.

II. REVIEW OF WATERSHED PLANNING AND MANAGEMENT HISTORY

Many of the issues, constraints and opportunities now determining the degree of success associated with watershed planning have historical roots in scientific, technological and social advances; also involved are changes in the environment, social preferences and contributions of Federal, state and local government to the management of natural resources and environment. While several eastern states (e.g., Pennsylvania and New York) were among the first to recognize the importance of the watershed process in flooding and water supply, the scientific basis of contemporary watershed management owes more to the Federal land and water management agencies with interstate regional authorities. Watershed management and its planning have grown increasingly complex as use and competition for watershed-based resources have intensified and as government authority has incrementally accumulated in mission-diverse agency settings.

LAND MANAGEMENT AGENCIES

Federal watershed-based planning in the U.S. goes back to the nineteenth century when Congress authorized the president, in the Forest Reserve Act of 1891 to set aside public domain forest preserves with the intent of protecting watersheds for water supply purposes (Hays 1999). The seminal observations of Marsh (1864) especially influenced the awakening of watershed protection policy. Watershed protection remained the leading objective of forest management until after the National Forests and the FS were formed in 1905. Connection of watershed condition to flooding and reliable supply of water for navigation purposes contributed to passage of the Weeks Act (1911), which authorized Federal purchase of private lands for National Forest designation in the eastern U.S. This watershed protection *solution* to two important water resources problems proved fundamentally sound but insufficient for expanding social needs. Soon after, because watershed protection alone was not able to meet rapidly growing demand for reliable water supply, the Nation entered its most active period of dam and levee construction. The tendency to overestimate the problem-solving capability of watershed-based protection and restoration continues today, but increasingly a mix of nonstructural restoration and protection and structural land and water treatments is considered necessary for solving complex sets of watershed-based problems.

As the FS turned its attention to multiple uses of National Forests and Grasslands, it continued to lead watershed research that emphasized forest management impacts on watershed processes affecting water supply and quality. Much in response to the Endangered Species Act (ESA) and increasing Federal emphasis on biodiversity maintenance, the FS has recently adopted an ecosystem management philosophy (Overbay 1992, Kennedy and Quigley 1993), which emphasizes sustainability of ecosystem processes while managing for other benefits including watershed biodiversity, extraction and recreation. Ecosystem management incorporates a formally stated process of adaptive management based on learning from past management to improve future management. The FS has been a leader in developing practical application of

adaptive management during the past decade (e.g., Rausher et al. 2000) and in analyzing human uses and values in watershed analyses (Fight et al. 2000).

The ESA has been an important motivator for adopting the ecosystem perspective in the FS and other Federal agencies because many sensitive, threatened and endangered species live on public lands. Watersheds are now widely recognized as a practical means for bounding many of the most influential processes affecting the community structure and function of aquatic ecosystems in receiving waters (NRC 1999a). Especially in the western U.S., the National Forests often occupy the upper watersheds of numerous river systems supporting threatened aquatic communities. Some of the more controversial aspects of recent forest management decisions revolve about the proliferation of the National Forest road system, improperly managed grazing, and timber cutting on steep slopes, all of which contribute significantly to erosion and sedimentation (Sedell et al. 2000). The controversy escalates, in part, out of formulating accepted tradeoffs involving native biodiversity, forest-based income and employment and public access to recreational opportunities.

The other large Federal land manager, the Bureau of Land Management (BLM), was established in 1946. The BLM was directed to bring order to public land management after decades of misuse of unreserved public-domain land, primarily by grazing and mineral-extraction interests. The BLM focused on improving the quality of public range forage for sustained livestock use but also addressed range use effects and mineral extraction on watershed resources. However, it was not until the Federal Land Policy and Management Act of 1976 that the remaining public lands were reserved in Federal ownership and the BLM had a unified management mandate, which emphasized multiple use and sustained yield, including water supply and watershed management. Like the FS, the BLM recently oriented management more toward ecosystem sustainability based much on sustaining national biodiversity as encouraged by the ESA. Unlike the FS, much of the land managed by the BLM is arid except for the riparian corridors so important to many western vertebrate species. Much of the unique biodiversity on the BLM lands occurs in riparian communities somewhat altered by past livestock grazing, recreation and other uses. Riparian community protection and restoration responds effectively to integrated watershed-based management. The BLM often manages lands adjacent to, but at lower elevations than, the FS, and the two agencies often partner in watershed-based planning also involving private landholders.

Numerous other Federal agencies manage lands, including the National Park Service (NPS), FWS, USACE, Bureau of Reclamation (BOR), Tennessee Valley Authority (TVA) and Department of Defense (DoD) military reservations. The largest of these holdings include watersheds of significant dimension, but most are relatively small and share watershed ownership. Perhaps for this reason, watershed planning has not been the dominant theme approach used in their land management programs. One exception is the Federal Highway Administration (FHWA), which has had disproportionate watershed-based impacts on water quality because the small surface area that highways occupy translates into very extensive linear impacts across many streams, wetlands and other sensitive watershed areas (Garrett and Bank 1995). The water resources agencies often own only the upland fringe around project waters and have no direct management control over peripheral watersheds contributing to project waters. Fragmented landownership remains a challenging reality for most watershed planning and a major reason for using watersheds as a basis for a more integrated natural resources and environmental management. Details on the planning frameworks of the FS, BLM and FHWA are provided in Appendix A.

WATER RESOURCES AGENCIES

John Wesley Powell, the second director of the U.S. Geological Survey (USGS), recommended a watershed basis for defining political boundaries in the western U.S. consistent with the extent that water scarcity determined social welfare (deBuys 2001). While failing to attain that goal, Powell's thinking greatly influenced water resources research and development in the West, including basin-scoped project planning by the BOR after it was created in 1902. Political boundaries, especially at the local level, often complicate watershed planning, which requires more cross-boundary political coordination and cooperation than would be necessary if Powell's vision had been realized.

Near the turn of the nineteenth century, Federal government review of water resources issues emphasized the need for a watershed approach to water resources planning. A basic need was for data on water runoff to assess water supply and flood management. The USGS was established to provide topographic, water runoff and other natural process data to facilitate watershed process and other analyses. A system of runoff monitoring stations was established first in the water-scarce rivers of the arid Southwest. This was also the region that was among the first to have major BOR projects completed. Throughout its history, the mission of the USGS has emphasized the collection of objective, science-based data and its analysis in support of other agency and private needs as its agency mission. Water resources have remained a major focus of USGS research, which in recent years has increasingly addressed information deficiencies about threatened and endangered species and their support ecosystems in the Biological Resource Division.

The Flood Control Act of 1917 authorized the USACE to undertake comprehensive study of watersheds to assess the relationship of flood control projects to navigation, water power and other appropriate uses of water resources affected by projects (Arnold 1988). During the 1920s, Congress authorized the USACE to conduct the first river basin management in the lower Mississippi Valley. In the 1930s, the USACE was authorized by Congress to conduct comprehensive basin studies nationwide to determine the type and arrangement of multipurpose projects that would most efficiently provide flood control, hydropower, water supply and navigation services (Arnold 1988). Many of the projects identified in those studies were later authorized for implementation during the 1930s through 1960s.

Much of the planning conducted at that time was what would now be called top-down, involving the public minimally and frequently limited to the more powerful development interests. Mass communication was more limited and much more locally controlled by those interests. While concern for certain recreational wildlife arose and was manifest in the Fish and Wildlife Conservation Act (FWCA) of 1934, environmental concerns were mostly peripheral, accessory to recreational and water quality interests. The growth of the information age after World War II and growing distrust of powerful, centralized interests (both public and private) has made unilateral, top-down planning for public resource management a thing of the past.

Other than water supply and flooding, early environmental concerns started with land erosion during the mid-nineteenth century (e.g., Marsh 1864). After years in basement divisions of the U.S. Department of Agriculture (USDA), soil erosion was elevated to high-profile government attention following the Great Plains "dustbowl" when the Soil Conservation Service

(SCS) was formed in 1935 (Helms 1998). The SCS almost immediately assumed a watershed approach for treating erosion and stream sediment problems in assistance to farmers, ranchers and other private landowners through the nation's three thousand conservation districts. The SCS was first authorized to consider treatments for small-watershed flood problems in 1944. In 1954 it was authorized to provide watershed-planning support for private landowners and for states, tribes and Federal agencies.

The SCS programs have been among the more successful government watershed services. The basic idea was for government to facilitate watershed-based solutions through private landowners arranged into conservation districts or other quasi-governmental local authorities. The watershed studies facilitated integration of land use conservation measures on private lands with structural measures placed in waterways to control erosion, sediment transport and flooding. In 1991, the SCS became the Natural Resources Conservation Service (NRCS), reflecting its expanded responsibility of land- and water-based resources management. Through the existing Watershed Surveys and Planning Program, the NRCS offers a collaborative technical service to address watershed protection, flood prevention, fish and wildlife habitat improvement, agricultural water management, water-based recreation, groundwater recharge, water quality management, and municipal and industrial water supply. It also facilitates wetlands restoration under the Food Security Act. The NRCS facilitation of watershed-based conservation planning by local interests is a good example of how many planning issues might be addressed in the contemporary watershed planning process. Over the years, priorities have shifted from rural economic development to fostering land treatments that solve diverse naturally and culturally caused watershed-based problems.

Starting in 1933, the TVA was authorized to comprehensively develop and manage the water-based resources of the Tennessee River basin for multiple purposes led by hydropower production, navigation improvements and flood control. The boundaries of its management authority were based on the watershed concept. The TVA is an exception in the history of public resources management: a unique example of a comprehensive government approach to solving pervasive and deep social problems in the Tennessee River valley. The TVA is a good example of how large-scale, mostly top-down, river basin management of water resources can effectively meet social needs. The TVA had deficiencies, however, including effects resulting in some of the most concentrated incidence of threatened and endangered aquatic species in the U.S. Imperilment of a large number of fish and freshwater mussel species has been identified in the Tennessee River Valley (Stein et al. 2000) and water impoundment is cited among the major reasons (e.g., Lowe et al. 1990). The TVA now emphasizes a more open planning process, including analysis of and treatment for watershed-based practices that aggravate erosion, water quality degradation and flooding.

The Federal water resources agencies were brought together under the Water Resources Planning Act (WRPA) of 1965, which provided a framework for integrated, multipurpose, water resources development through comprehensive river basin initiatives. The WRPA created a WRC to oversee the process and to develop a decision framework for water resources development. The intent was to coordinate more cost-effective water resources development across the range of purposes administered by the different water-resources agencies, including the USACE, BOR, SCS and TVA. The planning framework was defined hierarchically, starting most comprehensively at Level A programmatic planning that identified water resources problems, opportunities and appropriate policies of national scope. Most specific of all planning, Level C planning was done at the project level with a focus on engineered solutions. Level B

planning linked programmatic and project planning through the specific physical and social conditions existing in each river basin. Non-Federal interests and environmental concerns were to be included, and this framework emphasized an unprecedented integration of agencies, disciplines and resource management actions. However, the Federal water resources agencies dominated the planning process and partitioned project implementation according to how well each Federal agency's authorities responded to needs in the river basin (NRC 1992, Shabman 1993). Relatively few large projects came out of river basin planning, in part because of declining local interest in Federally controlled "master planning," but also because attitudes were turning away from reliance on engineered solutions for the water resources environment.

The dominance of Federal agencies in the history of river basin, water resources planning has influenced recent legislation and attitudes toward a watershed-based approach to planning. While completeness and effectiveness were generally conceded when river basin planning was done objectively, the actual choices of measures and projects have been criticized as favoring specific interests (NRC 1992, Shabman 1993). Also, the mission-driven expertise within the lead agency often predisposed plan selection toward those actions that the lead agency is most capable of implementing. Fairly or not, the BOR and USACE gained reputations for selecting large structural solutions to problems without complete, objective consideration of more efficient and environmentally sound alternatives (NRC 1992). Increasingly, the local agencies and NGOs perceived their interests and opinions were overlooked. In addition, the Carter Administration agitated members of Congress by working through the WRC to reduce the Federal scope of the traditional navigation, flood damage and water storage projects. With little resistance from Congress, the Reagan Administration eliminated the WRC and Federal involvement in comprehensive river basin planning in the early 1980s (Shabman 1993).

Until the 1986 WRDA, Federal water resources agencies had broad authority to act unilaterally. In 1986, the WRDA responded to the pressure of non-Federal interests by changing the basic relationship between local stakeholders and the Federal agencies during project planning, operation and maintenance. All development since then has emphasized an individual project focus requiring a state or local government sponsor, non-Federal cost sharing and non-Federal assumption of operation and maintenance. In effect, local sponsors have much more control than previously over the extent projects are proposed nationally and over the prioritization and placement of each project, including how each fits in watershed context.

The trend toward more emphasis on Federal-state partnerships extends well beyond water resources. States and other local interests are increasingly in the planning "driver's seat," sometimes reluctantly so, looking to the Federal government to facilitate with money and technical support, which includes objective facilitation of watershed planning when appropriate. Many of the contemporary issues challenging watershed planning and management have roots in the changing and sometimes uncertain roles of local, state and Federal agencies in the planning process. The program expectations of non-Federal interests often determine the project performance expectations. Whatever drives the interests of the sponsors indirectly drives the involvement of Federal water resources agencies. Increasingly, those local sponsor interests are determined, or greatly influenced, by the need to meet standards set by the Federal Water Pollution Control Act (CWA), ESA and other Federal and state environmental laws. The resulting interactions are often complicated by confusion over who might be in control. But increasingly, the project planning, so well developed by Federal water resources agencies according to a protocol developed by the WRC (1983), must fit into a larger, programmatic

planning context orchestrated by the states and other Federal agencies. More details on the present planning frameworks of the BOR, TVA, NRCS and USGS are provided in Appendix A.

REGULATORY AGENCIES

Formation of the USEPA in 1970 consolidated regulatory power from diverse laws administered by numerous agencies. The USEPA inherited administration of the National Environmental Policy Act (NEPA), which has a planning framework similar to the water resources, project planning framework developed by the WRC (1983). Some basic planning steps required for environmental impact assessment under NEPA, including evaluation of alternative plans, became universally incorporated in the environmental compliance of Federal agencies. In 1972, the CWA authorized the states, with USEPA oversight, to establish regulations in support of the Act's objective, which was the restoration and maintenance of the physical, chemical and biological integrity of the nation's waters. The USEPA is authorized to provide technical and financial help to the states for the purpose of meeting water quality standards and to levy fines when necessary. Early regulations focused on point sources of pollution, but the CWA required the states to develop watershed based which classified management plans water uses and water quality standards compatible with those uses.

The emphasis on watershed-based management and planning has grown, as success in controlling point sources has left much to be accomplished for nonpoint sources (NRC 2001). The concept of total maximum daily load (TMDL) originated with the CWA in 1972 and has more recently become central to the needs for achieving state water quality standards. Key to the utility of the TMDL concept is a detailed understanding of links between material sources, including pollutant sources, in watersheds and the watershed process resulting in material concentrations (including pollutants) in aquatic ecosystems. The USEPA has invested significantly in developing Internet-accessible, watershed-based planning primers and related documents to facilitate more effective action by the states and local governments (e.g., USEPA 1993, 1996, 1997a, b, d, 2001). The planning guidance encourages partnerships with Federal agencies and takes advantage of Federal funding under their diverse authorities.

During the past decade the USEPA has intensively promoted statewide watershed approaches to water program planning and management by providing technical assistance, communication and other facilitation services, and training (USEPA 2002). A statewide watershed approach to planning and management has been adopted by over 20 states with USEPA oversight to (1) delineate natural geographic management areas such as watersheds, (2) develop a series of management steps or phases to guide actions, (3) integrate the CWA with other water resource programs through coordinated implementation of management steps and formation of partnerships, (4) involve appropriate stakeholders, and (5) focus on environmental results (USEPA 2002). This watershed approach develops the major elements of the CWA planning and management cycle including monitoring progress in meeting water quality standards and addressing deficiencies in subsequent rounds of planning and implementation. The states monitor and regulate activities on a rotating watershed basis with the intent of reissuing permits once every five years. This allows the water bodies requiring TMDLs to be identified in time to gather necessary information for developing TMDLs. It also allows all permits within a watershed to be addressed at the same time, usually two years before the permit is issued.

Section 404, the USACE can establish general permits based on watershed or wetland management plans (e.g., Special Area Management Plans or SAMPs) to regulate loss of aquatic resources. The USACE encourages use of watershed plans for making permit decisions, including mitigation planning. For example, Federal guidelines for establishing wetland mitigation banks recognize the importance of strategic placement of wetlands to the long-term ecological health of a watershed (Federal Register 60:58605-58614). An innovative approach taken in southwest Florida (Alternatives Development Group [ADG] 1998) uses NEPA to create alternative watershed plans that address cumulative environmental impact where permit-by-permit regulation is both inefficient and environmentally counterproductive.

The ESA of 1973 authorized the FWS and the National Marine Fisheries Service (NMFS) to maintain an inventory of the status of rare, wild species and list threatened and endangered species for Federal protection from unpermitted destruction, including destruction of declared critical habitat. Aquatic species are disproportionately represented among the listed species and species of concern. In addition to enforcement protection, the agencies administer recovery plans and habitat conservation plans, which sometimes are defined by watershed boundaries.

In 1994, the FWS established an ecosystem approach to its management and reorganized integration of activities within river basin boundaries. The FWS created regional ecosystem teams, which have developed watershed-based strategies to recover listed species and prevent the need for future listing. This mission is also coordinated with other missions, including migratory bird management, anadromous-fish restoration and preventing establishment of nonnative nuisance species.

Planning interactions among the USEPA, FWS and NMFS are facilitated through legislation and interagency agreements. National Oceanic and Atmospheric Administration (NOAA) partners with the USEPA to administer the Coastal Zone Management Act, which includes provisions for planning watershed-based measures resulting in improved coastal water quality. In 2001, the three agencies drafted a Memorandum of Agreement to formalize earlier integration of ESA considerations in watershed management planning for water quality standards developed under the CWA (Federal Register 2001). More detail is provided for the planning frameworks of the USEPA, FWS and NMFS in Appendix A.

SUMMATION AND LESSONS LEARNED

For well over a century, Federal watershed-based planning has played a role at various scales in water, forest, range, crop culture and other natural resources management mediated by diverse Federal, state and local government agencies. Early watershed planning was rudimentary and typically single-objective in scope. The complexity and comprehensiveness of watershed planning increased over time and peaked during the years of river basin planning under the WRPA. The success of watershed-based approaches to management has been mixed, however. The influence of the “watershed perspective” has waxed and waned as the strengths and weaknesses of watershed approaches and alternative approaches to water resources management have come to light. While the theory underlying watershed planning and management is fundamentally strong, the practice is less certain.

The NRC (1999b) summarizes some of the major challenges that have emerged out of the history of watershed management. Watershed-based planning has often been perceived as an inflexible, prolonged, top-down process resulting in a “restrictive master plan” now resisted by local interests desiring more flexibility and control. Because watershed boundaries cross-political and administrative boundaries, the need for a coordinating “watershed authority” complicates the process. One of the major impediments in the past has been technical; simply defining and tracking watershed processes exceeded the science and the tools available for data management and analysis. As a consequence, planning models/protocols have been based on weak databases with marginal credibility. While the information age has done much to alleviate basic data collection and analytical impediments, many technical and analytical problems remain.

Many issues have less to do with the basic limitations of underlying science and technology, and more to do with who, how, where, when and with what financial resources the science and technology will be applied and for what mix of purposes. The technical and social inputs required in multiobjective watershed planning are complex, especially when environmental impacts are included as they invariably are at this time. Consequently, the process is slow and participants may grow impatient or lose interest during the process. Ambiguities, incompleteness, inflexibility and other aspects of inadequate planning frameworks contribute to the procedural problems. These complexities tend to reinforce a more expedient, single-objective approach while paying lip service to comprehensive planning. Most of the issues and constraints discussed in the next section are expressions of these general impediments to comprehensive watershed planning.

III. WATERSHED PLANNING ISSUES AND CONSTRAINTS

After decades in a lower profile, watershed-based planning has emerged once again as a popular way to organize complex sets of resource management problems for integrated analysis and approaches to solution. Contemporary watershed planning has had a relatively short history extending back through the last decade. Partly because of that short history, few in-depth analyses of contemporary watershed planning issues and constraints exist (USEPA 2002). Most agency documents, especially those of the USEPA, emphasize the advantages of watershed planning and minimize the difficulties. Some of the more useful general sources for providing insights about issues and constraints include USEPA (1997a), NRC (1999b) and (The Meridian Institute 2001).

Contemporary planning differs from previous watershed planning with respect to the comprehensiveness of outputs and outcomes considered and the inclusiveness of stakeholder collaboration in the process (Cortner n.d.). Environmental objectives, such as restored water quality and habitat of sensitive species, are much more likely to be among the primary motivators for watershed-based planning, on par with or surpassing water supply, flood damage reduction, navigation and recreation. These differences undoubtedly accompany major advances in scientific understanding of watershed ecosystem processes, major improvements in mass communication and decision processes, revolutionary changes in environmental concerns resulting in addition of environmental laws and increasingly diversified interest and involvement in the outcomes of the public planning process. All of these advances have provided resources for significant improvement in complex, public planning processes, including watershed-based planning. Yet, the large majority of watershed-planning issues continue to be based in chronic communication/coordination and motivation/cooperation factors.

The watershed approach has regained attractiveness as society has placed greater emphasis on restoring and protecting ecosystem properties that sustain future land and water management choices. Management choices dwindle as ecosystem parts and processes disappear. Especially important has been the increasing threat of extinction to numerous aquatic and riparian species as a consequence of ecosystem fragmentation, attrition and other alteration. In aquatic ecosystems, rapid negative changes in the quality and amounts of aquatic habitat have been especially critical considerations. Consequently, the CWA and the ESA have come to play pivotal roles. Recent Federal administration emphasis on sustainable development has motivated search by Federal agencies for more comprehensive and holistic approaches to resource management with an increasing emphasis on an environmental sustainability goal (The President's Council on Sustainable Development 1996, USACE 2002).

Based upon reviewed literature, this chapter discusses some of the more prominent issues and constraints that have been or are being faced by resource agencies. Many of the issues and constraints summarized in Table III-1 relate back to basic issues of communication, motivation and experience of the agencies and stakeholders involved. Some of the other issues are based in the agency procedures and the scientific support that may or may not be available to support these procedures. The key issues and proposed strategies are summarized in Table III-1 and further discussed in respective sections below.

