Report on

REVITALIZATION OF CORPS OF ENGINEERS PROJECTS

Prepared by
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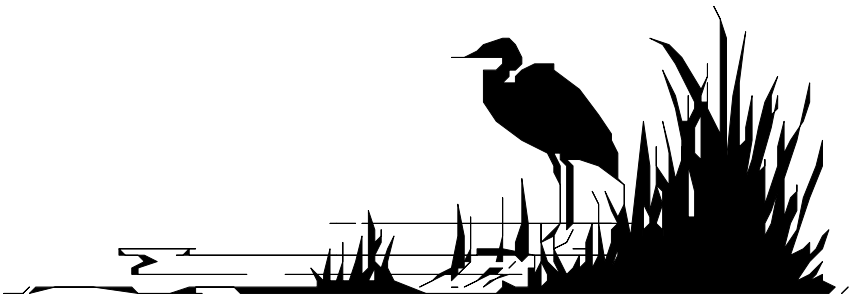
For
Institute for Water Resources
U.S. Army Corps of Engineers



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PREFACE and ACKNOWLEDGEMENTS

As the Nation grows and grows older, the adequacy and condition of its public works infrastructure is an increasing concern. There are also increasing concerns that while both demands and values are changing, the Corps' management of existing projects is not responding to those changes. Underlying these concerns is the further concern that some projects may not be fulfilling their original purposes, or that the original demands for which projects were developed to meet have dissipated or no longer exist. An example of the latter is the concern expressed by two members of Congress in a letter to the Chief of Engineers, questioning the need and propriety of continued maintenance of several projects. This letter was the impetus for this study. The projects in question involved continuing maintenance of a navigation channel for a very small number of barges and the resulting damages to surrounding habitat and fisheries, and of several small harbor projects serving primarily recreation and having little or no commercial traffic. While review of the concerns about these specific projects might be insightful, generically the concerns do not represent new issues. They do suggest, however, that there needs to be improvement in management, including accountability and communication, of these complex and difficult situations.

With the need to examine these high priority concerns, a study was initiated under the Fiscal Year 2001 Planning and Policy Studies Program of the U.S. Army Corps of Engineers Institute for Water Resources (IWR). The program is administered in IWR by Eugene Z. Stakhiv, Chief, Planning and Policy Studies Division and in Headquarters USACE, by Janice Rasgus of the Mission Planning and Development Branch, Directorate of Civil Works. The IWR study manager for this report was Theodore M. Hillyer. To accomplish the effort the services of William C. Holliday was employed through contract. It is Mr. Holliday's report that is provided herein.

Mr. Holliday is presently a consultant in water resources planning and management. He served as Senior Policy Analyst for the Institute for Water Resources from 1991 to 1998. Previously, he served three years as Assistant Chief, Panning Division, Directorate of Civil Works, Headquarters, USACE, including a dual assignment as Executive Secretary, Inland Waterways Users Board. Prior to that assignment, he served five years as Chief, Central Planning Management Branch, Planning Division, Directorate of Civil Works, HQUSACE, and two years as Senior Regional Planner, Central Planning Management Branch. Before moving to HQUSACE, he served 19 years in the Corps' Huntington District where his assignments included Chief, Special Studies Branch, Planning; Chief, Flood Plain Management Services; Chief, Project Planning Section, Planning Branch, Engineering Division; and progressive civil engineering positions related to water resources development. He also served six years in the U.S. Coast Guard Reserve. Mr. Holliday received a Bachelor of Engineering Sciences in Civil Engineering degree from Marshall University in 1960.

The study manager wishes to thank Henry Cardwell, Kenneth Orth, and Mark Dunning of IWR who provided review comments on an earlier version of the report.

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Executive Summary

PURPOSE. The Corps presently has stewardship responsibility for operation and maintenance of about 1,600 projects, and has oversight and inspection responsibilities for hundreds of local flood damage reduction (LFDR) projects for which local governmental agencies have assumed operation and maintenance responsibility. The aging of many of these projects generates concerns that some projects may no longer be, or need to be, serving the purposes for which they were authorized and developed; and, that other projects may not be meeting changing needs and opportunities. The study focused on the varying capabilities of these projects to meet changing water and related land resources needs and priorities, and on the adequacy of present policies and statutory authorities to ensure improved responsiveness.

OBJECTIVES. The primary study objectives were to:

- Determine the basic considerations that need to be addressed at any project that has been operating for some time, where conditions have changed or where there may be new opportunities based upon contemporary thinking.
- Develop a framework:
    - For systematically investigating, in conjunction with current operation and management policies and practices, revitalization needs and opportunities of all Corps-operated projects in relation to project resources to be responsive to increasing public demands and changing priorities; and,
    - Of procedures for review of individual projects to reaffirm the feasibility of their continuing operation and maintenance, and for formulating plans to improve project contributions to contemporary needs

To accomplish these objectives, the study considered the commonalties and fundamental differences in four main categories of projects for which the Corps has varying continuing responsibility:

- Harbor projects (including inland harbors)
- Locks and dams of the inland waterways system, and their connecting channels
- Reservoirs (e.g. single purpose, multi-purpose, system operated)
- LFDR projects (operated and maintained by non-Federal sponsors)