**TABLE III-1
PREVALENT WATERSHED PLANNING ISSUES AND CONSTRAINTS AND
SELECTED FEDERAL REMEDIES**

Watershed Planning Issue/Constraint	Proposed Strategy
Basic Decision Framework	
Incomplete planning-decision framework used	Get guidance and facilitation; start with any complete framework; develop conceptual models
Inadequate linking of decision-support system elements	Get guidance; invest in improved decision-support systems
Inflexible, top-down planning process	Framework requires a more open, inclusive public process
Delayed, ambiguous & misrepresentative communication	Rapid, clear, and verified processing of information
Fragmented Authorities and Missions	
Fragmented agency authorities	Develop more integrative frameworks; better training; MOAs
Fragmented agency sense of mission	Planning framework requires review of missions; better training
Unclear agency roles in planning process	Planning framework requires clarification of agency roles
Agency planners too narrowly focused	Planner selection guidance, increased training investment
Agency competition and reluctance to share power	Clearer missions, planning frameworks, executive orders, MOAs
Stakeholder Inclusion	
Incomplete stakeholder representation	Planning framework identifies affected parties early
Limited stakeholder instinct for decision process	Selection guidance, decision basics explained early
Stakeholder distrust of planning process	Selection guidance, explicit and open process, good facilitation
Stakeholder ignorance of watershed process	Selection guidance and education— preferably in the field
Stakeholder biases and inflexibility	Guidance for stakeholder choice criteria and facilitation
Stakeholder impatience with complex, planning process	Tentative framework defined early and modified by group
Stakeholder inability to understand risk and uncertainty	Guidance on stakeholder choice and education at several levels
Lack of strong, local leadership among stakeholders	Stakeholder selection guidance
Lack of objective, trustworthy information	Involve competent watershed specialists and research investment
Unclear definition of tradeoffs for stakeholders	Complete identity of all services/costs, improve models/methods
Technical	
Less than adequate science at watershed planning scales	Re-examine approach; proceed adaptively; invest in research
Incomplete data for basic process understanding	Re-examine approach; proceed adaptively: invest in research
Inadequate data for characterizing watershed attributes	Invest in data; proceed adaptively
Fragmented data management	Integrate fragmented research authorities into national database
Data and data management expense	Share data; invest in models/methods that use data efficiently
Lack of interdisciplinary communication	Cross-training, statement of assumptions, clarification of meaning, identification of uncertainties
Analytical	
Watershed boundaries sometimes are ill defined	Examine relevancy of uncertainty; re-examine approach, GIS
Risk and uncertainty are not clearly defined	Invest in representative data and models
Models of natural process are not comprehensive enough	Basic and adaptive management model development, GIS
Models do not link natural and social process	Basic and adaptive management model development, GIS
Ecological models are rudimentary	Basic and adaptive management model development, GIS
Motivation	
Inadequate funding for local, watershed planning	Guidance for fund raising
Fragmented sources of funding	Develop improved agency integration; guidance for fundraising
Complicated procedures for obtaining funding	Streamline red tape; guidance for fundraising
Buying local "ownership" in planning process	Propaganda; clearly defined distribution of benefits and costs

BASIC ISSUES AND CONSTRAINTS

COMMUNICATION AND COORDINATION

At the heart of any complex, watershed-planning process is the resolution of issues and constraints based in conflicting interests. A fundamental communication challenge is the need

for a clear statement of problems and the development of a shared vision of watershed conditions that will solve those problems. Most stakeholders come to a planning process naturally focused on their own needs, agencies included. Individual stakeholder visions typically come with blinders. Even planning facilitators are likely to be biased toward some outcome or another. The most basic challenge is assurance that all watershed services and effects are recognized and that all interests are fairly considered in the vision of management success. Frequently, the physical attributes of a desired, future watershed condition are more prominently emphasized in the development of a shared vision than the resulting stakeholder benefits and costs. To a degree, this may be unavoidable because the physical attributes are the objects of management and the basis of alternative plans. The sticking points, however, typically have to do with who benefits and who pays the bill. A fair and open analysis of tradeoffs is essential yet constrained by the quality of information and planning facilitation. Neither is likely to improve much without increased public investment in technical advances and training.

Tradeoff analysis often is complicated by stakeholders with long histories of antagonistic interaction and distrust of the information brought by their counterparts. Planners often assert that building stakeholder trust is a prerequisite to effective planning. But trust is built most thoroughly through confirmation of information accuracy, especially in controversial planning environments. While there are social means for developing more trust, such as providing relaxation time together, nothing helps resolve suspicions of dishonesty in stakeholder tradeoff analyses more than having information made available from an objective and “unimpeachable source.” Many public planning activities discover that information specific to the joint solution of watershed problems is of limited quality and quantity. Assuring that the necessary information is made available usually takes time, which is often regarded as the resource in least supply.

While invariably desired, speedy planning sometimes worsens problems by ultimately prolonging the process of solution and increasing stakeholder suspicion. In the complex decision process involving reluctant partnerships (a common watershed planning situation), building the stakeholder planning partnership needs more time investment than is first appreciated. Many stakeholders enter complex planning processes insufficiently prepared for the time a good decision takes. A careful process is not always in the interest of all stakeholders and some try to subvert it. Local project sponsors often are compelled to spend funds quickly or lose them. Of course, time is money, and too commonly funding fails to provide the commitment needed for the planning process. In addition, planning can drag out longer than necessary for reasons that have more to do with poor coordination and communication than with inadequate information.

Most stakeholders are uncomfortable with uncertainty (Gregory 2000, Hammond et al. 1999). Their involvement in the planning process usually is motivated by the need to protect or advance their own interests; that is, to increase the certainty of desired outcomes. Paradoxically, the quality of information needed for choosing wisely among alternative plans often is inversely related to the stated certainty of stakeholder-offered information. Objective science replaces anecdotal and unsubstantiated position statements with more accurate statements of outcome probability and risk. But such careful contextual statements are sometimes interpreted as weaseling. Much depends on the qualifications of the information source and the predilections of the stakeholders. Of course, the difficulty of overcoming mistrust and planning cooperatively depends on the stakes. Some watershed planning addresses relatively simple planning with no losers, such as the relatively inexpensive removal of an old dam that has outlived its original purpose and now threatens human safety and sensitive species. These simple cases are rare and win-win solutions are even more elusive in other more complex watershed planning.

Communication needs to be constant and universal among stakeholders, even when little has changed. Questions need to be answered promptly and rumors dealt with quickly. While all concerns need to be presented and considered, establishing an approach toward consensus early typically proves more effective than a combative approach. Watershed education is a common need, but experience indicates that learning and understanding via hands-on field visits, and in the context of the actual planning process, often proves more useful than more formal approaches. A complication is the need to translate the complex watershed process into an easily understood concept without falling into misleading half-truths and propaganda. Agencies are sometimes placed in the awkward position of carrying out laws and policies that push beyond the available science and information.

Facilitators need to foster respect for all planning participants, the watershed residents and the watershed natural resources. It often helps to address areas of conflict directly, clarify them, and where appropriate cast them as learning opportunities for the watershed planning participants. But in selecting stakeholders, it is also imperative to seek out people who are already well informed or who can learn about the watershed process and the resulting outputs and social outcomes.

MOTIVATION AND COOPERATION

Most organizations, both public and private, emphasize their own missions and less explicitly integrate their environmental objectives with other important objectives into a complex planning process involving diverse stakeholder interests. The NRC (1999a) has noted that environmental organizations have come to watershed planning relatively recently, but with focus on water quality, native biota and other environmental objectives. Only passing reference is made to more traditional watershed objectives that continue to remain important such as water supply, navigation and hydropower. Agency personnel often are motivated by a culturally rarefied sense of mission that may make that agency special in certain regards, and perhaps more meaningful to employees, but tends to align the agency with a subset of special interests with subsidy-seeking biases. History has proven to many agencies that well-served special interests are much more likely to support continued agency funding than a well-served, generally unaware public interest. Cortner (n.d.) recognizes the seemingly perpetual conflict between citizen and agency expectations in watersheds, but notes “the trend is toward more direct and open participation by citizens with the managers in a facilitation role.”

Experience with small watershed coalitions suggests that adequate commitment to funding from state and Federal sources is a crucial source of local, watershed management motivation. In a recent meeting of the National Watershed Forum (The Meridian Institute 2001), funding difficulties overshadowed other issues discussed by 480 community leaders involved in watershed planning and management oriented toward water quality outputs. Much existing watershed planning proceeds from the environmental adage—“think globally and act locally.” However, sound-bite motivation only goes so far where the “global” stakeholders, typically represented by the Federal agencies, greatly influence the planning process and outcomes from well beyond the watershed boundaries. Scientific study has increasingly justified global stakeholder participation in watershed management by documenting how off-site impacts are generated from the often small, but cumulative, effects of local resource management decisions on both public and private lands. Most Federal and state environmental law, including the CWA,

have responded to negative, off-site, cumulative impacts. But for local watershed planning groups, the motivation for planning and management often seems to arise primarily from obscure benefits derived outside the watershed and at significant local cost and limited local benefit. An often-repeated local refrain is the need for state and Federal funding consistent with the mix of benefits derived within and beyond the managed watershed. When the motivation is mostly from outside, a careful analysis of benefits and costs can be an important indication that state and Federal agencies are committed to a fairly balanced responsibility between local and off-site interests. Substantial Federal funding is available, but sources are scattered and much of it is linked to narrow interests and complicated procedures “leaving many needs unmet” (NRC 1999b).

While outside funding is critical, local pride in self-respected accomplishment results in more sustained commitment to effective small-watershed management. Motivating the local community to “buy ownership” in a watershed-planning process is the ultimate key to success. While outside funding is helpful, motivation based on pride in contribution and achievement is more likely to sustain the long-term planning commitment required for effective watershed management. But the lingering difficulty is in effectively capturing the larger off-site benefits as opposed to the smaller localized benefits, with these off-site benefits needed to present a complete watershed-based picture. Understanding how local actions influence all stakeholders within and beyond the watershed is important. Identifying the right leadership is critical as well, including elected officials and business and other nonpolitical leadership. Establishing “win-win” outcomes for all of the major stakeholders within the watershed are critical for developing local pride and sustained commitment.

When the primary motivation for local watershed planning originates internally, the commitment to finding the funding is stronger than when the motivation arises from state and Federal levels. It is important for self-motivated, local planning groups to line up money and in-kind services in advance of starting projects or risk discovering that stakeholders cannot afford it later, creating a sense of failure and negativism toward any subsequent planning process that might be motivated from outside. Progress often will need to be slow and may have to start with inexpensive and easily accomplished measures. Early success needs to be recognized, even celebrated.

Cooperation is the action that shows commitment to the planning process. Because watershed planning often is complex and involves many stakeholders and facilitative partners, cooperation is an elemental part of the process. Robotic bureaucracy and agency rivalries are common impediments. Planning inflexibility often is a symptom of an unwillingness to cooperate for one reason or another. For some stakeholders with special interests, cooperation may not appear to be the most promising strategy. Agencies should not need to be reminded of their obligation to provide for the general welfare over special interests. Rather a clear definition of establishing agency roles and needs very early in the watershed planning process is a prerequisite to effective cooperation.

Having a clear idea of the authorities, missions, technical expertise and planning frameworks used by each agency partner can at least set the stage for resolving issues of interagency cooperation. Cooperation is likely to be facilitated with flexible planning frameworks, allowing integration across them, and effective sharing of data and technical analyses through the planning process. While local communities benefit from appropriate infusion of Federal or state funding proportional to the larger regional and national interests, top-

down planning and project implementation perpetuate state and local reliance on the Federal government for technical plans. Through a variety of avenues, the states have called for more joint interaction with government and more grant program funding of community-based programs. Effective facilitation of these processes can be accommodated at the Federal level.

PROCEDURAL ISSUES AND CONSTRAINTS

Basic communication and coordination constraints have many of their origins in procedural issues associated with planning/management frameworks and facilitation. Framework limitations arising out of fragmented government authorities fundamentally limit facilitation and are emphasized here. Most procedural constraints and issues arise out of information deficiencies, which have their origins in technical, analytical and decision framework limitations; the limits of individual agency authority and mission; and the ways in which those limitations can be mitigated. Increasingly, local watershed institutions motivated mostly by the CWA, ESA and companion state laws are recognizing many practical impediments to watershed planning based on limited local resources and insufficient Federal and state facilitative services (The Meridian Institute 2001).

INADEQUATE DECISION FRAMEWORKS

Reviews of the obstacles to watershed-based planning (or any other regional planning process) frequently turn to the adequacy of the planning-decision framework. This perceived deficiency often underlies complaints of inadequate planning guidance, such as what some states have directed at USEPA, despite substantial USEPA investment in their watershed approach (USEPA 2002). Frustrations emerge in analyses of planning problems, captured well in the presentation title of Golden and Rogers (1996), *Moving the Watershed Planning Process from Quagmire to Success*. The different frameworks needed to solve a watershed-based problem are, at first appearance, evidence of the difficulty. However, closer examination mostly reveals differences in detail.

Results of study by psychologists indicate that untrained individuals “systematically employ cognitive shortcuts and appear to have little instinctive ability to structure decision tasks, clarify their objectives, incorporate probabilistic information with accuracy or balance the dual goals of limiting effort and achieving a satisfactory level of judgmental accuracy” (Gregory 2000). However, experience shows that sticklers for framework protocol risk failure in watershed planning. There is no certain way, no “one size fits all” or “cookbook recipe” guaranteed for success. Decisions are made complex by circumstances that cause numerous decision consequences, affecting varying interests in uncertain ways. While the basic elements of a decision process might be defined in principle (e.g., Robbins 2000, Hammond et al. 1999), the democratization of decision making with the intent of getting meaningful public input has yet to be consistently realized.

Watershed planning has one advantage over other regional planning processes in that the boundaries of many watersheds quite accurately enclose the important physical processes linking measures to objective achievement. This reduces, but does not eliminate, uncertainty associated

with boundaries placement on ecosystem processes because watershed boundaries often can be more accurately determined than for other alternatives. Even so, in karst or very sandy regions, watersheds can be difficult to define and connections between problem manifestation and problem solution can be hard to discern.

Efforts to engage public participation, also, typically fail to develop a foundation for good decision-making. The typical planning process does not handle rigid, agenda-driven positions well whenever some stakeholder give and take is needed. It assumes that cooperation and negotiation is in the best interest of all stakeholders, which is not always the case. The different levels of skill among individual planning facilitators show up especially in situations where stakeholder inflexibility dominates. While there has been much advance in theory and practice in facilitating generally satisfying results, contentious public involvement continues to constrain the complex decision process. Applying the basic elements of decision process with consistency and flexibility via talented facilitators shows signs of improving the public-service planning process. Understanding the underlying issues should help reveal the consistencies and inconsistencies, if any, among the different watershed planning frameworks with respect to the basic decision process described by Hammond et al. (1999), Gregory (2000) and others.

FRAGMENTED AUTHORITY AND MISSION

Limited Agency Authorities and Mission

The general resource agency authorities and mission emphases and other activities with respect to watershed planning are summarized in Table III-2. No Federal agency has an explicit watershed-based mission, but many agencies now interpret their mission in strategic plans that either explicitly or implicitly emphasizes a watershed basis for resource management. The NRC (1999b) identified twenty-two Federal agencies involved with the hydrologic cycle, but only those agencies most likely to intensively interact in a watershed framework are included in Table III-2. The agencies comprise a patchwork of overlapping, yet incomplete, authorities and activities related to the watershed planning process. Implicit in many of the agencies' policies is an ecosystem-based management approach often carried out within watershed boundaries, depending on which ecosystem outputs and services are targeted.

No single agency is authorized to conduct integrative management of all natural resources. Some of the land management agencies come closest within their authorized boundaries, but they must cooperate with other Federal and state agencies charged with assessing and regulating various environmental and social conditions. Each agency focuses its attention on the watershed outputs of greatest mission relevance. Similarly, agencies tend to focus stakeholder attention on those most receptive of their mission emphasis.

This tendency is evident, for example, in complaints by some states that the USEPA overly emphasizes water quality over all other stresses on aquatic ecosystems and too narrowly focuses on short-term achievement of water quality standards while espousing a more holistic approach (USEPA 2002). But USEPA is more typical than exceptional in this regard; most Federal agencies espouse an integrated, ecosystem approach to resource management while continuing to focus on their own congressionally mandated responsibilities. In funding

**TABLE III-2
SUMMARY OF FEDERAL AGENCY ACTIVITIES RELEVANT
TO THE WATERSHED PLANNING PROCESS**

(dot size approximates relative activity [in part from NRC 1999B])

VARIABLES	USEPA	NMFS	FWS	BOR	TVA	USACE	NRCS	FS	BLM	DOT	USGS
Primary Authorities/Mission											
Regulatory	•	•	•			•					
Land management			•	•	•	•		•	•	•	
Water resources management			•	•	•	•	•	•	•	•	
Planning assistance	•	•	•		•	•	•	•		•	
Research	•	•	•	•	•	•	•	•		•	•
Watershed Perspective											
Planning framework	•	•	•	•	•	•	•	•	•	•	
Education/communication	•				•	•	•	•	•		
Research	•					•	•	•		•	•
NEPA compliance		•	•	•	•	•	•	•	•	•	•
NEPA enforcement	•										
CWA compliance		•	•	•	•	•	•	•	•	•	•
CWA enforcement	•					•					
ESA compliance	•	•	•	•	•	•	•	•	•	•	•
ESA enforcement	•	•	•	•	•	•	•	•	•	•	•
Coordinate fiscal partnerships	•	•			•	•	•	•			•
Work with state and local partners	•			•	•	•	•			•	
Watershed-Based Decisions											
Watersheds define mission											
Set program goals (strategic)	•	•	•		•		•	•	•		
Set project objectives (tactical)		•	•	•	•	•	•	•	•	•	•
Establish program priorities	•	•	•					•	•		•
Coordinate decision process	•	•	•		•	•	•	•	•	•	•
ID objective indicators	•	•	•	•	•	•	•	•	•	•	•
Guide information inventory	•	•	•	•	•	•	•	•	•	•	•
Define management measures	•	•	•	•	•	•	•	•	•	•	•
Guide measures monitoring	•	•	•	•	•	•	•	•	•	•	•
Monitor objective indicators	•	•	•	•	•	•	•	•	•	•	•
Evaluate objective achievement	•				•			•	•		
ID decision stakeholders	•			•	•		•	•	•		
Organize stakeholder concerns	•			•	•		•	•	•		
Watershed Objective Focus											
Water supply	•			•	•	•	•	•			•
Water quality	•	•	•	•	•	•	•	•	•	•	•
Erosion/sediment control	•		•	•	•	•	•	•	•	•	•
Recreational fish and wildlife	•	•	•	•	•	•	•	•	•	•	•
Commercial fish and wildlife	•	•	•								•
Endangered species/ecological diversity	•	•	•	•	•	•	•	•	•	•	•
Flood damage reduction				•	•	•	•	•	•		•
Transportation / Navigation					•	•				•	
Hydropower				•	•	•					
Sustainability of process	•	•	•					•	•		
Monitoring and research	•	•	•	•	•	•	•	•	•	•	•
Focus of Watershed Scale											
Small	•	•	•	•	•	•	•	•	•	•	•
Medium	•	•	•	•	•	•	•	•	•	•	•
Large	•	•	•	•	•	•	•	•	•	•	•

environments that are virtually always viewed as insufficient by the agencies, an inclusive approach is more likely to be achieved by assuring that all issues are identified and each is addressed in a fully inclusive framework of appropriate agencies and interested organizations.

Fragmentation of government authority may be the most basic constraint operating on the efficiency, effectiveness and completeness of the watershed planning process. To compensate, Federal agencies are bound by the Constitution, congressional law, executive orders and interagency memoranda to cooperate and coordinate in pursuit of improving the general public welfare. Individual agencies are limited in various ways, forcing interaction, if government is to be successful. Because government has grown so large and complex, coordination and communication across agency authorities and missions have become one of its most

fundamental, operational challenges. At the Federal level, decades of emphasis on smaller government have compounded the very natural tendency of agencies to compete for scarce resources and to consolidate around central mission emphases. More effective integrative, interagency planning has to transcend “turf-guarding” and “empire-building” instincts. While this requires many avenues of effort, an essential aspect is development of a comprehensive management-planning framework for identifying problems and integrating measures for their solution.

A consistent theme revealed in review of Federal watershed planning is the emphasis on coordinated partnerships. The CWA and water resources projects require partnerships of the Federal agencies with state and local agencies and other local entities. Since 1986, all of the Federal water resources agencies must share more local control over project planning and implementation. Regardless of explicit partnership requirements, coordination between Federal and local interests is prerequisite to all decisions having regional impact, and it is the primary means for overcoming limited resources. The trend in recent years is for an increasing local role in all natural resource management decisions.

The USEPA has responded to this trend with greater transfer of leadership and control to the state and local authorities by emphasizing education and technical help over Federal authority in pursuit of its environmental standards. One result has been increased emphasis on the local watershed-based planning process to deal with the difficult technical and social issues associated with nonpoint sources of pollutants. The USEPA basically has a programmatic regulatory authority and has little direct project development authority. To meet its strategic goals, attaining environmental standards, the USEPA relies on partnerships with the local authorities and with Federal agencies authorized to plan and oversee implementation of projects. The inverse situation exists with the water resources agencies, whose authority since 1986 is mainly limited to project planning and implementation and requires local sponsors take responsibility of project operation and maintenance. There are, however, exceptions in specific water resources programmatic authorities, such as for the Comprehensive Everglades Restoration Plan in Florida and the Environmental Management Program of the Upper Mississippi River system.

Land management agencies typically have strong programmatic and project authorities for the lands they manage. Geographic fragmentation of authority is a more important complication facing the land management agencies, whose political boundaries frequently overlap the watershed boundaries defining important aquatic ecosystem processes. They frequently must integrate their management of watershed-based ecosystem conditions with the management of other government agencies and private landowners.

Effective means for integrating diverse land and water interests need to be developed and applied if the watershed planning process is to work as a general approach to solving problems in aquatic ecosystems. This requires improved integration of communication, cooperation and coordination methods; developing joint processes for identifying relevant stakeholders; developing better tools for identifying patterns of natural process, landownership, development and resource management problems and improved tools and training for analyzing the links between undesirable resource conditions, their causes and their solutions.

Resource Authorities and Expertise

Agency resource management authorities are limited either explicitly or implicitly. The major natural resource divisions include air, inland waters, marine waters, soil, forest, range, inland fisheries, marine fisheries, inland wildlife, marine wildlife and inland and marine biodiversity. Each of these resource divisions includes resource production and environmental protection responsibilities. The levels of expertise relevant to unique aspects of problem identification, plan formulation and evaluation vary at different agencies. Most fundamentally, these split between land-based and water-based resource authorities. In Federal agencies, water-based authorities include the USACE, BOR, NRCS, TVA, FWS, USEPA and NOAA.

Within resource categories, the development authorities of agencies are relatively narrowly defined. For water, the USEPA has very little development authority, which is limited mostly to funding project development by state and local agencies. The FWS and NMFS are authorized to develop fish and wildlife resources. Both the BOR and the USACE develop water supply for irrigation and domestic purposes. Whereas the NRCS and TVA are authorized to use terrestrial measures for addressing water problems, the BOR and USACE have been traditionally limited to the shore and open waters of relatively large water bodies. While each agency may have broad interdisciplinary capabilities, few have expert use in all areas and necessarily seek input from other agencies.

Geographic Authorities

Federal regulatory agencies typically have programmatic authorities that extend throughout the U.S. However, agencies with resource development and management authorities have explicit geographical limitations placed on their management authorities in whole or in part, such as state, county or municipal agencies; the authorized Federal reserves managed by the BLM, FS or FWS refuge lands; or project lands and waters held by the BOR, USACE and TVA. The NOAA and Department of Interior (DOI) split up inland and marine regulatory authorities for fish, wildlife and mineral resources.

Research Authorities

At one level or another, the Federal natural resource agencies have their own research authorities. However, in the DOI much of the basic programmatic research authority is concentrated in the USGS. The FWS, BOR and BLM conduct specialized studies in close connection to their projects. Agencies with broad programmatic research programs include the USEPA, NMFS and the FS. The USACE is authorized to conduct research of both programmatic and project-level applications such as research aimed at aiding flood damage project evaluation, fill regulation, ecosystem restoration and general planning and decision process.

Project and Program Planning Authorities

Differences exist among agencies with respect to programmatic and project authorities. The USEPA has broad national programmatic authorities across a range of air, water and land environments, but limited project management authorities. The USEPA depends on the agencies and private firms it regulates to provide the project management needed to complete USEPA program goals. For water quality goals, they partner with state agencies in program planning and rely on them to carry out project planning and implementation. The land management agencies have relatively broad programmatic and project management authorities mostly on the lands they own. The FWS and NMFS have broad ESA programmatic authorities but work with other agencies and private landholders to develop habitat conservation and species recovery projects. On the other hand, the water resources management agencies have relatively weak programmatic authorities and relatively strong project development authorities.

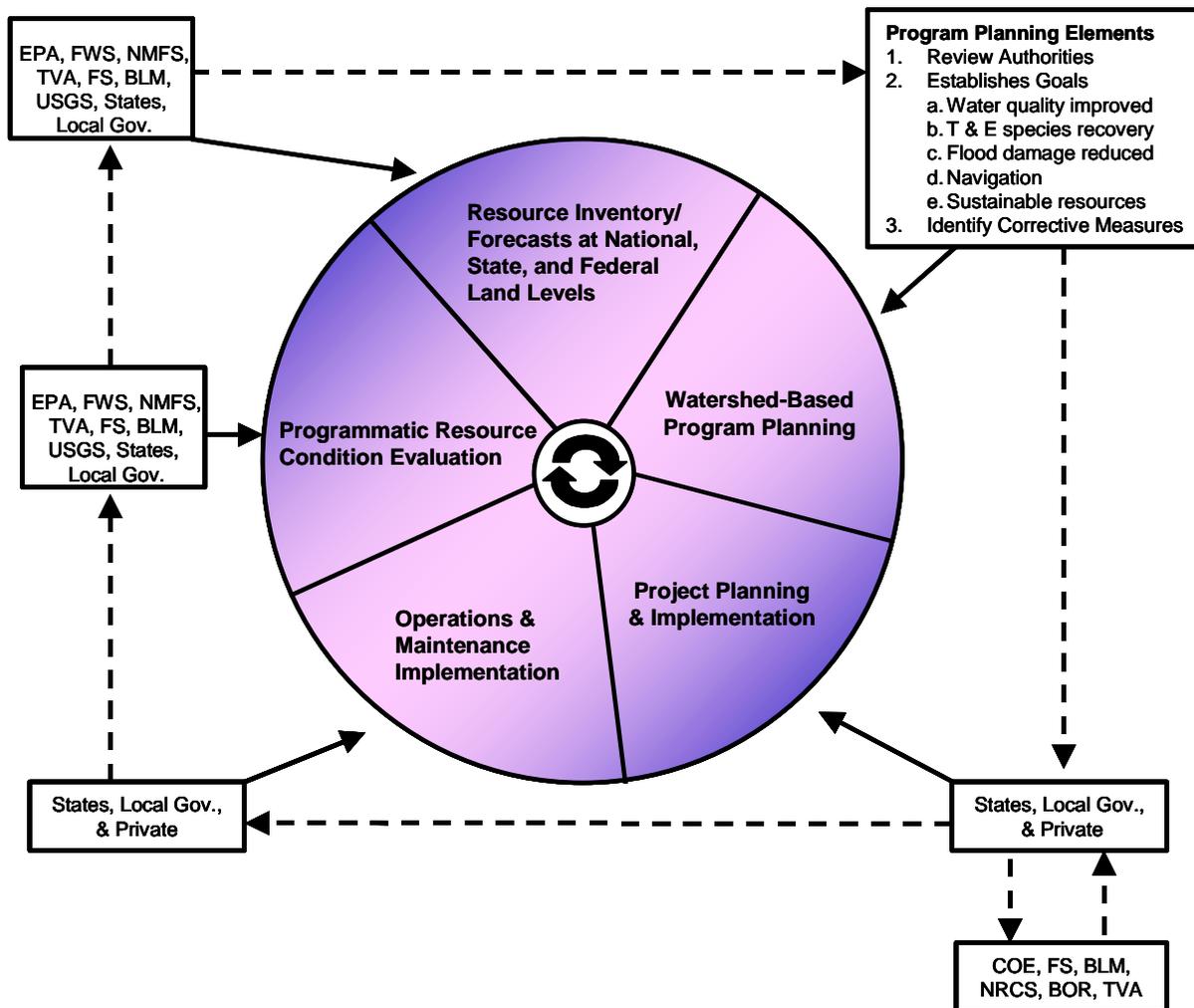
The differences between project and program planning sometimes are accompanied by confusion about projects and measures. For example, the USACE enters into watershed planning in which the different measures considered could individually become projects for different agencies to complete in coordination with whatever agency (usually a state or local agency) takes the lead in the watershed plan. In this example, the NRCS might become involved in land management measures, such as reforestation projects, and the USACE may become involved with water resources development projects. What are considered measures in project planning for one watershed might be considered projects in program planning for another watershed. Projects take on many forms, but natural resource management usually involves a clearly defined integration of resource management measures implemented as a stand-alone structural or nonstructural solution. These are applied to a clearly defined resource area over a specific time period to achieve clearly defined resource output objectives. These projects are typically authorized and funded through one or more programs. Agency programs usually are means for organizing agency resources (e.g., skills, authorized budgets, physical plant, equipment) to complete projects in pursuit of some authorized goal or purpose (which may be stated as an objective).

While projects may fall entirely within one program, they often are implemented under diverse programs both within and among agencies. Some environmental programs direct budgets toward a variety of projects that are funded primarily through other programs managed to enhance specific resource output goals (e.g., greater water supply, timber production or recreational fishery production). Once projects are implemented, operation and maintenance are budgeted under one or more programs that may differ from project planning and implementation programs. In some instances, such as many older water resources projects, operations and maintenance are maintained in individually identified Federal project programs. Since WRDA 1986, Federal water resources projects are operated and maintained through the programs of local project sponsors. This has resulted in water resources agencies focusing on project planning and implementation within the context of some state or local agency program or some other organizational program that operates and maintains the project.

Programmatic Planning Cycle

The cumulative result of incremental legislation is a patchwork of fragmented government authorities, which can be integrated into a functional whole only through coordination among all authorities. A generic illustration, is proposed in Figure III-1, of how these authorities might mesh through a watershed-based programmatic planning cycle administered primarily through coordinated effort including the states and those Federal agencies holding land management or regulatory authorities.

Starting at the top of Figure III-1, the first step in the cycle is an inventory of existing water resource conditions and forecasts of future conditions without plan implementation. Because of their comprehensive inventory and analytic resources, Federal agencies such as the USGS and USEPA can often substantially aid the states and local governments especially with a clearer integrated framework for interaction. The Federal capability typically increases as the watershed scale increases in size. Specific inventory information needs in smaller watersheds are



**FIGURE III-1
PROGRAMMATIC PLANNING CYCLE**

often more effectively and efficiently obtained at the local and state levels, but may be better analyzed in the context of existing Federal methods, models and computer platforms.

The second step is at the heart of the watershed-based program planning process, which includes review of watershed issues, authorities, establishment of goals and identification of corrective measures. Each of the issues and goals typically is associated with a specific agency authority. The difference between a fragmented approach, which is most usual, and a fully integrated approach, is the extent to which all issues and goals are collectively addressed through stakeholder participation in development of integrative measures. Resource sustainability is rapidly becoming an explicit goal of all agencies, but none have clearly identified ways to measure their contribution to resource sustainability in a fully integrated management framework.

In a fully integrated and comprehensive watershed approach, corrective measures typically require diverse projects to be planned and implemented at various locations in the watershed (third step in Figure III-1). Except when the watershed falls completely within Federal land management authority, the state or local government agencies usually take the lead in project development, but often pursue partnerships with Federal agencies to leverage their technical expertise and funding. For example, if Federal properties occur in the watershed, the responsible agencies are incorporated with respect for their project development authorities in the Federal fraction of the watershed. Water resources development agencies often are brought in by the states or local governments for their matching funds and technical expertise, including the watershed planning help authorized for the USACE. Once a project is implemented on non-Federal lands and waters, the Federal water resource agencies transfer project operations and maintenance to the state and local governments (fourth step in Figure III-1). However, these same agencies retain operations and maintenance authorities for many projects authorized before 1986, and through those projects can play a continuous, programmatic role in watershed planning and management.

Federal agencies with regulatory or land management authorities usually remain in an oversight position to monitor and evaluate for management results, including the results of project implementation and to enter those results in subsequent inventories, forecasts and planning (fifth step in Figure III-1). At the Federal level, clear programmatic authorities are provided to regulatory agencies and to the Federal land management authorities.

A watershed is merely one of numerous boundaries that can define a project area. Watershed boundaries can also define a program, such as the Great Lakes International Water Quality Program, the South Florida Ecosystem Restoration Initiative, the Chesapeake Bay Agreement or individual initiatives under the American Heritage Rivers Initiative. The hierarchical nature of watersheds allows flexibility. Smaller watersheds may be the basis of a watershed project within larger program-level watersheds. However, even very small watersheds can assume a program status for a local government agency, and many other Federal and state programs may be drawn upon to attain the local watershed program goal.

From the planning standpoint, the hierarchical ordering within both watersheds and governments needs to be reflected in the planning process. What are perceived as management measures within watershed projects at one scale of government might be perceived as projects at another scale of government. In planning, this could involve formulating and evaluating alternative assemblages of projects in a program, alternative assemblages of measures in a

watershed project and alternative plan formulation for a single measure within a watershed project.

For example, in past approaches to address erosion and related problems administered through the NRCS, the first level of planning was to conduct programmatic assessments of problem origin to identify priority subregional watersheds. Once they were selected, each would be assessed for the most appropriate types and combination of measures. Once a particular source of erosion was established as a high priority for treatment, a variety of erosion treatment measures might be selected for consideration at a point of origin or somewhere downstream from it. These erosions include using conservation farming, retiring the site and planting an exotic species, actively restoring the native vegetation, passively allowing natural vegetation to become established or maintaining the same land use but building a sediment catch basin below the source of erosion. The choices depend, among other things, on how much the soil loss from the site can be tolerated, how much the present type and intensity of land use can be acceptably altered and how much each treatment approach costs.

Stakeholder Inclusion

A fundamental revelation of fragmentation in agencies is the tendency to identify a subset of stakeholders as agency clientele. Even though a number of agencies emphasize the importance of including all stakeholders in the planning process, agency planning frameworks show little evidence of completing an evaluation of all recipients of natural and artificially enhanced services affected by the plans. Some agencies consider a stakeholder as any individual or group that can impede the management process, which is proper as long as the agencies accept responsibility for representing all public interests that might not be able to participate, including future public interests. Because watershed planning can be complex and costly, it is important to assure that the watershed planning process is needed and that local community support is built before proceeding. Identifying and recruiting the appropriate local leadership are a critical detail that can make or break the planning process if not done carefully. Federal or state authority is often questioned at the local level, and it typically proves effective to invite local political leaders to select a steering committee. Also important is recruitment of local opinion leaders—often not political leaders—especially if they have a challenging point of view.

Effective use of stakeholders in collaborative watershed planning often utilizes a central group of players that are consistently involved throughout the process. Along with the lead Federal agencies, this central group may include members of local governments, interest groups, technical experts, landowners, and other public groups. It is critical that the provisions of the Federal Advisory Committee Act (FACA) be addressed which is set up to ensure that Federal agencies do not delegate decision making authority and responsibility to non-Federal entities. If establishment of a formal committee that includes non-Federal members is desired, the FACA has strict guidelines to follow (e.g. formation of charter, official reporting process, frequency and timing of meetings). It is certainly possible to create a committee that abides by the FACA, but the extra due process drives most Federal agencies to carefully operate watershed stakeholder groups in a way that avoids the FACA. In a Federally led watershed planning effort, it needs to be made clear to the non-Federal stakeholder groups involved that their input is critical in assuring that the Federal agencies make decisions based upon good information. But it is simply

that: information to the Federal agencies, not decisions made by the non-Federal stakeholders dictating plans for the watershed.

TECHNICAL

Science

Correctly so, much has been made about the challenges associated with the social recognition in watershed and other regional planning processes. More faith than should be warranted is often placed in the science needed to define processes and outputs that ultimately translate into tradeoff costs and benefits (NRC 1999b). The advantages of watershed planning are linked closely to the watershed processes that align sources of problems to measures for their solution. It is an approach based in watershed science, which has advanced greatly during the last century.

The need to determine whether or not watershed management is up to the new demands for integrating natural and human systems into effective problem solutions was reason for the FS, NRCS, USEPA, TVA, BOR and USGS to provide support for a NRC review of the issues (NRC 1999b). Naiman et al. (1995) make the point that too often the “political process cart” gets ahead of the “scientific horse.” Scientists are increasingly unable to respond to the scale of the issues presented before them because too frequently policy development and responsive management proceed without an adequate empirical foundation. In other words, society fails to recognize the limits of science and the inadequacy of investment needed to mitigate that limitation. While management may recognize such limits, it is inclined to proceed because it depends on the policies to sustain the management bureaucracy. Consequently, the criteria for effective management and policy decisions are ambiguous. The NRC (1999b) concludes that while many watershed science issues are well understood in principle, many complex and uncertain aspects remain at the scales that now are being increasingly incorporated into watershed planning processes. “When faced with complexity and uncertainty, watershed planning and management must make provisions for ongoing monitoring and basic science research” (Stanford and Poole 1996).

A major NRC (1999b) criticism of the watershed approach to water quality management is the offhanded way in which the underlying science is taken for granted, such as in the framework offered by the USEPA (1993). Little is offered in the way of criteria for judging adequate science or the technical requirements. The general impression is that we know all there is to know to do effective watershed planning. “But these impressions are at best simplistic. Watershed management is both institutionally and scientifically complex, and there is significant need for new and more in-depth knowledge on both fronts before we can be more effective implementing watershed approaches” (NRC 1999b).

Data

The science of watershed management is no better than the data that go into it. At least two types of data are needed. First, long-term records are needed for watershed processes in

experimental watersheds exposed to a variety of cultural modifications. Much of the existing water data have been collected in experimental watersheds situated where human influence has been relatively minor and new experimental sites are needed in culturally impacted ecosystems (NRC 1999b). Most past experimental watersheds have been administered under the FS and the National Science Foundation's Long-Term Ecological Research program. Past data gathering has had significant gaps. A few of the more important gaps summarized by the NRC (1999b) include insufficient measures of cross-sectional variation in measured water quality parameters, insufficient sampling of stream discharge at the time of water quality sampling, insufficient data on toxic contaminants and insufficient attention to groundwater conditions and relationship to surface water conditions.

Second is the insufficiency of data needed to achieve objective multipurpose analyses in a particular watershed setting, to validate the predictions of watershed models and to monitor the effects of watershed plan implementation. For large-scale planning, such as at the level of the Comprehensive Everglades Restoration Plan (CERP), large investments in obtaining appropriate data may be justified. But for many other smaller watershed studies and planning, such as those that might be needed to develop about 40,000 TMDL plans nationally (NRC 2001), the database investment required of local communities may be a significant constraint on the watershed planning process. The USEPA (1997c) described their research strategy regarding monitoring and assessment. Often, concerned citizens are a potential data gathering resource and their involvement can be a positive means for motivating more effective watershed management. However, the limits of such sampling by people without advanced technical skills need to be considered carefully and their involvement limited to those variables requiring minimal technical skill.

The situation worsens for biological measures, which typically are more complex. The increasing emphasis on biodiversity measures and other measures of ecosystem integrity reveals the insufficiency of baseline and trend data. Much of what is available is anecdotal and incidental. Indications of technical shortcomings typically show up in the research needs of agencies. Chronic in such summaries is the need for spatially explicit databases, including well-placed continuous records of key variables and improved analytical models. The concern for data shortfalls with respect to quality and quantity shows up repeatedly in reports such as the NRC (2001) report on TMDL approach and the NRC (2000) report on ecological indicators. Social and economic data are more likely to be widely available because the U.S. Bureau of the Census makes these data available with appropriate computer software (NRC 1999b). However, very specific watershed distribution data often need to be gathered firsthand.

Data collection is expensive and NRC (1999b) recommends that existing collection be reviewed carefully by USGS, NOAA and other agencies with major data collection responsibilities to assure the placement and frequency of collection are optimal for needs. With careful design, analyses of strategically placed data can be extended to other watersheds, enabling a much-reduced requirement for on-site collection, especially when advanced watershed simulation models are available for analyses. If watershed management and planning are to expand to the level anticipated by agencies such as the USEPA, much must be done to set up the most cost-effective data collection network.

Data Management

Much has been made of developing geographical information systems (GIS) for geographically referenced data storage, retrieval and analysis, but data management has been nearly as fragmented as agency authorities and mission. A number of agencies have invested in their own GIS resulting in a geographical data patchwork with gaps and overlaps, varying according to the specific scale and perceived data needs of each agency. For example, the data collected for the USGS Gap Analysis Program (GAP) are national in scope and originally focused on identification of terrestrial biodiversity threats. But GAP is also working with selected states on aquatic issues (Jennings 1997). The USEPA has recently set as a priority, the cooperative development with the USGS of a national GIS for water quality management (USEPA 1997d). Integrating research activities for cost-effectiveness remains a challenge to both Federal and state agencies. Perhaps more problematic is assurance of data quality, quantity and consistency across the full spectrum of watershed planning needs.

The NRC (1999b) recommends that the Federal Geographic Data Committee, which has the primary responsibility for establishing the National Spatial Data Infrastructure, take the lead in developing national data standards and a central clearinghouse and in maintaining a single national watershed database (Federal Geographic Data Committee 2002). Within that context, agencies should be encouraged to coordinate and link their databases.

ANALYTICAL

Tradeoff Analysis and Valuation

Central to the issue of watershed planning is the need for a generally satisfying analysis of the tradeoffs involved. Estimating all outputs from a watershed management plan in ways that are meaningful for tradeoff analysis and plan selection is one of the most problematic technical challenges. Analysis of outputs aims at effectively measuring both the physical resources in the watershed as well as the social, economic and cultural resources. Cost-benefit analysis is useful for those values that can be translated into monetary terms but falls short for those increasingly important environmental values that are much more resistant to full monetization (Feather et al. 1995). Indices of habitat suitability, biotic integrity and functional capacity for environmental benefits and cost-effectiveness analysis are difficult to impossible to translate into concrete outputs, let alone some common measure such as dollars. It is one thing to trade against the estimated number of individuals added to a species population; and another to estimate a gain or loss in an index that typically has no clear translation to actual ecological performance. The costs are often obvious and stressful and the benefits often unclear.

Uncertainty and Risk Analysis

Output estimation is also inherently uncertain, and the risks that tradeoffs will not materialize as predicted are often substantial. A major obstacle is the availability of tools that are capable of uncertainty and risk analysis in forecasts of plan implementation results. Uncertainty

and risk are most usually quantified by examining historic records of variation. Other than arbitrary rules, no basis exists for quantifying either uncertainty or risk without such a record. Except for water runoff records and a limited amount of water quality data, the record for watershed and biological processes is poorly developed for widespread applications. Few habitat or ecosystem models address uncertainty and risks that outputs will not result as planned. Predictive tools are needed and are more suitable when uncertainty is somehow expressed. “Whether the interest is in predicting sediment and nutrient transport, hydrologic and hydraulic effects of landscape alterations and restorations, or related problems, there must be attention to building and using predictive models that can address hydrologic, ecological, social and economic outcomes of particular management actions” (NRC 1999b).

Watershed Models

Numerous analytical tools are available that meet certain watershed planning needs. Donigian et al. (1996) and NRC (1999b) provide a summary review and entry to the literature for many of the models in use. The NRC (1999b) summarizes the criteria for simulation in a contemporary watershed model and concludes that no existing model comes close to meeting all of the criteria. Existing models are often force-linked into sets without adequate consideration of feedback loops and other interactions. Some models appear useful but oversimplify watershed processes leading to unreliable results. Other models require substantial calibration for the specific applications using on-site data. Even when provided with data, these data intense models often are imperfect predictive tools (NRC 1999b). Unsophisticated users, such as local commissions faced with meeting state water quality standards, may not be aware of the limitations of such tools and can be disappointed with the results without careful briefing. Model assumptions commonly are understated, dismissed or ignored. Models often are difficult for decision makers to use. The NRC (1999b) identifies modeling gaps especially in the need of advanced watershed simulation models that link natural and social attributes and are easily used by managers.

Ecosystem and Habitat Models

Compared with watershed models, the habitat models used to guide restoration of ecosystems in support of selected fish and wildlife species are even less reliable predictors. One of the most important reasons is that very few of these models are linked to watershed models, so that the effectiveness of watershed measures in restoring ecosystem attributes cannot be analyzed directly. While the methods are available to link watershed processes to discharge and geology so as to estimate geomorphologic responses of water channels and basins to management changes, limiting factors may sometimes rest outside the habitat and even outside the watershed. This is especially true for riparian species affected by hydroregime, but perhaps more so by terrestrial processes.

Decision Support Systems

There is a need for developing better user-friendly decision support systems that facilitate the development and analysis of alternatives for general benefits and costs, and how they are distributed across stakeholders. A decision support system is “a suite of computer programs with components consisting of databases, simulation models, decision models and user interfaces that assist a decision maker in evaluating economic and environmental impacts of competing watershed-management alternatives” (NRC 1999b). To be effective, planning and implementation for watershed management need to integrate theory, data, models and expert judgment into the solution of problems using a scientific basis. Linking all of the component models of extremely complex watershed processes is technically challenging and requires substantial investment.

Adaptive Management

Many of the technical and analytical limitations associated with watershed planning, especially when they include ecosystem restoration objectives, may be most appropriately approached through adaptive management (NRC 1999b). When rigorously done, this involves pairing a watershed-based model with careful monitoring to assess watershed response to implementation of measures and to make adjustments as needed both in the model and in the management actions (Walters 1986). The most effective adaptive management extends learning from the specific watershed situation to other watersheds at a programmatic level of planning.

IV. ISSUES MANAGEMENT IN WATERSHED PLANNING

MOTIVATION FOR INTEGRATIVE WATERSHED PLANNING

POLICY COORDINATION IN WATERSHED PLANNING

The challenge of managing the issues and constraints in watershed management centers on a need to improve integration of the fragmented public authorities, missions and goals resulting in overly focused planning objectives and incomplete involvement of stakeholders in plan tradeoff analysis. This is not a new problem as was presented in the historical review earlier in this report. Single-minded intent on problems impeding one purpose typically causes other problems for other purposes over time. Federal government has slowly adapted, becoming at least more comprehensive in its legislative philosophy, and has attempted in various ways to tie fragments together through patch-up policies in laws, presidential orders and interagency agreements and understandings. While authorities and missions continue to be fragmented, the Federal agencies have a significant watershed or other regional planning history, oriented toward integrating agency activities into more cohesive and comprehensive planning and management.

The WRPA of 1965 called for agency coordination and comprehensiveness in jointly developed river basin plans for projects proposed by the Federal water resources management agencies. The Coastal Zone Management Act of 1970 authorizes integrative coastal resource management. Since 1990, NOAA and the USEPA have cooperatively administered it to aid twenty-nine coastal states in their management of health and safety, public access, economic development and nonpoint source pollution among other objectives. Watersheds draining into the coastal waters are targeted for water quality management designed to protect estuaries and coastal oceans as well as freshwaters in the watersheds. The CWA authorizes the states, USEPA and USACE to carry out water quality management jointly. Increasingly, this is being accomplished in a watershed-planning context. In 1995, fourteen Federal agencies signed a Memorandum of Understanding (MOU) to Foster the Ecosystem Approach (FHWA 1995), which is aimed at sustaining or restoring the functions and values of ecosystems. The approach emphasizes integration of ecological, economic and social factors in the context of ecological boundaries to pursue social, economic and environmental goals

Response to the CWAP has resulted in a more unified Federal policy for ensuring a watershed approach to Federal land and resource management through an agreement between the USDA FS, DOI and USACE (Federal Register 65:8833-8839; February 22, 2000). The policy was developed in consultation with other Federal agencies, including the USEPA, the states, tribes and other interested stakeholders. The intent is to develop consistency in a scientific approach for assessing, protecting and restoring watersheds. Steps are taken to assure that Federal actions are coordinated and consistent with state, tribe and local government water quality management plans, which are coordinated with, and approved by, the USEPA. The policy is expected to apply to 40 percent of the U.S. watersheds. While focused on Federal lands, it encompasses state and local collaborations and partnerships. In addition, the USEPA, FWS and NMFS recently published notice of an interagency agreement to improve coordination in administration of the CWA and ESA to enhance protection of threatened and endangered species

and to reduce the need for future listing of species (Federal Register 66:11201-11233). They intend to use a team approach to restore and protect watersheds and other ecosystems, to achieve the protection, recovery and restoration goals of the ESA and CWA through the watershed management planning process.

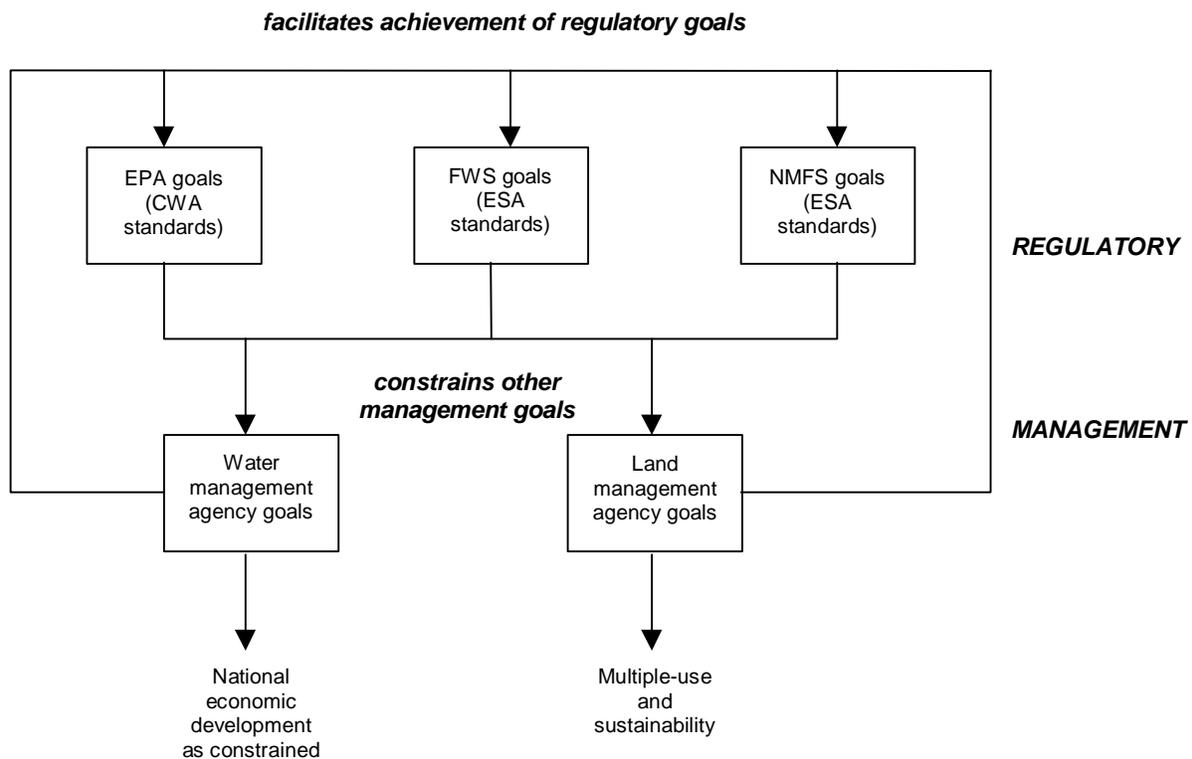
Congress has authorized a number of examples of watershed-based regional planning and management programs. During the 1960s and 1970s, the Federal water resources agencies led a number of river basin assessments of water resources needs under the WRPA of 1965, which involved coordination with other agencies but leaned heavily toward structural projects in and near the waterways. More recently, specific large watersheds have gained congressional attention. The Great Lakes International Water Quality Agreement (International Joint Commission 1987) has been led by Canadian and U.S. environmental agencies but includes inputs from other state and Federal agencies. The Chesapeake Bay Management Plan incorporates several state and Federal agencies organized around restoring the Chesapeake Bay through coordinated watershed-based projects and measures. In Florida, the Comprehensive CERP integrates the activities of numerous state and Federal agencies in a multiobjective, multi-project water resources management program focused on ecosystem restoration but also providing for flood damage reduction, water supply and other objectives.

Thus new congressional authorities and derivative policies have intermittently recharged motivation for watershed planning for well over a century, resulting in substantial cumulative, but fragmented, Federal authority. Impediments to realizing greater consistency and comprehensiveness in the early years were generally based in the limited congressional view of Federal authority, which was linked closely to watersheds supplying navigable water for interstate commerce (Hays 1959). The sharing of power between local, state and Federal governments, and the deep respect held for private property rights in the U. S. contribute to the partitioning of natural resource management authority. That partitioning requires yeoman communication, coordination and clarity of vision for achievement of integrative management goals. More recent impediments to a fully integrated process appear to be linked less to inadequate authorities and more to the difficulty that the Federal, state and local agencies have in developing integrative policies and procedures.

ECONOMIC AND ENVIRONMENTAL OBJECTIVES

Watershed planning is motivated by the need to meet a combination of economic development and environmental objectives in a watershed or other regional context. The motivation is most effective when all objectives are acknowledged, integrated and incorporated into the perspectives of each of the participating agencies. This requires not only an explicit planning process that seeks all watershed functions and modifications affecting watershed service quality but also full participation of all agency stakeholders concerned with those services. Especially critical is a careful statement of all problems and opportunities to be addressed and consideration of explicit objectives for each of the relevant watershed services. Just as critical are the formulation, evaluation and selection of plans that consider all possible measures for achieving the objectives, regardless of which agency is authorized to implement the measures.

As it is practiced primarily at this time, local watershed planning often is motivated, or at least strongly influenced, by the need to meet environmental standards. Regulatory goals and objectives might also contribute positively to the achievement of land and water management goals, but evidence to date suggests that among the water resource agencies, activities have been constrained by environmental regulations much more than they have been stimulated to proactive efforts in past watershed planning process. While sustainability is increasingly being adopted as a goal among water resource agencies, measures of resource sustainability have not been clearly determined to guide policy. This appears to be less true of those land management agencies that have adopted a clearly defined policy for resource sustainability. There is growing evidence in agency strategic plans that the FS and BLM are gradually adopting a management model that uses native biodiversity along with other measures to gauge resource sustainability. The public welfare, promoted through increased economic wealth, is treated primarily by resource development and management agencies focused on improved national economic development (NED) but constrained by the need to maintain environmental protection and sustainability standards (Figure IV-1). Historically, the forces motivating a river basin or watershed approach to planning were water supply and flood damage reduction objectives or, in the case of land management agencies, water yield. While these traditional objectives continue to be among the primary motivators for watershed-based studies involving the water resources agencies,



**FIGURE IV-1
FEDERAL AGENCIES “INTEGRATE” TO FORM A SYSTEM
LARGER THAN THE INDIVIDUAL PARTS**

including the USACE, the need for regulatory agencies to attain environmental objectives has grown in relative importance and has become the most universal motivation for a state and Federal interagency watershed planning process.

All water resources development projects must meet the environmental standards developed and administered by USEPA, FWS and NMFS. All agencies entrusted with management authority over Federal lands and waters are expected to be responsible stewards who improve environmental conditions degraded by past projects to at least meet minimum standards. Few agencies, other than the USACE, have the authority to actively restore ecosystems under the management authority of other agencies or certain private institutions (e.g., The Nature Conservancy, Ducks Unlimited).

Achieving an appropriate balance of economic development objectives and environmental objectives, including environmental sustainability and sustainable economic development, may be the single most difficult challenge in existing watershed planning. Both the environmental and economic-development results of plans, including their opportunity costs, need to be clearly defined in terms that can be understood by all of the stakeholders in the planning process. Some standards may be locally negotiable while other standards are likely to continue to constrain and even drive the watershed planning process wherever they appear as issues. A general case in point is the standards established in law and rules to protect and recover Federal threatened and endangered species.

COMMON ELEMENTS IN WATERSHED PLANNING PROCESSES

Despite differences in authorities and mission, agency watershed planning frameworks reveal many common elements, at least within subsets of agencies. These include:

- Watershed planning is a continuous process when planning is programmatic.
 - Ó Most watershed planning is incompletely informed by the state of existing ecological, social and economic science, and is an imperfect work in progress.
 - Ó Watershed planning requires adaptive management to more fully determine and meet efficiency, effectiveness, completeness and acceptability criteria.
 - Ó An agency may only play a temporary role in project planning and implementation, but this does not dispel the need for adaptive management under the programmatic authority of some agency or NGO.
- Watershed planning is multiobjective in scope, if not in implementation.
- Watershed planning must involve more than one state and Federal agency affected by plan implementation because no single agency has the authority to carry out the entire process alone.

- Watershed planning involves multiple stakeholders affected by objective achievement and by the consequences of incomplete, inefficient, ineffective and otherwise unacceptable planning.
- Watershed planning at all agencies follows the same basic decision process, but varies in the details depending on the agency mission.

WATERSHED PLANNING IS A CONTINUOUS PLANNING PROCESS

All watershed-based planning and implementation of measures incorporate unavoidable uncertainty and risks, requiring a continuous planning cycle of monitoring and adaptation. Watersheds with problems serious enough to require publicly planned corrections are almost invariably culturally modified ecosystems. They are both ecologically and socially dynamic in ways not completely understood. Refinements, or even major redirection, may be required when planning uncertainties involve substantial risk that worthy objectives will not be realized over the period of intended effect. Programmatic planning for risk management requires continuous monitoring and evaluation of implementation outcomes, and anticipation of corrective actions where and when needed. The most effective programmatic planning not only will take advantage of independently researched science but also will incorporate rigorous applied science into the program. For a watershed process, this often materializes in a physical model that links proposed measure performance to physical indicators of objective achievement, such as indicators of water quality, hydroregime behavior, species population performance and the integrity of aquatic and riparian ecosystem structure and function.

WATERSHED PLANNING IS A MULTIOBJECTIVE PLANNING PROCESS

The accumulation of numerous watershed-based problems and environmental and management authorities has resulted in a de facto need for natural resources programs and projects to be multiobjective in planning scope, if not in implementation. All of the public services provided by a watershed, whether natural, enhanced or impaired, need to be identified to determine the stakeholder interests that might be affected. Whenever environmental constraints require additional project measures, the constraints act as objectives whether or not they are identified as such. By this reckoning, virtually all traditional water resources development projects now include a minimum of two objectives with at least one environmental protection objective. In the past, environmental protection often has included objectives other than impact avoidance. Compensatory mitigation actions, for example, have taken the form of fish and wildlife enhancement objectives. If there was an opportunity to alter the natural state to more closely meet water quality standards, that objective had to be included separately from an avoidance-mitigation objective. Even when an ecosystem (watershed) restoration objective is identified, some stakeholder interests often are less satisfied with the quality of the natural services that are likely to replace the services provided by the no-action condition. Whenever stakeholders need to be accommodated, at least one other objective needs to be achieved.

WATERSHED PLANNING IS A MULTIAGENCY PLANNING PROCESS

The network of authorities generated by Congress and state legislatures guarantees that no watershed planning process can be carried through implementation legally under a single state or Federal agency. Virtually all Federal natural resource and environmental law mandates appropriate coordination with other agencies at Federal, state and local levels to assure that all environmental and social obligations are met. The complications associated with integrating natural resource and environmental law, such as WRDA, FWCA, NEPA, CWA and ESA, have resulted in various informal and formal understandings and agreements that establish a multiagency planning process. Many authorities that come together under the rubric of regional planning, often using a watershed approach or perspective, include the USEPA, FWS, NMFS, FS, BLM, FHWA, BOR, TVA, NRCS, USACE and state and local agency counterparts. However, the process of integrating these agencies has been, thus far, piecemeal and variable depending on the specific objectives involved. During the past decade, the USEPA has begun to bring more order and comprehensiveness into the watershed planning process, using water quality objectives as the focus for integrating with other watershed-based objectives.

WATERSHED PLANNING IS A MULTI-STAKEHOLDER PLANNING PROCESS

Only the least impacted of watersheds are likely to be defined by the restoration of a single impaired natural service. Much more often, planning and implementation of measures throughout a watershed will result both in improvements and in degradation of numerous watershed services, each with their associated stakeholder interests. The perspective of a watershed varies depending on the relationship of agencies and other stakeholders to the services provided. Farmers and ranchers, for example, are more likely to focus on the capacity of the watershed to produce crops and livestock, which is facilitated by the NRCS. The NRCS and other water resources agencies are also concerned about runoff quantity, quality and variability in services provided to irrigators, domestic water supply, navigation interests, floodplain users, hydropower users, recreators and those concerned about the permanent loss of species. The diverse interests are rarely totally compatible, and tradeoffs are commonly necessary. Past lumping of environmental objectives under some general rubric, such as environmental protection and ecosystem restoration, has too often generated incompletely satisfying consequences. The “incidental” service effects are typically not understood well enough to cast as problems in the making, which could then be solved by achieving preventative or compensatory objectives.

WATERSHED PLANNING INVOLVES THE SAME BASIC DECISION FACILITATION

The process for making smart decisions in complex situations is described by Hammond et al. (1999) and Gregory (2000). The following elements are key to facilitating effective decision process:

- Identify the decision problem. Define it to solve the right problem.
- Identify the objectives. Clarify the achievement to be gained by the decision.

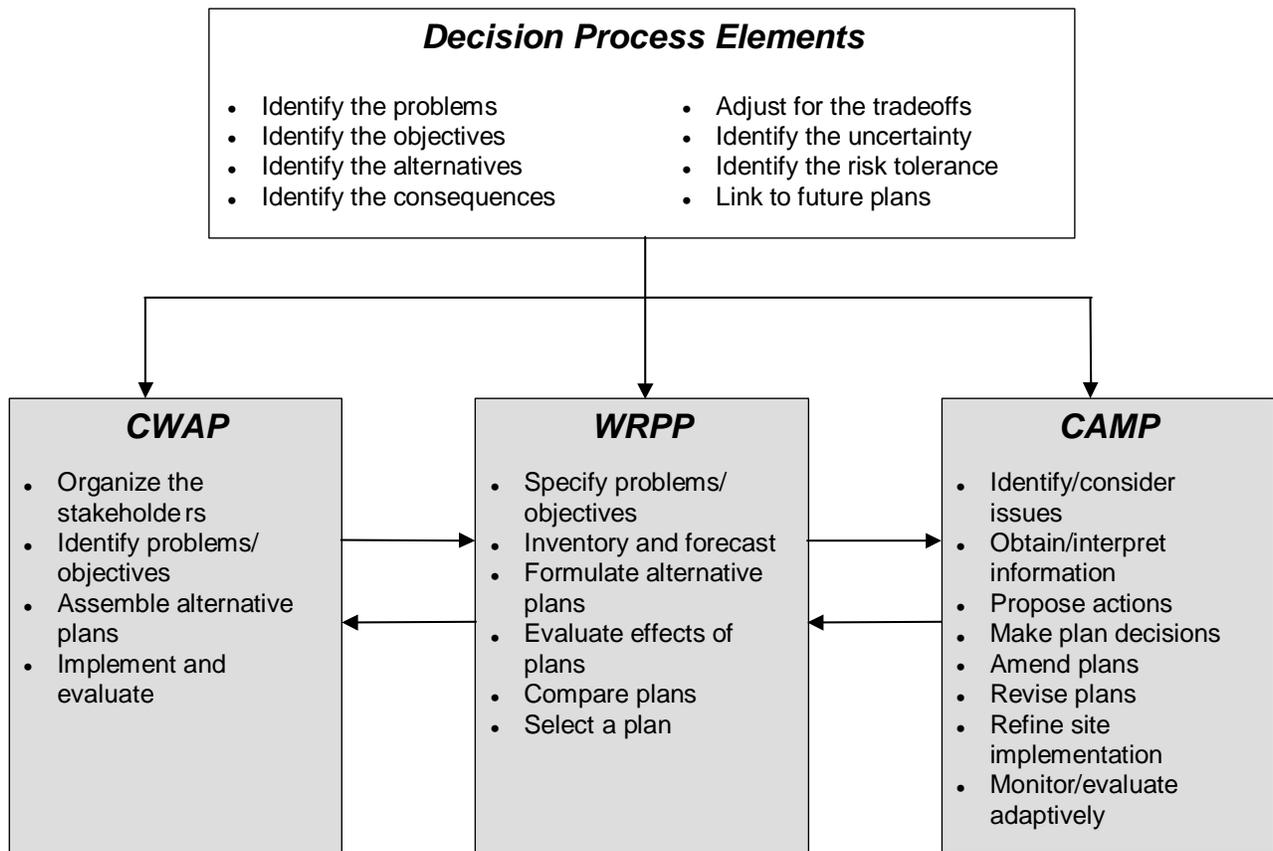
- Identify the alternatives. Create better alternatives to choose from.
- Identify the consequences. Show how the alternatives meet the objectives.
- Adjust for the tradeoffs. Balance objectives when conflicts arise among them.
- Identify the uncertainty. Quantify the uncertainties affecting the decision.
- Identify the risk tolerance. Account for the willingness to accept risk.
- Plan ahead. Coordinate present and future decisions.

These elements appear in various expressions of most natural resources planning processes. The first five are elemental in any project or program planning. The last three typically are considered in project planning but may have even greater implications in program planning. Historically, most programs have been initiated without complete knowledge of how projects should be carried out most efficiently, effectively, completely and acceptably to meet program goals and objectives. Participants in the better-managed programs learned adaptively from the outcomes of each implemented project and applied what was learned to the planning of new projects. In this way they incrementally improved their management of uncertainty and associated risk, and they became better at coordinating present project decisions with future project decisions to accomplish program objectives. The management science of “lessons learned” has improved and is the basis of the adaptive management concept, now an important strategic concept, being applied experimentally in several Federal management projects as part of the ecosystem approach.

V. WATERSHED PLANNING FRAMEWORK(S)

INTEGRATING WATERSHED PLANNING FRAMEWORKS

Because many aspects of watershed planning are held in common by different Federal agencies and some state agencies, opportunities exist for initiating integration of watershed planning frameworks by first recognizing their general attributes and then, coordinating elements. This is a start toward integrated frameworks, which requires more analysis and development (Stakhiv 1996). The greatest differences among agencies are based on the mission focus on environmental, land resource and water resource outcomes resulting from watershed management. Whether by initial design or simply by implementation, some of the frameworks cater more to programmatic activities while others emphasize project development. Once coordinated, however, the Federal and state agencies have all the authority required to plan watershed management comprehensively. Three general planning frameworks (see Figure V-1) originating from observed practice primarily at the Federal level are described further in this chapter.



**FIGURE V-1
FEDERAL WATERSHED PLANNING FRAMEWORKS**

CLEAN WATER ACTION PLAN FRAMEWORK

The Clean Water Action Plan (CWAP) is programmatic and developed primarily by the USEPA for the purpose of meeting state and national water quality standards determined under the CWA and, more recently, the CWAP. It is an open-ended, continuous process that emphasizes information inventory and forecasting, substantial reliance on stakeholders for identifying acceptable measures for achieving objectives, monitoring and evaluating results and adjusting measures as needed to assure that objectives are achieved. Because conditions in watersheds change, the planning process is continuous and needs continuous funding in a programmatic context. There is limited project development authority under CWAP.

COMPREHENSIVE ADAPTIVE MANAGEMENT PLAN FRAMEWORK

The Comprehensive Adaptive Management Plan (CAMP) is programmatic, developed by the FS and has established a potentially useful model for other agencies. The purpose of the planning process in the FS is beneficial use of forest and grassland resources compatible with the restoration and maintenance of sustainable ecological process in the National Forest System. This planning process emphasizes the uncertainty associated with the concepts of ecosystem management and ecological sustainability and the need for an adaptive management process based on scientific monitoring of ecosystem responses to management. Planning is viewed as an open-ended, continuous cycle through inventory of programmatic problems and opportunities, strategic and operations planning, plan implementation (operations), monitoring and evaluation of performance and results, and adjustment of planning and implementation processes. The planning cycle of the CAMP has much in common with the Comprehensive Management Planning framework advocated by the FWS and by state agencies using fish and wildlife Federal aid funds (see Crowe 1983).

WATER RESOURCES PROJECT PLANNING FRAMEWORK

The WRPP is project planning, which is most completely developed by the USACE (Yoe and Orth 1996) but closely parallels planning frameworks used by the NRCS, TVA and BOR. The WRPP differs from the other planning approaches in being a closed-ended process for planning projects without explicit steps for monitoring and evaluating project performance in a programmatic context. However, while it fails to completely address all needs in a programmatic planning framework, it excels for project planning and is easily integrated with the two programmatic approaches, which include the monitoring and adaptive elements for a continuous planning process.

CLEAN WATER ACTION PLAN FRAMEWORK

The USEPA guidance emphasizes that contemporary watershed planning is not served well by any single recipe for success but is flexible and builds support from numerous points of

stakeholder view. The steps in the CWAP framework are more important for guiding the general planning process than for prescribing every step “literally and in sequence.” The following is a brief framework description.

PRELIMINARY TO PLANNING: ORGANIZE THE STAKEHOLDERS

- **Assemble a Partnership:** Before watershed planning begins, a partnership needs to be assembled from local concerned individuals, agencies and NGOs with a stake in the watershed condition.
- **Include All Stakeholders:** Appraise the composition, strengths, maturity and representation of the stakeholder membership to fill gaps where needed. The group will be most effective when leadership, technical, communication, education, political liaison and public policy roles are well covered.
- **Verify Stakeholder Memberships:** Assure that all stakeholders in the watershed planning process believe their efforts are needed.

SPECIFY PROBLEMS (CHALLENGES) AND OBJECTIVES

- **Identify Concerns:** The partnership of stakeholders should identify and address all concerns, no matter how minor they may seem that may combine water and other natural resources issues, local economy and social matters.
- **Identify Valued Watershed Features:** As part of developing the stakeholder partnership, those features of, and events in, the watershed that are especially valuable ecologically, economically or socially are identified for the purpose of establishing a watershed goal or set of goals.
- **Seek and Analyze Data:** Make use of suitable existing data (e.g., water quality data, land use/cover information, point source data).
- **Prioritize Problems/Opportunities:** One way to prioritize problems is to establish criteria, which might include:
 - Ó The extent the problem impedes goals and alters valued features and events
 - Ó The ability of the planning group to bring about change
 - Ó How much time elapses between actions and results
 - Ó The extent that costs outweigh or fall short of the benefits
- **Document Problems and Opportunities:** Documentation is needed of obstacles and opportunities for positive effect.
- **Document Useful Information:** All data and other information gathered during this initial phase need to be well organized, tracked and stored.

- **Establish Objectives:** Focus the group by describing objectives in measurable terms and recognize that they may change as more information becomes available.
 - Ó Take into account existing regulations and legal constraints.
 - Ó Consider all stakeholder views and seek group consensus for a vision of success.
 - Ó Keep objectives acceptable and doable in the minds of all stakeholders.

DEVELOP ALTERNATIVE PLANS AND WAYS TO MEASURE PROGRESS

- **Select Management Alternatives:**
 - Ó Draft a list of management alternatives that could help achieve the objectives.
 - Ó Use watershed computer models to help understand watershed relationships.
 - Ó Use other decision tools to address economic and environmental concerns.
 - Ó Use models and tools to compare different management alternatives.
 - Ó Document the alternatives and their advantages and disadvantages.
- **Assemble an Action Plan:** List the actions (measures) the group decides to meet for each objective.
- **Identify Those Responsible:** List who is responsible for each action and how progress will be demonstrated.

IMPLEMENT AND EVALUATE EFFORTS

- **Fund Actions:** The more complex management actions—like cost-share incentives or implementing technical projects—require funding and consideration of funding options.
- **Prioritize Actions:** More actions are likely to be listed than can be done, and the group will need to reevaluate priorities based on available funds, return on investment, time available, difficulty of the action and action effect on other actions.
- **Measure and Report Progress:** Scientific monitoring is needed to track larger and more complex activities. Other low-tech approaches (i.e., social activities) may be useful for getting people involved and interested in the watershed's condition.
- **Review the Plan:** As seasons go by, the watershed partnership will need to review the plan for continued or improved effectiveness.
- **Refine the Plan:** Refine the objectives as well as the management options to address them. Remember that watershed plans are always evolving and adapting to new and improved information, addressing new issues and making progress.

COMPREHENSIVE ADAPTIVE MANAGEMENT PLAN FRAMEWORK

The FS offers the most explicit framework for adaptive management planning in a programmatic context, which may or may not be applied in a watershed context. A recent digest of the planning framework is provided in the Federal Register (2000b). The planning framework may be applied at all levels of FS planning from national to regional to district. The FS policy states that the planning should:

- Be flexible
- Fit solutions to the scope and scale of needed actions
- Engage the public
- Apply the best science
- Contribute to sustained use of National Forest System lands
- Be interdisciplinary and collaborative

IDENTIFICATION AND CONSIDERATION OF ISSUES

- **Origin of Issues:** Issues may arise from sources that include inventories, assessments, analyses, monitoring, project evaluations, discussions with the public, proposals by organizations, administration leadership, cooperatively developed landscape goals, evaluation of sustainability, policies, new laws and applications for occupancy and use of FS lands.
- **Consideration of Issues:** Critical factors are based on scope, complexity, geographic scale of measures needed, statutory requirements, organizational and community capabilities and resources and scientific merits. The relationship of potential actions to the existing strategic plans and policies and other stakeholders are also important considerations.

INFORMATION DEVELOPMENT AND INTERPRETATION

- **Review Information:** To determine if more information is needed, review information such as inventories, broad-scale assessments, local analyses or monitoring results.
- **Broad-Scale Assessments:** Provide ecological, social and economic information of broad geographical scale to develop conclusions and any needs for additional research.
- **Local Analyses:** Cover watersheds or other ecological and social regional units to provide ecological, social and economic information. These should provide descriptions of the area, issues, current conditions, syntheses and interpretations of information and recommendations.

PROPOSED ACTIONS

- **Proposal:** The responsible official proposes site-specific action, an amendment or revision to the plan or both.
- **NEPA Requirements:** The proposal must be analyzed in conformance with NEPA procedures.

PLAN DECISIONS

- **Identify Desired Resource Conditions:** Define the resource conditions sought within all parts of the plan area, which may include, but are not limited to, the desired watershed and ecological conditions.
- **Objectives:** Develop concise statements describing measurable results (including desired levels of uses for sustainability, values, products, services) and assuming spending levels as appropriate. Objectives should include estimates of time and resources needed for completion.
- **Identify Standards:** Identify the requirements and limitations for land uses and management actions necessary for achieving desired conditions, objectives and compliance with laws and policies.
- **Designate Suitable Land Uses:** Identify suitability for specific land uses such as transportation, grazing, timber production and special designations.
- **Monitoring Strategy:** Develop a general approach and measures planned for monitoring results after plan implementation (required for each plan).

AMENDMENT

- **Amend Plans:** Add, modify or rescind plans based on consideration of issues, information and analysis of effects. Collaboration opportunities must be outlined.
- **Environmental Review of a Proposed Plan Amendment:** The NEPA procedures must be followed to complete the analysis, and proper public involvement is required.

REVISION

- **Application of the Revision Process:** A review is required for overall management of a unit of the National Forest System, and an opportunity to analyze the effects of plan decisions.

- **Initiate Revisions:** Opportunities must be provided for collaborating and summarizing relevant issues, developing information, analyzing, evaluating the effectiveness of contribution to sustainability and identifying specific watersheds in need of protection or restoration measures.
- **Public Notice of Revision Process:** Give public notice and make information available for public comment for at least forty-five days.
- **Notice of Intent:** Following the NEPA process, a Notice of Intent is prepared for a draft Environmental Impact Statement and, after public comment on the draft statement, a final Environmental Impact Statement is prepared.
- **Final Decision on Plan Revision:** A record of decision for plan revision is signed.

SITE-SPECIFIC DECISIONS

- **All Site-Specific Decisions Must Be Consistent With the Plan:** If not consistent with the plan, the proposal must be rejected, the plan proposal modified or the plan amended.

MONITORING AND EVALUATION FOR ADAPTIVE MANAGEMENT

- **Plan Monitoring Strategy:** Each plan must have a practical, effective and efficient monitoring strategy to evaluate sustainability, including ecosystem diversity, species diversity and social and economic sustainability.
- **Monitor Site-Specific Actions:** Authorizations of site-specific actions should describe the required monitoring and evaluation, and determination should be made of the adequacy of funding.
- **Monitor Methods:** Monitoring methods may be changed to reflect new information without amending or revising the plan.
- **Use of Monitoring Information:** Monitoring information is to be used to determine if site-specific actions are accomplished as specified, if the aggregate effects of completed and ongoing actions contribute to the desired conditions, if the assumptions remain valid and if the plan or site-specific actions need modification.
- **Coordinate Monitoring Activities:** Monitoring and evaluation should be done jointly with other agencies, the scientific community and others where practicable. Opportunities should be provided for public involvement.
- **Annual Monitoring and Evaluation Report:** A report must be completed within six months of each year of evaluation.

WATER RESOURCE PROJECT PLANNING FRAMEWORK

Variations of the six-step project planning process (WRC 1983, Yoe and Orth 1996) are commonly used in water resources development studies conducted by Federal agencies. It is a basic approach to problem solving and aligns closely with many of the elements described in an effective, basic decision process (Robbins 1999, Hammond et al. 1999). A comparison with CAMP and CWAP will reveal the greater detail applied to the process of formulating and evaluating project plans, which involves half of the six steps. The WRPP framework is most effective when the solutions to problems are quite certainly solved by project implementation. No provision is made for adaptive modification, which is typically better managed in a program-planning framework such as CWAP and CAMP. The six steps to the WRPP framework are briefly described in the following section.

(1) SPECIFY PROBLEMS AND OPPORTUNITIES

- **State Problems Clearly and Concisely:** Typically, project partners identify water resources problems and opportunities clearly and concisely.
- **State Objectives and Constraints:** Once identified, the problems and opportunities are translated into objectives that generally indicate needed actions and constraints.
- **Define the Project Area:** In addition, a project area is defined that is appropriate for addressing the problems, which may be a watershed or other area definition.
- **Use a Watershed Perspective:** While a watershed perspective improves most water resources projects, the project area of many projects is smaller than the effective watershed. Watershed projects typically are more inclusive of numerous problems and opportunities with measures dispersed throughout the watershed.

(2) INVENTORY AND FORECAST CONDITIONS

- **Inventory Resource Conditions:** Information is collected to produce an inventory of past and present resource conditions describing the problems and opportunities using existing and original data about natural, social and economic processes.
- **Data Selection:** Data are selected either to develop plans or to evaluate the effects of plans.
- **Forecast No-Action Condition:** Forecasts are made of the no-action (without project) condition based on trend data and on the probability that such trends will continue.

(3) FORMULATE ALTERNATIVE PLANS

- **Identify Measures:** Plan formulation identifies measures for attaining objectives within the identified constraints, including conformation with all environmental and other laws.
- **Develop Alternative Plans:** Alternative plans are developed from different measures or significantly different combinations of measures. Watershed project plans would have in common the dispersion of measures throughout the watershed. A single such dispersed measure would be watershed reforestation. Alternatively, the measures might include a diverse mix of nonstructural and structural land and water treatments applied at various origins of the problem.
- **Involve Disciplinary Diversity:** Generally, plan formulation improves as the disciplinary diversity of the planning team increases.

(4) EVALUATE EFFECTS OF ALTERNATIVE PLANS

- **Compare Plans With No-Action Plan:** Each alternative plan is compared with the without-project plan to determine the plan effect (or impact).
- **Apply Planning Tools:** Models and other planning tools often are used to evaluate the proposed measures for their effectiveness, efficiency, completeness and acceptability in realizing the objectives.
- **Gauge Effects:** Both positive and negative effects are gauged by magnitude, location, timing and duration.
- **Disqualify Flawed Plans:** At this point, fatal flaws that disqualify the plan are identified, and the plan is either modified or discarded. Common types of evaluations include cost estimation, real estate costs, economic benefits, environmental benefits, negative environmental impacts and positive and negative social impacts.

(5) COMPARE ALTERNATIVE PLANS

- **Compare All Remaining Plans:** The plans are compared to determine which is the best plan.
- **Identify Effects and Tradeoffs:** Because plans are not likely to be universally best, the important effects of the plans have to be compared and tradeoffs considered and each plan ranked. Comparisons might be made based on the degree objectives are met, dollar costs and benefits, effects required by law, cost-effectiveness and other effects important to stakeholders and society.

(6) SELECT RECOMMENDED PLAN

- **Decision Makers Select Plan:** The results of comparisons made in the previous step are provided with recommendations to decision makers, who select a plan to recommend for implementation.
- **The NED Plan May Be the Best:** Excepting ecosystem restoration (which is judged based on cost-effectiveness), the best plan is defined as the NED plan, which is the one that contributes most to the NED consistent with protecting the environment (WRC 1983). An exception is commonly granted when the local project sponsor prefers a plan other than the NED plan.

ENTERING THE INTEGRATED FRAMEWORKS

The three frameworks can be interfaced and integrated as shown in Figure V-2. The adaptive, programmatic planning cycle forms the conceptual center, whether the framework starts out from the CWAP or CAMP approach. The WRPP framework is limited to projects but is applicable to a programmatic planning process if adaptive management monitoring and evaluation steps are added. This might be done, for example, through a specific program

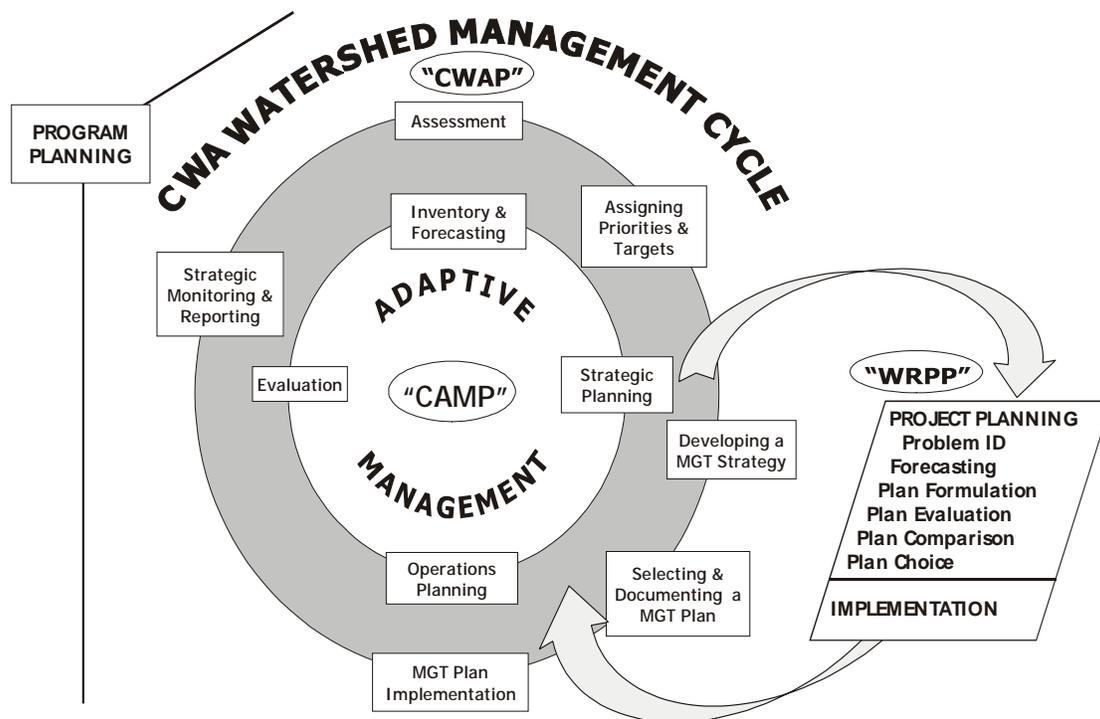


FIGURE V-2
INTEGRATION OF THE CWAP, CAMP AND WRPP
INTO AN ADAPTIVE WATERSHED MANAGEMENT FRAMEWORK

planning authorization such as the CERP. This kind of flexibility might be possible through any of the three frameworks depending on the framework of the lead agency.

CLEAN WATER ACTION PLAN LEAD

A CWAP lead is likely to be a state or local government agency that has adopted a planning framework like that developed for the USEPA watershed management cycle. Although it places water quality standards first among objectives, USEPA advocates a multiobjective-planning framework. The CWAP framework emphasizes recovery of sensitive, threatened and endangered species under the authorities of the FWS and the NMFS.

Coordinating with USEPA, the lead state or local agency may approach a Federal water resources agency, such as NRCS, BOR, USACE or TVA, to jointly fund multiobjective projects, possibly including flood damage reduction, ecosystem restoration, navigation or water supply objectives. One major motivator for such alliances is the Federal funds that would be brought to a watershed project meeting the qualification criteria. If so, a WRPP framework might be inserted into the CWAP process either in a fully developed or modified form, depending on how well the local sponsor has satisfied planning criteria (efficiency, effectiveness, completeness and acceptability). To an extent, the WRPPs of different agencies differ depending on missions and authorities and sometimes are complementary, as are the NRCS with USACE, BOR and TVA. This type of partnership would be more common east of the Rocky Mountains.

COMPREHENSIVE ADAPTIVE MANAGEMENT PLAN LEAD

Especially in the western U.S., where the Federal land management presence is large, local/state watershed agencies/organizations might approach a Federal land management agency partnership before, or in addition to, approaching a Federal water resources agency. The CAMP framework of the FS brings a stronger land management, project planning process to the framework, just as the NRCS does for agricultural conservation planning.

At the programmatic level, the adaptive management steps for CAMP are very similar to the monitoring, evaluation and plan refinement steps of the CWAP. But for non-Federal lands, the local partnerships are responsible for programmatic watershed planning, including adaptive management. Generally, continued enforcement of the environmental standards at both state and Federal levels motivates commitment to the adaptive management process.

WATER RESOURCES PROJECT PLANNING LEAD

A local sponsor may very well approach a water resources agency for a flood damage reduction, water supply, ecosystem restoration or other such primary objective, not addressing directly water quality or endangered species. Even so, the partnership is constrained to assure that the standards set by environmental law are met and, where possible, environmental conditions are improved. In one form or another, CWAP steps are likely to require consideration and inclusion, if not already incorporated, into a watershed-oriented WRPP framework. Because

the water resources agencies are not generally authorized to do programmatic watershed planning (there are specific exceptions), this responsibility falls to the local sponsors. Motivations for sustaining programmatic goals typically originate from both state and Federal law.

VI. SUMMARY AND FUTURE ANALYSIS

This study has established that the skeleton of an integrated watershed-planning framework can be assembled from existing Federal planning frameworks, but much is left to be done to develop an integrated framework. The most advanced planning framework detail has been developed for WRPP (the Type C planning of the WRPA of 1965) such as described by Yoe and Orth (1996). While not specifically developed for watershed studies, the WRPP framework can be adapted with development of suitable guidance. Project planning, however, fails to adequately address certain watershed planning element needs that can be better accomplished at the program level (e.g., adaptive management). Integrative watershed planning at the program level (such as the Type A and B planning of the WRPA) is a strategic process that is presently less developed than project planning.

Presently programmatic watershed planning tends to be concentrated in the local watershed planning process and is focused on meeting environmental standards while sustaining local welfare improvement. The process tends to exclude consideration of impacts outside the local (usually small) watershed planning scope. There is less clear evidence of the big-picture sustainable development planning and management at interstate regional and national levels despite regional watershed programs such as the Great Lakes and Chesapeake Bay programs, which are mostly motivated by environmental standards. As long as local environmental standards drive the planning process, the efforts may remain less than fully comprehensive and of questionable ultimate effectiveness.

The WRCs hierarchical concept of watershed-based planning is a reasonable starting point for improvement (Stakhiv 1996) of interactions among local, state and Federal agency participants in the watershed planning process. Interagency definition of criteria is particularly needed for the sustainable development, cumulative impact analysis and adaptive management elements required for a complete watershed-planning framework. All three elements require incremental impact analyses with respect to stated regional and national criteria or standards, and, together, contain aspects that appear to be internally inconsistent. Existing environmental standards might establish one basis for judging cumulative impacts and guiding adaptive management, once that process is better defined. The more comprehensive standards needed to guide sustainable development are not clearly defined enough (strategically and programmatically) to transform watershed project planning into a comprehensive, proactive and adaptive watershed planning process.

The results of this study confirm the complexity encountered in past watershed planning. The watershed planning environment of the Federal agencies reviewed here provides a start for developing a detailed framework with which the USACE can either participate in or lead interagency watershed planning involving Federal, state and local interests. The results also indicate a need for more thorough research and development of some of the more important elements of watershed planning practice before a detailed framework can be completed for testing in actual watershed studies, modifying from lessons learned and translating into planning guidance. Based upon the apparent needs through this literature based study and the concepts that were identified during the District focus groups, framework elements that deserve more detailed research and development include:

- **Adaptive management.** Agencies such as the FS have gained useful experience in trials for evaluating adaptive management design and performance, funding mechanisms and lessons learned from successes and frustrations.
- **Environmental sustainability.** Various agencies have adopted an environmental sustainability or maintenance policy that appears to be central to principles underlying watershed planning. The details of how those policies have been carried out in watershed planning need further scrutiny.
- **Watershed science and models.** Watershed planning pays homage to the need for good science that links watershed uses through processes to aquatic impacts, usually through mathematical models. However, many problems associated with planning needs getting ahead of the science need to be addressed. Exactly how watershed science and modeling have been used to facilitate watershed-planning process needs to be developed more thoroughly than it has been. Furthermore, research is needed to bring technical watershed science more firmly into project level planning.
- **Identifying and integrating the local, state and Federal hierarchy of public interests in watershed planning.** Much of present watershed planning starts at the local watershed level, where local interests are not clearly linked to regional and national interests. The successes and failures of planning procedures now used in other agencies to integrate the locally driven watershed planning process into an effective interstate and river basin planning process need to be further developed. Assurance that all stakeholders in the watershed planning process are included from the beginning is commonly stressed, but the procedures and protocols for that assurance need to be researched in more detail. Ineffective coordination leads the list of constraints on the watershed planning process. More detailed elaboration of what works and what does not is needed to facilitate completeness, speed, and accuracy of information conveyed to about:
 - Ó Funding needs
 - Ó Assignment of responsibilities
 - Ó Planning progression
 - Ó Monitoring and adaptive management
- **Develop the USACE watershed-planning framework.** While this study focused on other Federal watershed planning processes, it revealed that the USACE has facilitated successful watershed planning. Framework refinement would be improved by case study review. As the USACE watershed level planning experience continues, there is a very good opportunity to provide a more comprehensive planning package to further supplement the traditional USACE technical contributions such as hydrologic modeling, environmental analysis and socioeconomic analysis. The results of District interviews suggest that existing authorities and policies are not entirely supportive of the USACE-led watershed planning. An in-depth analysis of authorities and policies is needed to recommend ways for mitigating existing impediments to a more effective watershed planning process.

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APPENDIX A
FEDERAL AGENCY WATERSHED PLANNING

FEDERAL AGENCY WATERSHED PLANNING

INTRODUCTION

The current explosion of local watershed planning and management efforts have continued to involve Federal agencies in their collaborative planning processes. The following section reviews the planning protocols of selected Federal agencies that have continued to be highly involved in watershed management and planning activities all over the country. The six selected agencies, order not withstanding, are the USEPA, the TVA, the U.S. FS, the BLM, the BOR and the NRCS. There are other Federal agencies that do watershed planning, but their involvement is limited based on the literature reviewed. Except for those agencies, which are summarized at the end of this appendix, each of the selected agencies is reviewed under the following subheadings: mission, authorizing legislation, framework, models/data, participation and funding mechanism.

ENVIRONMENTAL PROTECTION AGENCY

MISSION

According to the USEPA strategic plan (USEPA 2000) “The mission of the USEPA is to protect human health and to safeguard the natural environment—air, water and land—upon which life depends.” In Goal 2 of the strategic plan the USEPA states: “Watersheds and their aquatic ecosystems will be restored and protected to improve public health, enhance water quality, reduce flooding and provide habitat for wildlife.” The USEPA has more aggressively advocated a watershed approach to water quality and more general environmental protection since the early 1990s. The USEPA has set an objective for 2005 of increasing the number of U.S. watersheds that meet 80 percent or more of the water quality standards by 175 more than the 1998 baseline number of 501 (out of a total U.S. number of 2,262). Included are standards that support healthy aquatic communities.

Watershed planning at the USEPA addresses environmental management on a community or watershed-specific basis rather than its previous top-down regulation (NRC, 1999b). The USEPA intends watershed planning to be comprehensive by incorporating a complete range of scientific expertise and a full range of interests or stakeholder concerns to address the highest-priority problems within hydrologically defined areas, taking into consideration both ground- and surface-water flow. However, the USEPA planning does not explicitly link problem and watershed-scale identification. By 2005, the USEPA intends to provide decision support tools for use by local decision makers in community-based watershed management.

AUTHORIZING LEGISLATION

The CWA of 1972; Resource Conservation and Recovery Act, the Federal Insecticide, Fungicide and Rodenticide Act, and the 1974 Safe Drinking Water Act (SDWA).

FRAMEWORK

The USEPA fosters a cooperative and coordinated partnership with states, tribes and other Federal agencies. Many of the Federal environmental statutes call for the USEPA to authorize or delegate to states the primary responsibility for implementing programs, once the USEPA determines they meet qualifying criteria. In 1995, the USEPA and states established the National Environmental Performance Partnership System, which provides for joint setting of environmental priorities and the negotiation of Performance Partnership Agreements that define responsibilities. An important part of the USEPA role in the partnership is providing technical support, including decision tools such as planning guidance using a watershed approach (Figure A-1). In effect, the USEPA programmatic goals and objectives are implemented through watershed projects planned by the states, tribes and local communities using the USEPA guidance.

The USEPA supports watershed approaches that aim to prevent pollution, achieve and sustain environmental improvements and meet other goals important to the community. A major objective of this approach is to facilitate the development of more effective TMDL plans for impaired bodies of water. As of 1998, the USEPA, states, tribes and other Federal agencies were working in a total of 2,262 watersheds delineated using the USGS hydrological unit codes. Although watershed approaches may vary in terms of specific objectives, priorities, elements, timing and resources, the USEPA has required that all should be based on some stated guiding principles. The USEPA has identified a set of coordinated management activities to identify watershed problems and objectives for their resolution. These include the following:

1. Problem prioritization and resource targeting that take into account stakeholder concerns within the relevant watershed unit.
2. Goal setting that ideally begins with established water quality standards but reviews and, if appropriate, revises those standards to better meet expectations within the local watershed.
3. Data analysis that accurately assesses the watershed's aquatic resources.
4. Geographic management units that are spatial units within which watershed policies are implemented and monitored.
5. Broad stakeholder involvement in the planning process.

In summary, a successful watershed project, according to the USEPA, should consider the following important elements:

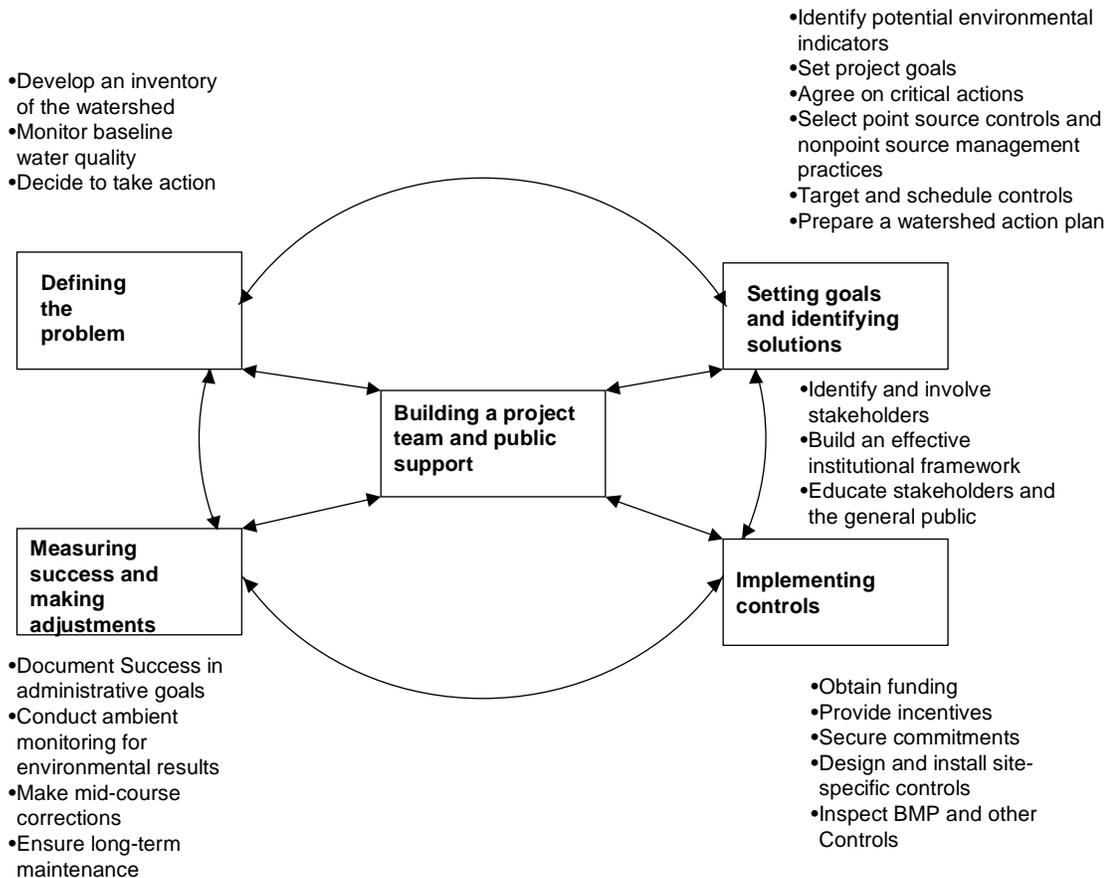


FIGURE A-1
WATERSHED PLANNING AND MANAGEMENT PROCESS ELEMENTS
 (showing individual activities relevant to pursuit of water quality objectives
 in state and local programs [USEPA 1993])

- Defining the problem by developing an inventory of the watershed and its problems and conducting baseline monitoring.
- Setting goals and identifying solutions by developing project goals, listing management measures and planning in detail for their implementation.
- Implementing controls by obtaining funding, securing commitments and installing controls
- Measuring success and making adjustments by documenting success in meeting goals, monitoring changing management measures as needed, adjusting management practices to adapt to the changing needs and ensuring project continuity.

The USEPA attempts to base the geographic scope of management units on hydrological considerations, although the agency considers other factors such as political boundaries as well. The USEPA acknowledges that watersheds may be defined at different scales and that the scale identified has implications for the roles of political authorities and relationships between

stakeholders. However, it does not explicitly link problem and scale identification. Even though the USEPA emphasizes the involvement of a broad array of stakeholder interests, it does not acknowledge that this mix is likely to result in the need for conflict resolution (NRC 1999b). Most important, it does not offer any procedures for identifying tradeoffs between different plan options, and the USEPA “understates the need for compensation tools to address unequal burdens shouldered by some interests in the implementation of watershed management plans” (NRC 1999b).

MODELS

The USEPA’s water programs, and their counterparts in states and pollution control agencies, are using Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) as one of the modeling tools. This tool integrates a GIS, national watershed data and environmental assessment and modeling tools. The BASINS addresses three objectives:

- To facilitate examination of environmental information
- To provide an integrated watershed and modeling framework
- To support analysis of point and nonpoint source management alternatives

In addition, the USEPA is developing methods, including models, which will indicate ecological health at multiple spatial scales, trace the transport and fate of pollutants within watersheds and evaluate the efficacy of watershed restoration schemes. Numerous watershed models have been developed to trace and predict water quality. The outputs of some of these models are compared by Donigian et al. (1996).

DATA

Using monitoring data, stakeholders can identify stressors that may pose health and ecological risk in the watershed and any related aquifers, and prioritize these stressors. Data analysis and professional judgment are used to identify problems, sources, and stressors. The data necessary for this effort include the following:

Spatially Distributed Data

- Land use/land cover
- Urbanized areas
- Population place locations
- Soils
- Elevation
- Major roads
- USGS hydrologic unit boundaries
- Drinking water supply sites
- Dam sites

- USEPA regional, state, and county boundaries
- Federal and Indian lands
- Ecoregions (Ecological regions)

Environmental Monitoring Data

- Water quality monitoring station summaries
- Water quality observation data
- Bacteria monitoring station summaries
- Weather station sites
- USGS gauging stations
- Fish and wildlife advisories
- National sediment inventory
- Shellfish classified areas
- Clean water needs survey

Point Source Data

- Permit compliance system sites and computed loadings
- Industrial Facilities Discharge sites
- Toxic Release Inventory sites
- Superfund National Priority List sites
- Resource Conservation and Recovery Act sites
- Mineral Industry Locations

PARTICIPATION

The USEPA stresses the importance of broad stakeholder involvement in the planning process. It urges that watershed planning and management partnerships include representatives from all levels of government within the watershed's boundaries. Additionally, any others within the watershed with an interest in the management of the watershed, such as representatives of conservation districts, public interest groups, industries, academic institutions, private landowners and concerned citizens, should be included. The USEPA encourages watershed partnerships between stakeholders to develop plans that are consistent with applicable regulations of relevant levels of government and the needs and concerns of all stakeholders.

FUNDING MECHANISM

The USEPA has a *Catalog of Federal Funding Sources for Watershed Protection, Second Edition 1999*, this catalog provides a guide for watershed practitioners on the Federal monies that might be available to fund a variety of watershed protection projects. This version of

the catalog updates the USEPA's *Catalog of Federal Funding Sources for Watershed Protection* (USEPA 1997b). This new funding catalog presents information on sixty-nine Federal funding sources (grants and loans) that may be used to fund watershed projects. The catalog includes key words that may be used to search for funding programs for particular subject areas.

TENNESSEE VALLEY AUTHORITY

MISSION

“The mission of the TVA is to develop and operate the Tennessee River system to improve navigation, minimize flood damage and to provide energy and related products and services safely, reliably and at the lowest feasible cost to residents and businesses in the multi-state Tennessee Valley region” (TVA 2000). Other management purposes include “water quality, public lands conservation, recreation and economic development.” One goal of the TVA is “supporting a thriving river system.” Provision for acceptable water quality and minimizing flood damage are two strategies that link closely with a watershed approach to planning. The performance measures include additional flood storage availability in reservoirs and achieving watershed water quality.

The TVA generally organizes its planning and management of watersheds in the context of the Tennessee River basin. Until 1999, the key organizing features of the TVAs watershed-planning approach were watershed-based River Action Teams (RAT). In 1999, the RATs and parallel land management teams were joined into watershed teams, which consist of water resources experts, such as biologists and environmental engineers, as well as community specialists and environmental educators. Any one of more than six hundred watersheds is the watershed team's fixed geographic area defined for planning and other purposes, and it may transcend various political boundaries. However, the teams are allowed flexibility in identifying the appropriate watershed scale for dealing with particular problems. However, the variation of the watershed scale to address specific problems is not dealt with explicitly by the TVAs Clean Water Initiative (CWI) guidelines. The TVA strongly emphasizes inclusion of all stakeholders as well as development of partnership in the watershed planning process.

AUTHORITY

Under Section 26a of the TVA Act, the TVA has the authority to regulate land use and development along the Tennessee River and its tributaries. A number of amendments have been proposed to the regulations that implement the TVAs responsibilities under Section 26a. The TVA launched its CWI in 1992; this is an alternative program that focuses on integrating local residents, businesses and government agencies in watershed protection efforts.

FRAMEWORK

Identification of problems is performed with the help from continuous resource assessment based on the TVAs ecological monitoring program. The analysis of data is used to identify specific problems and measurable objectives, which are used to prioritize problems for treatment of the identified shortcomings. When making the analysis, the TVA considers tradeoffs made in selecting some projects over others but does not discuss the use of the principle of analysis in selecting alternative solutions to a particular problem. The TVA does, however, recognize that all stakeholders may not be equally informed about watersheds and that lack of awareness and understanding of the functioning and value of aquatic ecosystems is an important source of environmentally harmful behaviors and lack of support for watershed management. The CWI strives to involve stakeholders in watershed projects as a means of increasing knowledge through participation, changing behavior toward better stewardship of the environment and revealing shared values regarding the environment and the need for watershed management.

In its management of the Tennessee River watershed, the TVA uses a holistic, integrated method that factors water quality with other concerns to achieve a balance among the competing demands placed on the river system. However, the TVA does not have the authority to regulate water pollution. The USEPA and the individual states that share the river set their own pollution regulations and grant discharge permits. Those controls are mostly focused on business and industrial operations located along the river, not on the activities of the general public.

The TVA participates in a cooperative process with local and regional, private and government partners to improve water quality and other natural resource conditions. The TVA conducts watershed assessments in the six hundred eleven watershed units constituting the Tennessee River system. To help people in communities across the Tennessee River valley actively develop and implement protection and restoration activities in the individual watersheds, the TVA formed eleven multidisciplinary watershed teams. These teams work in partnership with business, industry, government agencies and community groups to address nonpoint source pollution (e.g., runoff from farms and suburbs); shoreline management and the protection of stream corridors, wetlands and clean drinking water. Among other accomplishments, these community coalitions have:

- Instituted agricultural and urban-management practices that reduce water pollution
- Treated eroded land and stabilized streambanks
- Planted vegetation and installed structures intended to improve aquatic habitat
- Collected waste and litter from streambanks and shores

The TVA clearly stresses that the water in a watershed represents only half of its overall ecology, since land and its sustainable management also play a pivotal role in maintaining the watershed's health. The TVAs Land Stewardship Planning program attempts to steer a fair course among these competing demands while maintaining the stability of ecosystems and conserving the valley's resources for generations to come. The reservoir land management process systematically identifies the most suitable uses of public land, with particular emphasis on protecting natural resources. Specific plans have already been completed for 141,000 acres of public land; plans for another 65,000 acres are currently under way.

PARTICIPATION

Public involvement plays a key role in this process. The TVA recognizes that a fair, comprehensive strategy based on stakeholder opinion is important before it can commit to developing and implementing any management plan that will affect the region's watershed. A section of the TVAs website that is devoted to land use actions provides information about requests for land use changes and collects the comments that help the agency apply a plan for the area in question.

The Regional Resource Stewardship Council provides another avenue for public involvement. This twenty-member advisory group helps the TVA set priorities concerning the best practices for managing the public assets and natural resources of the Tennessee Valley. Its website offers regular updates of the council's activities and a complete contact list of participating members. The TVA acknowledges that planning, public input and partnerships are the elements that guide wise and effective use of the environment.

Other TVA-sponsored initiatives designed to safeguard the region's water include the Tennessee Valley Clean Boating Campaign, which promotes water quality protection on the part of recreational boaters; and Kids in the Creek, a program that teaches schoolchildren throughout the valley about watershed stewardship.

U.S. FOREST SERVICE

MISSION

“The mission of the USDA FS is to sustain the health, diversity and productivity of Nation's forests and grasslands to meet the needs of present and future generations” (FS 2000). These areas provide multiple benefits to the country, from traditional commodities such as timber, range, forage and minerals, to opportunities for recreation. Through the land and resource management planning process, this agency addresses the sustainability of ecosystems by restoring and maintaining species diversity and ecological productivity to provide for recreation, range, water, timber, fish and wildlife. Through technical and financial help, the FS also assists states and private landowners in promoting rural economic development, improving the natural environment of cities and helping rural communities with natural resource concerns such as practicing good stewardship of private forestland, erosion control and watershed protection. It pursues some of its mission off the National Forests and National Grasslands through research and information dissemination. An important product is the assessment of the nation's forest and range renewable resources, which is updated periodically.

The first goal of the FS strategic plan is to “promote ecosystem health and conservation using a collaborative approach to sustain the Nation's forests, rangelands and watersheds.” This goal places watersheds at the same level as forests and rangeland as objects of its mission. The first objective in the goal is to “improve and protect watershed conditions to provide the water quality and quantity and the soil productivity necessary to support ecological functions and intended beneficial water uses.” To achieve this objective, the FS will implement a watershed

assessment system with national standards (about completed); complete watershed assessments, plans and projects for watersheds identified for priority treatment in the CWAP; design projects to achieve soil and water quality protection and watershed restoration; ensure continued availability of water to users and provide technical support for sustainable management, protection and restoration of watersheds. The 2006 objective is a 20 percent increase in the number of watersheds having restored or improved conditions. The FSs Natural Resource agenda in 1998 identified watershed health and restoration among its four priorities.

AUTHORIZING LEGISLATION

The Organic Administrative Act of 1897; the Multiple Use Sustained Yield Act, P.L. 86-517; the National Forest Management Act, P.L. 94-588; the National Environmental Policy Act, P.L. 91-190; the Cooperative Forestry Assistance Act, P.L. 95-313 and the Forest and Rangelands Renewable Resources Planning Act, P.L. 95-307.

FRAMEWORK

The Nature of Land and Resource Management Plans (LRMP), also known as Forest Plans, is the product of a comprehensive notice and comment process established by Congress in the National Forest Management Act (NFMA). The LRMP establishes direction so that all future decisions in the planning area will include an “interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences.” The LRMP provides direction to assure coordination of multiple uses (outdoor recreation, range, timber, watershed, wildlife and fish and wilderness) and sustained yield of products and services. Because watersheds are considered one of the multiple uses, the identification of the watershed scale is a secondary consideration subsumed under the multiple-use goals and objectives of the FS administrative units and there are no provisions for watershed scale assessments.

The “Forest Plans” consist of ten steps:

1. Identifying purpose and need
2. Planning criteria
3. Inventorying data and information
4. Analyzing the management situation
5. Formulating alternatives
6. Estimating effects of alternatives
7. Evaluating alternatives
8. Recommending preferred alternatives
9. Approving the plan
10. Monitoring and evaluation

The FS is required to continuously monitor, evaluate and adjust these plans and coordinate them with the goals and objectives of the agency strategic plan. More specific problems, goals and objectives are established under particular projects that are carried out within the framework of Land and Resource Management Plans (LRMPs) and the NEPA. The

LRMPs must comply with site-specific requirements associated with Federal environmental laws like the CWA.

Watershed management provides a means by which the FS addresses the CWA provisions for nonpoint source pollution control. The FS planning process solicits public comment on proposed plans and projects through standard NEPA procedures.

Recent changes in the National Forest System Land Management Planning regulations (Federal Register 65:67514-67574 regulations) are based on numerous principles anchored by an adaptive management principle. “Planning is an ongoing process, where decisions are adapted, as necessary, to address new issues, new information and unforeseen events.” In the planning framework, land and resource management planning is to be flexible, engage the public and apply the best available science to achieving “sustainability in the use and enjoyment of the National Forest System lands.” Planning also is to be cyclic and adaptive management incorporated for plan refinement. Monitoring and evaluation for adaptive management are to be congruent with the appropriate spatial and temporal scale, including watershed scales, for restoring and maintaining ecological sustainability. Various measures of sustainability are indicated with ecosystem and species diversity emphasized.

MODELS

The FS uses aerial photography and other remote sensing techniques, such as digital-sketched mapping, to collect resource conditions information over large areas. In addition, the FS uses the FS Natural Resources Information System (NRIS), a set of corporate databases and computer applications designed to support field-level users. The NRIS databases contain basic natural resource data in standard formats built to run within the FS computing environment. The NRIS focuses on the biological, physical and human features that make up national forest and grassland landscapes. Within the NRIS is the Watershed Improvement Tracking (WIT), which provides a means to inventory, plan, implement and monitor watershed improvement projects either individually or at the watershed level.

PARTICIPATION

The FS works in partnership with others, in the public and private sectors, which are trying to facilitate locally led changes that benefit both the land and the rural communities. The FS emphasizes its efforts on locations near national forests and grasslands because its management decisions have a direct impact on rural communities that are within and near National Forest System lands.

FUNDING MECHANISM

Since 1990, the overall goal of the FSs rural community assistance efforts has been to facilitate and foster sustainable rural community development by linking community assistance

efforts with natural resource management. Assistance to rural communities and natural resource-based businesses focuses on the themes of:

- Healthy communities
- Appropriately diverse economies
- Sustainable ecosystems

The FS provides direct assistance to rural communities and natural resource-based businesses to help build local capacity, to stimulate appropriate diversification of local economies and to expand markets for local products. It engages local communities in collaborative planning and natural resource stewardship and helps provide for a sustainable future through research, technology development, and technology transfer.

BUREAU OF LAND MANAGEMENT

MISSION

“It is the mission of the BLM to sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations” (BLM 2000). Current efforts under the CWA and other factors have led the BLM to focus on a watershed approach and use of the subbasin as the common assessment unit for all phases of resource planning and management. Subbasins are medium-size watersheds in the fourth level of USGS hydrologic units. Watershed management strategies for meeting goals include updating watershed analyses to restore fish habitat and populations, improve water quality and remain compliant with the CWA. By 2005, the BLM intends to achieve proper or improved functioning in 80 percent of the BLM-administered riparian and wetland communities of watersheds in priority subbasins. By 2005, the BLM intends to achieve an upward trend in upland range condition in 50 percent of the watersheds in priority subbasins.

The BLM manages more than 264 million acres of land and more than 560 million acres of subsurface mineral resources. Most of these lands are located in the West, including Alaska, and are dominated by extensive grasslands, forests, high mountains, arctic tundra and deserts. The BLM plays an important role in the CWAP because of its stewardship of critical water resources, including watersheds, riparian areas and aquatic habitat. In that context, the BLM works collaboratively with states, tribes, local governments and other interested stakeholders. An important aspect is the Abandoned Mine Land Cleanup Program under the Clean Action Plan. In that program the BLM and FS work with the states to create partnerships for mine pollution cleanup.

AUTHORITY

The BLM, an agency of the U.S. DOI, administers diverse resources on, and uses of, the nation’s public lands within a framework of numerous laws. The most comprehensive of these is the Federal Land Policy and Management Act of 1976 (FLPMA). All bureau policies,

procedures and management actions must be consistent with FLPMA and the other laws that govern the use of public lands. The BLM performs a variety of functions in managing the public lands, including, but not limited to, taking inventory of resources; preparing land use plans and assessing environmental impacts; conducting land surveys; issuing use authorizations; enforcing permit conditions; designing and constructing roads and improvements; restoring degraded fish and wildlife habitats; identifying and managing significant natural, cultural and recreational resources; protecting public resources; and monitoring uses. In addition, the BLM maintains the original property title and cadastral survey records of the U.S.

FRAMEWORK

Current Federal efforts under the CWA and other factors have led the BLM to focus on a watershed approach using the subbasin as the common assessment unit, given the pattern of the BLM landholdings and other criteria. The BLM identifies priority subbasins, which may encompass more than one watershed, to ensure that these areas receive more immediate attention. Priority subbasins are delineated based upon:

- Whether lands are in the National Landscape Conservation System
- Proximity to planned community growth areas
- Importance for public water supply purposes
- Significance of their habitat and heritage values
- Potential for commodity production

The BLM determines how lands are managed through land use planning. The BLM assesses the condition and use of the public lands in order to determine the:

- Resource conditions and use
- Risks or threats to sustainable resource values
- Opportunities for enhancement of resource values through management intervention

The BLM applies the following strategies:

- Development and implementation of a comprehensive resource assessment across the public lands that:
 - Ó Use the hydrologic subbasins as the basic geographic building block
 - Ó Use minimum suite of indicators
 - Ó Is applied in cooperation with partners
 - Ó Is updated periodically
- Use of assessment strategy as a basis for setting priorities for planning and restoration actions
- Initiation of resource assessment on those areas where additional information is needed to determine if existing land use plan decisions are meeting resource needs

- Development of schedules for more detailed assessments and needed resources in priority watersheds
- Use of consistent assessment methods and data standards when assessing subbasins

Through resource monitoring and other sources, the BLM offices acquire timely information on the effectiveness of ongoing management. This information is used to adapt management practices when required. Additionally, the BLM recognizes that cooperative restoration strategies across landscapes will work only if public land users, adjacent landowners, involved governments and others work together. The BLM, for example, is working closely with partners to reduce the rate of spread of invasive plants.

Standards are expressions of physical and biological conditions or the degree of function required for healthy, sustainable lands. To ensure that the standards are appropriate for individual areas and to increase public support, the BLM looks to its Resource Advisory Councils for help. While allowing for adaptability, all standards are based on fundamental requirements for land health. The BLMs goal is to achieve sustainable conditions of land health by adopting the following objectives:

- Watersheds are properly functioning.
- Ecological processes, including the hydrologic cycle, the nutrient cycle, and energy flow, are being maintained.
- Water quality complies with state and other applicable water quality standards and achieves BLM management objectives such as meeting wildlife needs.
- Habitats are being restored or maintained for Federal threatened and endangered, Federal proposed, Federal candidate, and other special status species.

In the past, most BLM resource data have come from local inventories or monitoring. However, the BLM recognizes that while site-specific data are essential for many day-to-day management decisions, they do not necessarily help the bureau manage on a landscape basis. Therefore, the BLM is developing and applying a unified assessment system, and it is not alone in recognizing the need for a reliable, cost-effective way to assess land health. Different assessment systems may be required for different types of ecosystems.

PARTICIPATION

The BLM and others are working to develop cost-effective methods to measure and track the health of the land. The BLM is also participating in a number of interagency and intergovernmental assessments of ecological condition, trend and function. Examples include the Eastside and upper Columbia River basin assessments, primarily in Oregon and Idaho and the Henry's Fork assessment in Idaho and Wyoming. Such assessments are crucial to improving the BLMs understanding of natural and human sources of ecosystem stress. They also help identify areas that may warrant restoration and maintenance activities.

The BLM is working with the NRCS to determine if the National Resources Inventory can be adapted to measure and track the health of the public lands. A pilot effort, adjusted to address land health questions on the BLM-managed lands, is under way in Colorado. The BLM hopes to take the lessons derived from such efforts and, in collaboration with others, develop a monitoring and assessment system that can be applied on a routine basis over widespread areas. This assessment system according to the BLM will have to be understandable, cost-effective, reliable and repeatable and will require widespread support to be of most benefit. It also recognizes that it should also include the use of remotely sensed data (i.e., derived from satellite imagery) and other emerging technologies. The BLM plans to continue the use of existing quantitative and qualitative methodologies to assess individual grazing allotments, riparian areas, key watersheds and priority upland areas in order to focus on restoration and maintenance activities.

All of the BLMs activities are conducted with extensive public participation and in coordination with other Federal agencies; state, tribal and local governments and other affected interests. The BLM is working with the public to better understand and protect resources through interpretation, environmental education, permit stipulations and environmental stewardship efforts. Visitors are asked to use and enjoy the public lands while minimizing environmental impact. The concept is that well-informed, environmentally sensitive recreation users can play a key role in protecting cultural, natural and scenic resources and sustaining the health of the nation's public lands.

FUNDING MECHANISM

While the demand for recreation on public lands continues to increase, the BLM reports that funding has not kept pace with the rising costs of managing recreation sites and providing services that the public expects. Environmental health in some areas is declining because of overuse. The very resources that attract visitors may be in jeopardy. The BLM recognizes that sustainable, quality outdoor recreation opportunities depend on healthy land and water resources. The bureau provides users with information on how to minimize impacts to the land. In some cases, the BLM also controls the type and location of physical access to recreation lands.

The BLM pursues challenge cost-share partnerships and grants to strengthen its relationship with users and local communities. Through these partnerships, work accomplished at specific recreation sites is aimed at reducing risks to public health and safety, decreasing environmental degradation, improving the quality of the resources and delivering land use ethic messages to the public.

BUREAU OF RECLAMATION

MISSION

“The mission of the BOR is to manage, develop and protect water and related resources in an environmentally and economically sound manner in the interest of the American public”

(BOR 1999). The first goal of the present strategic plan (revised in 1999) is to manage, develop and protect water and related resources. To meet this goal, it intends, as appropriate, to “address resource needs from an ecosystem perspective and on a watershed or river-basin level.” Another goal is to use watershed approaches for decision-making (including water resources planning). The outcome desired is sustained and improved habitat and water quality “benefiting multiple species within watersheds affected by or affecting Reclamation water supplies and water systems.” Endangered species are an important focus. The BORs long-term goal is for its programs to support “local, regional and collaborative watershed-based approaches to protect or enhance fish, wildlife and related resources.”

AUTHORIZING LEGISLATION

National Reclamation Act of 1902 and The Government Performance and Results Act of 1993. The authority of the BOR is primarily seated in the individual facilities it has developed and operates.

FRAMEWORK

The BOR follows the *Economic and Environmental Principles and Guidelines* (WRC 1983) for WRPP. The BOR’s guidebook entitled *Achieving Efficient Water Management* details a programmatic five-step planning process. These are a logical sequence of decision-making phases or activities that include:

1. Gathering information and defining problems

This phase of the process considers the physical setting, water rights, permits and contracts, lands and crops, district operation and operating policies, water pricing and accounting, the inventory of water resources, other water uses and existing water management and conservation programs.

2. Setting goals and priorities

The intention here is to chart a direction and to establish yardsticks by which to measure progress in meeting goals.

3. Evaluating options

This phase of planning activity involves identifying candidate measures for improvement and investigating how well each option might contribute to achieving the defined goals. This considers such factors as costs, water savings, flow and use patterns, environmental impacts, legal and institutional considerations and political acceptability. The evaluation process involves going back and forth between evaluation steps.

4. Defining a plan of action

This phase of the planning process involves selecting the measures evaluated in the previous phase for implementation. The BOR's planning guidelines state explicitly the criteria to consider in the selection of alternatives. The list of criteria provided suggests alternative values to be considered in the selection of particular solutions. The suggested criteria include relative implementation costs, ease of implementation, costs and benefits of water saved, environmental effects and the extent to which proposed measures complement or conflict with other measures already in place.

5. Implementing and Monitoring

In order to make the plan a reality, defining the sequence of activities and then allocating the necessary funding to support those activities are important. The implementation schedule for the plan involves the time required to develop the various measures included in the plan as well as budgeting and staffing issues. Additionally, an ongoing monitoring program allows the measurement of the effects of the action taken. Monitoring effects may involve installation of measuring devices, better observation of existing measurements and frequent spot checks.

This planning process often requires an iterative process between steps (see Figure A-2). For example, it is very common to determine, in the course of evaluating options, that further information gathering is needed. The BORs planning process does not address the issue of appropriate watershed scale. The BOR's water management is centered on districts, not watersheds. While the BOR's planning guidelines acknowledge potential conflict or tradeoffs associated with the implementation of a particular plan, it provides no compensation measures in conjunction with plan implementation. Implicit in the guideline is the assumption that a plan can be developed and implemented that avoids unacceptable tradeoffs between different interests.

DATA

Data that might be useful for achieving the above goals include:

- Hydrology of source streams, district reservoirs, area wetlands and groundwater

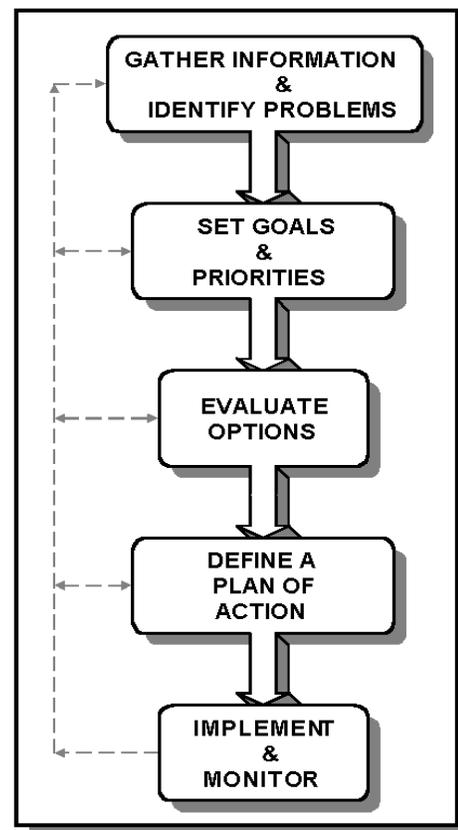


FIGURE A-2
BOR PLANNING PROCESS
(for projects sustained under BOR
operation and maintenance authority)

- Water quality of sources and return flows
- Climate information such as precipitation and temperature

Sources of hydrologic, climatic and water quality data include extension offices, local universities, the National Climatic Data Center, the USGS, the USEPA, the NRCS, Reclamation and private data publishers.

PARTICIPATION

The BOR planning guidelines do stress the importance of stakeholder involvement in creating effective and credible plans. The BOR seeks to include water users, local community leaders, state and Federal agency staff and representatives of various interest groups in the planning process. According to the BOR, stakeholder involvement seeks to build credibility; identifies and understands the diverse concerns and values of parties potentially affected by the plan and develops a consensus among divergent interests.

NATURAL RESOURCES CONSERVATION SERVICE

MISSION

The mission of the NRCS is to “provide leadership in a partnership effort to help people conserve, improve and sustain the natural resources and environment” (NRCS 2000). Strategies used to pursue mission goals promotion of cooperative watershed or other regional approaches to grazing lands, croplands and forest lands and lands undergoing urban development. A related strategy involves partnering to promote technologies and improved practice standards for reducing runoff of nutrients, pesticides sediment and other pollutants from nonpoint watershed sources. In addition, the NRCS will continue to work with local sponsors to develop and implement watershed protection plans for upstream watersheds, including both structural and nonstructural measures. Specifically, NRCS provides conservation and watershed protection planning assistance, including area-wide planning assistance and technical assistance to individuals, groups and units of government and lays out basic planning guidelines in its *National Planning Procedures Handbook and Specific Watershed Applications in SCS (1992)*. These procedures, or guidelines, are intended to assist in the development of plans based on ecological, economic and social considerations. Its performance targets for 2005 include natural resource planning assistance to 2000 communities and meeting the total conservation needs on crop, range and forest lands.

The NRCS also offers financial assistance to various watershed communities, surveys the Nation’s soils and inventories natural resource conditions and use.

AUTHORIZING LEGISLATION

The Federal Crop Insurance Reform and USDA Reorganization Act of 1994, P.L. 103-354; Soil Conservation and Domestic Allotment Act of 1935, P.L. 74-46; Watershed and Flood Prevention Act of 1954, P.L. 83-566; Flood Control Act of 1944, P.L. 78-534; Food and Agriculture Act of 1962, P.L. 87-703, Sec. 102; Agriculture and Food Act of 1981, P.L. 97-98, Sec. 1528-1538; and Federal Agriculture Improvement and Reform Act of 1996, P.L. 104-127. The Watershed and Flood Prevention Act, P.L. 83-566, August 4, 1954, (16 U.S.C. 1001-1008) authorized the Watershed Surveys and Planning program. Prior to fiscal year 1996, small watershed planning activities and the cooperative river basin surveys and investigations authorized by Section 6 of the act were operated as separate programs. The 1996 appropriations act combined the activities into a single program entitled the Watershed Surveys and Planning Program. Activities under both programs are continuing under this authority. The purpose of the program is to assist Federal, state and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater and sediment and to conserve and develop water and land resources.

FRAMEWORK

In its planning guidelines, the NCRS presents a three-phase nine-step planning process with the intention of its being used in a dynamic, iterative mode in the development of “area-wide conservation plans” for watersheds. The planning process follows:

Phase I – Collection and Analysis

- Step 1 Identify Problems and Opportunities:* Identify resource problems, opportunities and concerns in the planning area.
- Step 2 Determine Objectives:* Identify the client’s objectives or desired future conditions.
- Step 3 Inventory Resources:* Inventory the natural resources and their condition, and the related economic and social considerations. This includes on-site and related off-site conditions.
- Step 4 Analyze Resource Data:* Analyze the resource information gathered in planning step three to clearly define the natural resource conditions, along with related economic and social issues. This includes problems and opportunities.

Phase II – Decision Support

Step 5 Formulate Alternatives: Formulate alternatives that will achieve the client's objectives, solve natural resource problems and take advantage of opportunities to improve or protect resource conditions.

Step 6 Evaluate Alternatives: Evaluate the alternatives to determine their effects in addressing the client's objectives and the natural resource problems and opportunities. Evaluate the projected effects on ecological, economic and social concerns. Consider those ecological values protected by law or executive order.

Step 7 Make Decisions: The client selects the alternative(s) and works with the planner to schedule conservation system and practice implementation.

Phase III – Application and Evaluation

Step 8 Implement the Plan: The client implements the selected alternative(s).

Step 9 Evaluate the Plan: The effectiveness of the plan is evaluated as it is implemented, and adjustments are made as needed.

PARTICIPATION

Partners working together with the NRCS on watershed projects include:

- Soil and water conservation districts
- County boards of supervisors
- City governments
- State governments
- Other Federal agencies
- Environmental groups
- Hunting and fishing groups
- Conservation groups

FUNDING MECHANISM

Technical and financial assistance is provided in cooperation with local sponsoring organizations, state and other public agencies to voluntarily plan and install watershed-based projects on private lands. The program empowers local people or decision makers, builds partnerships and requires local and state funding contributions. Watershed plans involving an estimated Federal contribution in excess of \$5,000,000 for construction or construction of any single structure having a capacity in excess of 2,500 acre-feet, require congressional committee

approval. Other plans are approved administratively. After approval, technical and financial assistance can be provided for installation of works of improvement specified in the plans.

OTHER FEDERAL AGENCIES

FISH AND WILDLIFE SERVICE

The FWS mission is “working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people” (FWS 2000). According to the strategic plan, “the ESA purpose is to conserve the ‘ecosystems upon which endangered and threatened species depend’ and to conserve and recover listed species.” A watershed perspective is often taken in making decisions for threatened and endangered species protection, habitat conservation and recovery plans. For harvested species at risk, the FWS assists interstate commissions in the development of fishery management plans, which may be linked with watershed-based ecosystem restoration plans. The service works with state and Federal partners to restore aquatic species to self-sustaining levels by “reestablishing watershed functions through removal of, or passage around, manmade barriers in rivers and streams.”

The FWS uses an ecosystem approach, which it characterizes in the service manual as one that conserves natural biological diversity and ecosystem integrity while supporting a sustainable level of human use. Although the service recognizes that no single ecosystem designation will satisfy all needs, it has adopted the USGS hydrologic unit map as a foundation for organizing and managing its programs because of its flexibility and utility in facilitating partnerships. It also justifies the watershed basis because 45 percent of the threatened and endangered species depend directly on aquatic, wetland and riparian habitats often linked to sustaining and impairing conditions through watershed processes. The service has just recently formed ecosystem teams for each of its fifty-three watershed-based ecoregions. The team’s develop ecosystem plans collaboratively with partner, which include goals, objectives, strategies, field facility contributions, three-year service budget needs and projects implemented. It readjusts plans and budgets as needed. The service came late to an ecosystem approach in part owing to its failure to delist any of the aquatic species because of the successful action of a recovery plan. Most aquatic species at risk do not as yet have formalized recovery plans (NRC 1999b).

For ESA administration, the FWSs primary strategy is to identify the ESA standards and cooperate in an advisory (review) capacity through the planning and actions of other agencies and private landowners. The service makes it clear in its strategic plan that while it must list threatened and endangered species, “all Federal agencies are responsible for preventing endangerment and for recovering endangered species.” It also interacts with the water resources agencies through the independent authority of the Fish and Wildlife Coordination Act. A recent draft MOA with USEPA and NMFS calls for more formal interaction between the agencies in the administration of the CWA. The FWS is brought into the process to the extent that the CWA is increasingly being executed through a watershed management approach, with associated planning.

Other than ESA-related planning, the service develops management plans for its own refuge lands and for the DoD military reservations. Historically, these have been species-based plans rather than watershed-based plans. Through administration of its Federal aid programs for sport fish restoration and wildlife restoration to the states, the service provides assistance in developing comprehensive management plans using funds provided by the International Association of Fish and Wildlife Agencies. The framework of these plans is programmatic and has much in common with an adaptive management framework. Crowe (1983) described the basic elements of the comprehensive management planning process. This planning process is compatible with any regional breakdown of management activities, including a watershed approach; however, few if any state fish and wildlife agencies are regionally organized by watershed.

NATIONAL MARINE FISHERIES SERVICE

“The NMFS conserves, protects, restores and creates habitat for fish and other protected resources.” The major goal of the service is restoring and sustaining sustainable living marine resources and their natural support communities. The NMFS administers the ESA for marine and anadromous species. It recently obtained the authority under the Magnuson Act to restore marine ecosystems to reverse declines in resource production. It recently created in 1997 its first habitat plan for its National Habitat Program. That program plan incorporates an ecosystem perspective that can take the form of coastal watersheds involving anadromous species. The intent is to protect and improve habitats and ecosystems vital to self-sustaining populations of marine resources. The program also intends to expand agency initiatives into an ecosystem context, including watersheds, and to leverage its funding effectiveness through partnerships especially on a watershed or other ecosystem basis. It intends to use its wetland, waterway, and hydropower permit review authority to increase focus on watersheds and other ecosystem expressions. In a recent listing of seven threatened salmonid evolutionary units in the Northwest, the NMFS’s recovery plan focuses on a wide assortment of watershed-based improvements. The service works with numerous local watershed councils and evaluates watershed conservation plans. It provides guidance to the states pertaining to recovery of listed species using watershed assessments among other sources of information.

NATIONAL PARK SERVICE

The NPS preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world (NPS 2000). The NPS manages a significant land area under Federal auspices, much of it in a relatively unimpaired state of scientific value for determining natural ecosystem integrity and other environmental reference data. The first strategic plan goal is “natural and cultural resources and associated values are protected, restored, and maintained in good condition and managed within their broader ecosystem and cultural context.” Specifically with respect to water quality the NPS intends in the long-term for 85 percent of 265 National Park units to have unimpaired water quality. It also intends to improve the status of Federally listed threatened and endangered

species, including aquatic species dependent on watershed condition. “Park aquatic resources are vulnerable to degradation from activities within and external to parks.” However, the NPS has yet to classify and rate the ecological health of aquatic resources and has made that a strategic objective. While concerned about water quality and aquatic species, the NPS has as yet to explicitly take a watershed approach to its planning process. It does coordinate, as do all Federal agencies, with USEPA through the CWAP.

FEDERAL HIGHWAY ADMINISTRATION

The FHWA mission states: “We continually improve the quality of our Nation’s highway system and its intermodal connections. We carry out this mission by providing leadership, expertise, resources and information in cooperation with our partners to enhance the country’s economic vitality, the quality of life, and the environment.” Provisions of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) require that transportation planners, highway officials, and transit interests recognize environmental values and incorporate environmental protection and enhancement measures into programs. The ISTEA establishes planning as a pivotal strategy in the cooperative approach for financing needed improvements in the nation’s transportation infrastructure. The approach is a Federal aid program wherein state and local governments finance needed transportation improvements with the use of Federal funds made available from taxes collected primarily through the sale of gasoline. Under this funding arrangement, the state Departments of Transportation (DOT) and the Metropolitan Planning Organizations (MPO), must plan highway and transit improvements through the use of a integrated process that results in long-term programs of projects needed to support the current and future movement of people and goods. The USDOT and USEPA support coordination of transportation planning with effective watershed planning to reduce erosion and nonpoint source pollution and to avoid or minimize impacts to wetlands and other bodies of water from transportation construction, maintenance, and operations (see Table A-1). It is the policy of the

**TABLE A-1
COMPARISON OF TRANSPORTATION
AND WATERSHED PLANNING (from BANK 1996)**

Transportation Planning	Watershed Planning
System-oriented, responding to area-wide needs	Watershed-based, develops area-wide goals and needs
Pubic involvement, that includes the full participation of interested stakeholders and partners	Identification and participation of stakeholders, local partners, and sponsors of watershed-based initiatives
Consistency with concurrent environmental planning efforts	Coordinates and implements various area-wide planning efforts
Fiscally constrained metropolitan plans with realistic expectations for implementing actions	Maximize effectiveness of watershed plan by coordinating programs having limited available resources
Investment studies require broadly based environmental information to determine potential effects of transportation improvements	Watershed-based environmental and land-use data required to generate goals and plan
Possible resource-specific mitigation strategies (e.g., planning-area wetland banking program)	Strategies for resource protection and conservation incorporated into goals and plan

FHWA to promote and support watershed planning and the coordination of transportation planning with effective watershed planning to reduce erosion and nonpoint source pollution from highway construction, maintenance, and operations. The relationship between transportation development and efforts to manage and protect watersheds indicates that highway and transit programs could be integrated with basin-wide planning strategies to ensure all individual project recommendations are sensitive to environmental needs. The strategic plan of the administration's environmental research program identifies improved understanding of land use linkages to environmental quality for watershed planning purposes. The plan also includes investigation of watershed-based planning for improved mitigation of wetland losses incurred by highway development, including development of better models. The plan identifies a need to incorporate transportation into a more comprehensive watershed-based planning process through improved coordination with regulatory agencies, the transportation community, and other stakeholders.

U.S. GEOLOGICAL SURVEY

“The USGS serves the Nation by providing reliable scientific information to describe and understand the earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.” Because the USGS has no regulatory or developmental responsibilities, it can direct its research mission toward unbiased, high-quality data gathering and analysis. While situated in the DOI, the USGS serves a wide range of Federal, state, and local agency “customers.” As part of its strategic direction, the USGS intends to strengthen its contribution to a number of complex issues, including the resolution of conflicts over management of rivers for multiple purposes and the understanding of ecological functions and assessing predicted change at varying scales. Accordingly, research attention will focus, among other things, on surface- and groundwater interactions, the impact of land use on water quality and quantity, the vulnerability of people and infrastructure to hazards, and detailed understanding of habitat requirements in light of complex changes in landscapes. An important part of the mission is enhancing predictive-/forecast-modeling capability, including provision of models to USEPA for linking land use to water quality in a watershed context.

A principal activity of the USGS is maintenance of a national network of stream gages, which is funded in small part by the USGS, by other Federal agencies for pursuit of their missions, and, in large part, by state and local authorities (USGS 1998). The stream gages provide data for water supply evaluation, flood information and instream flow requirements of aquatic threatened and endangered species and water quality monitoring. The USGS works with the states to evaluate TMDLs from watersheds as required in the CWA. The USGS participates in the National Water Quality Assessment Program to assure a nationally consistent study design and methods of sampling and analysis that allow comparisons of water quality across the nation. These studies reveal the watershed linkages between land uses and water quality. Thus the USGS plays an important quality control and analytic role in the monitoring and evaluation of the programmatic watershed planning and management process facilitated by the USEPA.

APPENDIX B
DISTRICT FOCUS GROUP SUMMARY NOTES

Districts' Emerging Watershed Themes

It is important that the key elements developed from this study are generally understood and relevant to the USACE District planners. To get feedback on preliminary findings, focus groups were conducted with four USACE Districts (Baltimore, Jacksonville, Seattle and Portland). Each session lasted about one and a half to two hours and was attended by planning staff experienced with watershed planning issues. The District teams were presented with findings from a preliminary draft report depicting other agency watershed history, constraints and issues, and frameworks. The District participants were then asked to comment on the presentation and offer perspective on watershed planning based upon their experience.

The following paragraphs compile the notes taken and summarize the major themes emerging from each of these focus sessions. These themes include Internal USACE Issues, CWAP, Adaptive Management, Monitoring and Data Management, Programmatic Needs, Regulatory Actions and Watershed Planning, Planning Framework and Stakeholder Collaboration. While some paraphrasing was done to enhance readability, the presentation shown below is developed exclusively from the comments offered by four group participants.

Internal USACE Issues

The USACE tries to bring the best science to the watershed planning and restoration activities to help ensure that the best information is used to justify and design its projects. It was noted however, that many scientists disagree on certain issues and it is sometimes surprisingly difficult to comfortably converge on what is the “best science.”

Many argue that the public should come to the USACE to help them build projects that are needed to meet regional/watershed goals. The USACE is simply one tool available to project partners in addressing needed watershed improvements. They are a piece of a more comprehensive menu of services relevant to the watershed. It is essential to recognize the USACE strengths and weave that into the broader watershed process. The USACE strength is in planning and building projects.

The USACE is very sensitive to not stepping on other initiatives in place by the locals. The Districts strategically distance themselves from actions where involvement is not required: e.g., BMPs for local communities—this is between the state and local governments. The USACE recognized that these were happening and included them as appropriate in the watershed plans but did not get actively involved in the design and implementation of the BMPs. Another example is a county comprehensive planning process. The future land uses are taken as given into the USACE watershed planning. The USACE can figure out ways to keep tabs on the bigger watershed picture, which may raise concerns from local sponsors that often have very specific and localized projects in mind.

Conversely, some look to the USACE to be the leader in watershed planning. It can bring structure and closure to the process that some sponsors really need. Without the USACE, some planning processes flounder, and the USACE has the reputation of moving effectively to project completion. As of late, the USACE is being asked to help out in areas that traditionally are the responsibility of others. For example, it is involved in the Florida Keys Carrying Capacity Study that is directly dealing with growth management issues in Monroe County, Florida. Furthermore,

the USACE is asked to implement the wastewater master plan in Monroe County. Similarly, the USACE is working in eastern Pennsylvania on a wastewater treatment plant.

Integration cannot be emphasized too much. It is critical to find the balance between dividing up work/authorities among the agencies and the integration of their products/insights into an integrated result. This is facilitated through active working groups and task forces. This brings better technical information to the table and a common understanding of how this information will be used in the planning effort. This emphasis on synergism causes everyone to feel ownership in the project. For example, for Jacksonville District's Comprehensive Everglades Restoration Program (CERP), the FWS is getting funding to sit at the table and is fully integrated into the process. This goes beyond the standard coordination efforts in the process.

Coordination is an important element of watershed planning that the USACE finds difficult. Sometimes it is important just to have a seat at the table. Funds directed at coordination needs are becoming sparser. It is not easy for the USACE planning staff to attend watershed planning council meetings, and the like, that are organized to bring stakeholders together for comprehensive watershed planning and management. It would be helpful if the USACE could get more involved in the earlier stages. Section 211 authority (Performance of Specialized or Technical Services under WRDA) is a move in the right direction, but it is not really set up for collaboration. Coordination with the FWS is done through the Coordination Act. The USACE could utilize the FWS expertise more effectively and needs to develop a mechanism to get it involved.

Willamette River basin study is a significant watershed planning effort. The \$100,000 available for reconnaissance-level planning was simply not enough. They have secured \$225,000 and it still is not enough. General Investigation (GI) funds are needed in this case to have meaningful coordination. It has been rather cumbersome to fiscally keep this project going.

The USACE culture is to build something that cost-effectively meets water resources needs. The project planning process is robust but costly. High-feasibility study costs can point toward large construction costs. This is the USACE model; its processes, guidance and experience support it. A unique exception to this construction "focus" is the Matawoman (Baltimore) watershed feasibility study. This project is located in Charles County, Maryland and uses GIS-based models to examine the impacts of build-out conditions in the estuary. The USACE has initially been a major player in the Willamette basin supporting traditional missions. Now that the emphasis is on restoration, the USACE has a responsibility to continue effective involvement in all aspects of the basin management. It is difficult/cumbersome for the USACE to fit into a planning process without having it lead to a project. It is a big circle of management activity involving many different agencies and groups.

True watershed planning can be very complicated, leading to major feasibility study costs. The USACE authorities are constrained. Watershed planning has to end up with solid recommendations, meaning a project. There are different ways to get to the end. This is a rather ornate process and the customer has to be comfortable when it is complete. The right words are needed to market the USACE role to local sponsors for large watershed studies. How can the sponsor be motivated to want to collaborate with the USACE? Only part of the motivation should be big money for construction.

The USACE should better position itself to be one of several at the table, whether in a lead role or support role. It is everybody's river. A good example was the River Renaissance in Portland. One of the big TMDL issues on the Willamette is temperature, which the USACE directly impacts through regulation schedule. The USACE really does not have funding to participate effectively in TMDL planning, so they have to borrow from other in-house sources. The USACE is participating to some degree in the CWAP, but this is being lead by the USEPA. Again, no funding is available for the USACE to be very active—water quality is a low priority for the USACE.

It is important that the USACE management supports District overtures to potential project partners. A great deal of credibility is lost when Districts enter dialogue with locals and Division/HQ/Congress do not provide support or appropriations to follow through on locals' needs. Strong and effective public relations are needed. Districts need the backing of the agency. All in all, the District needs more funding to get more involved with watershed planning. They are doing the best they can in a restrictive fiscal environment. A watershed that has strong congressional support typically gets the funding and vice versa.

So much is lost to turnover of key staff. It would be extremely helpful to have watershed planning training, similar to a PROSPECT course. It can be difficult to work with the USACE authorities to do watershed planning. It is important to know how to take full advantage of the continuing authorities program to participate in watershed activities.

Clean Water Action Plan

The focus group participants met the prospect of the USACE involvement in the CWAP with a mix of frustration and skepticism. At the District level, the USACE for the most part does not have an active role in the CWAP. If any role, it is mainly informal and patchy. The Federal lead for the CWAP is the USEPA and the USACE often struggles in joint initiatives with the USEPA. The USACE District staff is simply not funded to participate and finds it difficult to justify getting intensely involved. Several participants noted that they did not recall being invited to sit at the CWAP table, but if they were asked, they still did not know how they would pay for it. Some expressed concern the CWAP activities were not really leading anywhere and the USACE would be better off focusing elsewhere on good project development.

The participants, however, did recognize the intent of the CWAP and viewed it as appropriate to provide a broad planning look. It lends well to watershed perspective and planning by getting key players at the table. The apparent weakness is that the CWAP initiatives provide little guidance on how to actually implement projects. It falls short in actually doing something to improve or manage the watershed. The comment was made that it would be interesting to see an assessment of some of these high-profile Federal programs like the CWAP and Coastal America for what has resulted.

The participants took the CWAP discussion as an opportunity to compare other continuous planning programs, providing examples of programs that they thought were similar to the CWAP. The FS Northwest planning initiative concerning the spotted owl was preferred over CWAP activities in the northwest. The Chesapeake 2000 Agreement calls for development of watershed plans for two-thirds of the Chesapeake Bay watershed subbasins. Effective coordination with states will be key to the success of Chesapeake 2000. State-driven watershed

programs have seen success in several parts of the country, which in many respects set the stage for Federal involvement.

To the degree that the CWAP interfaces with the TMDL planning, the District participants noted greater interest. Clearly there is overlap; for example, water temperature in the Willamette River (Portland) is a TMDL issue and something the USACE management should address. Some expressed interest in knowing more about the CWAP initiatives but recognized it was not a good fit given the water quality emphasis and limited funding attention for the USACE involvement.

Adaptive Management, Monitoring and Data Management

Focus group participants recognized the value of effective adaptive management in watershed planning. Adaptive management requires setting clear goals and objectives, delineating performance standards, monitoring and then evaluating how well the goals and objectives are being met. Needed changes can be made to the project/watershed, which can result in new projects. However, the USACE processes are not set up to effectively implement adaptive management. Certainly there is a great deal of talk about adaptive management, but the USACE needs to “walk the walk.” Most of the participants agreed that this is an area of watershed planning that needs attention in the short run.

Funding and technology are the major constraints. The participants questioned the USACE policy on a 1 percent monitoring budget, which makes it very difficult to be effective. It needs to be understood at the USACE HQ that watershed planning is dynamic and experimental. The GIS, while an important resource, can be very costly to use in a project. It is a methodological and financial commitment to use effectively in the analysis and plan formulation. Time is another constraint. The process does not have enough time for the development of elaborate models that may bring more certainty to the associated analyses. The CERP was fortunate to access a well-developed hydraulics and hydrology model from the South Florida Water Management District (SFWMD). This model had been an ongoing project over about twenty years and was a key analytical tool for the CERP. These models not only were used for planning and design activities, but were extremely useful for education of stakeholders (e.g., Governor’s Commission on Sustainable South Florida).

Monitoring and evaluation are big-ticket items on the Columbia River for the fish mitigation actions. To really understand the right thing to do for the targeted species, one could easily spend more than the 1 percent targeted amount for monitoring. Some level of rationale and justification is needed to address monitoring needs, but it is dependent on the project. Some Districts have to be creative with the CAP (Continuing Authorities Program) funds to address adaptive management issues.

Adaptive management is central to the CERP and is being carried out by the Jacksonville District and other partners. Restoration Coordination and Verification (RECOVER) is the program for the CERP that operationalizes the adaptive management features. Needs and activities in the Jacksonville District have significantly influenced much of the recent USACE-wide legislation that calls for adaptive management and watershed approaches. It is a very fashionable approach right now that empowers teams of professionals to make decisions about monitoring and plan modifications. It must be realized that adaptive management can be expensive to implement.

Improvements to the USACE capabilities in watershed planning should be directed at analysis and monitoring. Data management is often inefficient to access and disconnected. There are numerous studies going on, but the data does not seem to be effectively shared or aligned. The USGS and the NMFS, among other resource agencies, have data/information that the USACE cannot get to without purchasing it. Ready access to critical information is either not in existence or not recognized by the USACE staff. This is a source of extreme frustration and confusion. It should be noted that some Districts have strong environmental science capabilities and have designed very effective monitoring plans that are regimented and cost-effective. This kind of involvement however strains the 1 percent USACE budget.

Adaptive management means getting a project to about 60 percent complete and then finishing based upon what technology is working in the watershed. The USACE mentality and culture is to design very specific features of the project, which is counter to adaptive management. To some, the need to change the original design is an indicator of project failure. The USACE typically builds projects and then turns them over to the local sponsors. With adaptive management in mind, it may be a good idea for the USACE to stay involved with the project for a defined amount of time, e.g., five years. Seeley Creek (Bradford County, Pennsylvania) is a project that is planned to include adaptive management principles—selected performance of project features has to be met before it is actually turned over to the sponsor.

Programmatic Needs

Watershed studies were conducted in-force with the Level A & B Basin Studies of the 1960s and 1970s era. These were comprehensive and done in coordination with the other key water resources agencies. One concern of the Districts is that basin studies became outdated after about five years. There were too many unanticipated changes in the watershed. In general, the states did not really like them because they took so much time to conduct and they did not effectively lead to many projects. Level B Studies and Urban Studies from the 1970s had very good information, but they tended toward water quality issues and lost priority within the USACE. This apparent lack of success caused the USACE to move away from this approach.

On the other hand, several commented that the approaches such as the Level A & B Basin Studies could be the way to go for watershed studies. The USACE general investigation process caters to single-purpose projects, which does not fit well with the watershed process. Maybe it would be prudent to go back to the 100 percent Federally funded basin studies. Technology and data analysis have come a long way since the 1960s and 1970s, and information can be kept current and more efficiently shared and collected. The Pacific Northwest River Basin Commission was staffed full time by the USACE, which resulted in several assessments.

Presently, most USACE initiatives are driven by localized needs versus revealed through a comprehensive watershed planning process. Some of the local efforts do not have technical coordination with other activities in the watershed. It would be better to have a handle on the larger-scale needs so that the system-level priorities can be set. Then when opportunities for local projects come up, they can be pursued in better recognition of the comprehensive impacts. If the Federal contribution could be 65 percent, then the remaining 35 percent could be essentially covered by in-kind services by the local sponsor. This configuration of support would greatly aid watershed based planning.

Using planning funds to sit at the table programmatically does not work well. CAP has possibilities to address the more dynamic issues in the watershed. Some combination of Sections 205 and 206 (Flood Damage and Aquatic Restoration) is being proposed in the WRDA 2002. This appears to have promise in addressing the multipurpose nature of watershed planning. Planning Assistance to States (Section 22) offers some promise, but it is not funded adequately. The key is to develop a program that allows for real strategic planning. Right now, it is more opportunistic based, and better solutions possibly are being passed up. Reconnaissance-level planning is needed to define the big picture with the critical stakeholders, and then localized projects can be developed at the feasibility level.

Many of the focus group participants expressed willingness to support the USACE on designing/changing authorities to better cater to watershed planning. The USACE should also carefully evaluate the merits of comprehensive river basin studies. These would be 100 percent Federally funded. In order for this to happen, more Federal funding has to be found and policies need to be revised. There are bubbles of leadership throughout the country, but no real leader nationally.

There are larger-scale activities that drive the smaller decisions. This is a source of disconnect, because the tools used are designed for the smaller decisions. The USACE is very good at tactical-level planning but needs to improve or look elsewhere for strategic planning. Integration with other agencies is key. Right now, the USACE simply is not working effectively with the USEPA.

In terms of programmatic emphasis, the FS approach in the northwest is preferred over what most have seen with the CWAP. There are also some strong, well-recognized frameworks used by the state of Washington, referred to as state action plans. Bonneville Power Administration (BPA) spends about \$185 million annually on basin studies in Columbia, with analysis of fifty-two subbasins. This provides a snapshot of fish and wildlife needs and is used to prioritize projects. See www.cbfwa.org for additional information on this initiative. It was noted that the TVA has a similar program.

A perpetual feasibility study or phased approach could address the programmatic needs of an effective watershed plan. An effective framework would be based upon regional priorities, actions taken then reviewed and then the next step is considered. Annual examination of progress is needed. Some small/demo projects can be developed with the CAP studies that support large GI watershed initiatives.

Regulatory Actions and Watershed Planning

Regulatory and management elements of Federal watershed agencies tend to be disconnected. Permits are being issued for development in areas where plans for restoration are being formulated. This is inconsistent and frustrating. It is very difficult for the USACE and FWS regulators to keep up with the workload. They are forced to conduct permit-by-permit analysis and do not have the opportunity to look at the big picture. This is a critical shortcoming. It is critical to get a handle on the impacts of regulatory decisions over time as they impact the watershed. There is uncertainty as to the key resource needs and evaluation factors; this is an area where the resource agencies need to come together.

The USEPA and USACE regulators have closer working relationships with the locals than the planning staff. There is a fuzzy line between water quality needs concerning the USEPA and the USACE. This is sometimes partially facilitated by a memorandum of agreement. There are times when the state gets concerned about water quality goals as part of the USACE restoration. They sometimes resist quantifying water quality outputs because they do not want to risk failure. Sponsors do not want to be told their projects might fail. The USACE regulates local development activities through its regulatory authority. Then another branch of the USACE asks locals to plan with them. This makes for a complex, sometimes conflicted relationship between the USACE and the locals. However, special area management plans, which are occasionally used by the USACE regulators, are likened to planning. Properly used, these can be effective.

Some resource agencies primarily address preservation, where the USACE focus is on restoration. While different focuses exist, there should be much better coordination between preservation and restoration. There is a major part of the Puget Sound (Seattle District) watershed management that does not involve the USACE. The WRDA 1986 addresses endangered species issues that are relevant to watershed planning. Related USACE guidance is somewhat confusing on how to address these provisions. The ESA drives the Willamette initiative and associated habitat needs.

Planning Framework

Watershed planning requires collaboration and can be very difficult. All the agencies and stakeholders need to be at the table representing the range of objectives, including social objectives. Though full-time proponents of some key objectives may not be present throughout, a sound framework should include all the key objectives of the watershed. While full inclusion is desired, it is very cumbersome to navigate such a planning process and it can be costly.

Watershed planning has to end up with solid recommendations—a project. It is a rather ornate process and the customer has to be comfortable when it is complete. Some sponsors are highly sophisticated, and it is a matter of the USACE planning process being woven into the sponsor's process. Using a watershed approach, goals are set, budgets/funding are evaluated and the stakeholders drive many of the site-specific details of the project. Good examples of locally led frameworks are Fairfax County, Virginia and Montgomery County, Maryland.

Watershed planning is clearly a multiple-objective planning framework. A critical analytical challenge is to try to decide on the best plan. When dealing with project planning, the NED goals must be worked within the NEPA goals. A framework for trade-offs should be sought. Measurements of outputs are required for each objective, which have to be somehow brought together analytically. Some outputs can be monetized and others cannot. Weights can be assigned to each objective to determine the best combination of project features.

Development of a tradeoff framework is “easier said than done.” Lack of an effective trade-off tool appears to be a clear gap in the watershed-planning framework. This is an area of research that should continue to receive attention. It seems that some kind of common metric needs to be created. Certainly, the different outputs can be arrayed against the planning alternatives for comparative analysis. But as these matrices get big, it becomes extremely difficult to make it useful. A large multi-criteria decision-making model seems to be unrealistic and probably ineffective given present technology. For the CERP, they generally avoided negative aspects of tradeoffs, because they did not want it to appear that one objective or interest

might be getting less attention. Some noted that while tradeoff analysis is important to pursue, it should not get overly specific in empirical terms. The present process has some latitude built into it that allows for judgment and negotiation of key project planning issues.

As mentioned before, watershed studies were conducted in-force with the Level A & B Basin Studies of the 1960/1970s era. These were comprehensive and done in coordination with the other key water resources agencies. The problem with the basin studies was that they became outdated after about five years. There were too many unanticipated changes in the watershed. In general, the states did not really like them because they took so much time to conduct, and they did not effectively lead to many projects. This apparent lack of success caused the USACE to move away from this approach. As planning needs have evolved, some participants noted that maybe the USACE should reconsider the comprehensive planning frameworks likened to the A & B Studies.

The CERP is a large project that has inspired innovation in the planning process. The \$7.8 billion project has been successful thus far because of the team planning approach that the District has followed. The CERP has been characterized by extremely active stakeholder involvement. Everyone is invited to the table. For example, subbasin boards and drainage Districts are actively involved in the planning and implementation and are in turn considered responsible parties in the success or failure of the CERP. A great deal of time, effort and money has gone toward communication efforts. This goes beyond the standard public involvement and coordination. The USACE has tapped into public relations experts and has been overtly marketing the CERP. This brings benefits of communication, but most importantly it builds a foundation of trust among the stakeholders and the general public.

True watershed planning can be very complicated, leading to major feasibility study costs. The USACE authorities are constrained. Watershed planning sometimes requires examination of a large geographic area—the big picture (e.g., Gwynn Falls, Maryland). Approval of the magnitude of this study can be challenging at the Division level. Section 22 can be used to scope watershed projects that would lead to other, more elaborate planning activities, but the magnitude of funding is not adequate to see the project through. The USACE is configured for bigger-ticket items generally. They have tried to advertise just doing plans, but they have to be big and finding a sponsor is difficult.

A perpetual feasibility study or phased approach could address the programmatic needs of an effective watershed plan. A framework is developed based upon regional priorities; actions are taken then reviewed and then the next step is considered. Annual examination of progress is needed. The CAP studies that are creatively tied to large GI watershed initiatives can be used for small pilot or demonstration projects.

Some of the larger-scale activities that drive the smaller decisions present some challenges in the interpolation. They can be disconnected because the tools used are designed for the smaller decisions. The USACE is very good at tactical-level planning but needs to improve or look elsewhere for strategic planning. Integration with other agencies is key, and several commented that this is an area where the USACE struggles. Cost-sharing rules do not readily lend themselves to a comprehensive watershed perspective. Cost-shared projects are relatively small in geographic scope. BPAs involvement in the Columbia River salmon issues has been central to the fiscal backing of these issues, but this is certainly an exception to normal situations.

Comments were made on the three frameworks compared in the presentation. Certainly the CERP compares favorably with the CAMP attributes. The RECOVER elements of the CERP, \$10 million annually, are managed programmatically. It was noted that another framework could be added that is driven by endangered species planning. The NMFS and the USFWS have recovery planning processes that are directed at selected species, which have realized mixed success. (See these links <http://www.salmonrecovery.gov/strategy> and www.research.nwfsc.noaa.gov/cbd/trt/.) The BPA spends about \$185 million annually on basin studies in Columbia, with analysis of fifty-two subbasins. This provides a snapshot of fish and wildlife needs and is used to prioritize projects. (See www.cbfwa.org for additional information on this initiative.)

Stakeholder Collaboration

Another major issue in watershed planning is collaboration, whether it is collaboration between agencies, with local sponsors, with other stakeholders or within agencies. If there were no collaboration between the stakeholders, conducting watershed studies would more than likely not work. It was noted that the local sponsors sometimes work very effectively to gain the USACE support in the watershed. Through congressmen and other political means, needs are surfaced that the USACE is asked to address. When it comes to feasibility, the sponsor has a vote just like the USACE on how the project should look.

Local sponsors are sometimes not necessarily interested in ecosystem restoration. They may be focused on issues such as water quality and stormwater management. The restoration dimension is what the USACE can bring to the table, but the planning processes and cost-sharing aspects of a particular study usually are not exactly aligned. This can cause confusion concerning project goals. This really comes into play when the sponsor has to pay for something that is not a priority in their mind.

Sometimes the locals are not looking for the USACE to help with a planning study, they know what they want to do and are not interested in going into a big reconnaissance or feasibility planning process. Watershed studies are cost-shared 50 percent with local sponsors, who typically have particular ideas about the features of the plan. They also have concerns about the scale and scope of the study and resultant plan. The local sponsors simply want the projects built and maintained.

Upper Susquehanna River Basin Cooperstown Area study in New York is a GI study that is locally driven and aimed at wetland restoration. The locals did much of the planning and the USACE will manage the construction of about 200 acres of wetlands in 2002. This is a very good example of a watershed planning and the USACE accommodating a unique role in the project and will hopefully set some precedent for the USACE for involvement in future environmentally related projects.

Coordination with the FWS is done through the Coordination Act. Several commented that the USACE could utilize the FWSs expertise more effectively. The FWS staff can do their analyses quickly and inexpensively, as they are the experts in their field. The USACE could consider a funding mechanism that would involve the FWS in monitoring.

Each agency has different objectives and authorities and therefore there are limits to what can be done. For example, the USEPAs TMDL program is a very important element to

watershed management, but the USACE does not really have authority to get involved in the TMDLs unless special authorization is granted. In order to get the other agencies at the table in a meaningful way, watershed studies should accommodate cross-agency budgeting. A good example of this type of budgeting cited at one of the focus sessions was CALFED from California.

“Properly functioning condition” is a restoration planning principle that is being used in the northwest. The NMFS wants to restore the fisheries to historic conditions but runs into very relevant constraints, e.g., flooding. Some implementable plan needs to be developed through creative compromise and design to accommodate the objectives and constraints. The role and needs of cost-sharing sponsor have to be directly taken into account.

Water management Districts in Florida are an extremely important player in the water projects in that state and are a key partner with the USACE. They bring a great deal of expertise—especially hydrologists—to the table. The water management Districts are tax-based and have capable technical staffs and truly serve as equal collaborators on the CERP and other projects with the USACE.

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There was a fair amount of concern that environmental groups would bring suit against the USACE feasibility study for the CERP in the name of Federal Advisory Committee Act (FACA). This was a concern because of extreme use of a team approach. However, it turned out not to be an issue. The environmental groups did sue them, but it was only because of changes to the text made at the Chief’s level.

The CERP in many respects was born out of the Lower East Coast Water Supply Plan, which links major water resources development in south Florida with water supply. The models demonstrated that a tremendous amount of water was being lost to tide, which could be used to support water supply needs for municipal and industrial purposes as well as restoration. Emphases on project benefits were directed to different audiences strategically. The state, particularly the governor’s office, was keyed into water supply, while the national level audience pushed restoration benefits. The DOI ended up suing the USACE as part of the feasibility study to get its critical features in the final preferred plan.

Real estate is a major issue for watershed planning. Land ownership patterns greatly influence participation in watershed objectives and restoration. Ultimately, the landowners have to make a decision about the management of their own land. For example, a plan for restoring wetlands in the Patuxent River Western Branch, Maryland, was developed and of the more than

one hundred twenty potential restoration sites, only one was approved because of real estate issues.

The general strategy is to try to move the real estate issues to the local governments and sponsors. Generally, the Federal government has limited effectiveness in addressing local real estate and land management matters. However, it was noted the NRCS and USFWS seem to have had some success with easement mechanisms.

An example of very successful stakeholder collaboration was the Northwest Forest Plan. The key Federal agencies all worked together in a regional office. Generally speaking, the U.S. FS addressed the resources needs in the mountains, the NRCS in the farms, the USACE/BOR in the water, and the BLM in areas between. The USEPA and the NMFS addressed regulatory goals and issues. Tribes represented the issues on reservation holdings. This was a well-regarded model for collaborative planning but required Federal investment. The USACE spent \$400,000 for staff, coordination, studies and projects.