DEFINITIONS. "Rehabilitation" refers to major repairs of structural components, and repair or replacement of operating equipment, to ensure proper functioning for authorized purposes. "Restoration" refers to returning a degraded asset (especially environmental and cultural) to its original, desired condition. "Revitalization", as used here, is meant to imply the improvement and/or increase in beneficial outputs, short of project replacement. Revitalization encompasses rehabilitation and restoration, but also includes increased or new beneficial exploitation of underutilized assets. Age is not a dominant factor in determining the useful and productive life of a project. Its importance as a factor in determining the need for rehabilitation varies greatly by type of project. However, age does generate concerns as to the present viability of a project, both for fulfilling authorized purposes, and for meeting changing and/or increasing needs. Because "changing needs" may be a reduction in demand, or in the worth of a particular output, consideration of rehabilitation, restoration or revitalization must also consider the ramifications of a project's underlying viability.

COMMONALITIES AND DIFFERENCES. To highlight the commonalities and differences, each of the four categories (harbors, inland waterways, lake projects and LFDR projects) was compared by the following generalized, comparative attributes: physical and operational, economic, environmental, and budgeting and funding. These are summarized in the following table.

Comparative Attributes	Category of Project			
	Harbor	**Inland Waterway**	**Lake**	**LFDR**
Physical and Operational	No moving parts and no structures to operate and maintain.	Complex structures and extensive moving parts requiring constant O&M.	Require massive structures and limited moving parts to O&M.	Vary considerably in construction and structural components.
Economic	Generally have high O&M costs relative to the initial investment. No resources that afford opportunities for increased economic gain.	Generally have moderate O&M costs relative to initial investment. Limited potential for improved economic efficiency.	Have low O&M costs relative to initial investment. Benefits generally grow over time and there can be opportunities to convert storage capacities to other purposes.	Have moderate to low O&M costs relative to initial Investment. Benefits generally grow overtime, but little opportunity for increased economic gain.
Environmental	Tend to have continuing adverse environmental effects depending upon levels of contaminants in dredged material. Potential for beneficial environmental initiatives is nearly nil.	Tend to have continuing adverse environmental effects but generally far less than harbor projects. May be limited opportunities to operate projects to increase oxygenation.	Have relatively little continuing adverse environmental effects once constructed. Projects may be subject to environmental degradation from recreation facility overuse, pollution from upstream sources or excessive siltation. May be many opportunities for small environmental improvements.	Tend to have little or no continuing adverse environmental effects. There is some potential for project modification to provide a more natural environment and significant ecosystem restoration.
Budgeting and Funding	New construction cost shared. Federal share from General Fund. Maintenance from the Harbor Maintenance Trust Fund.	New construction and major rehabilitation funded from the Inland Waterways Trust Fund. O&M from General Fund.	New construction, if any, cost shared. Federal share from General Fund. O&M from General Fund supplemented by recreation user fees.	New construction is cost shared, with Federal share from General Fund. O&M is funded entirely by non-Federal sponsors.

POLICIES, GUIDANCE AND MANAGEMENT TOOLS.

Engineer Regulations: The pertinent regulations vary considerably in age, the oldest adopted in 1982 and the most recent in 1999. They also tend to be narrowly focused within functional areas. These ERs are summarized in the following table.

ER	Date	Description
1110-2-100	15 Feb. 1995	Applicable to all projects. Provides the policy, defines the objectives and responsibilities, and establishes the procedures to assure the safety, continuing structural integrity, and operational adequacy of major Civil Works projects
1110-2-240	8 Oct. 1982	Applicable to lake projects and navigation dams. Prescribes policies and procedures in carrying out water control management activities, including establishment of water control plans for Corps and non-Corps projects.
1110-2-401	30 Sep. 1994	Applicable to LFDR projects. Provides instructions for the preparation of O&M manuals outlining the responsibilities of those local sponsors that will OMRR&R the project.
1110-2-8151	31 July 1997	Applicable to navigation projects. States the objective, outlines the scope, discusses funding, assigns responsibility, and establishes the procedures by which the Corps evaluates planning design construction, and O&M performance of navigation projects.
1110-2-8154	31 May 1995	Applicable to all projects. Establishes policy for the water quality management program at Corps projects.
1130-2-540	15 Nov. 1996	Applicable to lake projects. Establishes land management policy for Corps administered project lands and water, based on various authorizing legislation and the principles of good environmental stewardship.
1165-2-119	20 Sep. 1982	Applicable to all projects. Presents policy with policy with regard to Section 216 of the 1970 FCA (modification to completed projects).
1165-2-501	30 Sep. 1999	Applicable to all projects. Addresses authorities through which the Corps can examine ecosystem restoration needs and opportunities, and participate in the study, design and implementation of ecosystem restoration and protection projects.

Environmental Operating Principles: On March 26, 2002, the Chief of Engineers announced the adoption of a set of Environmental Operating Principles that will guide the Corps in all its work. The seven principles ensure that the Corps will:

- Strive to achieve Environmental Sustainability.
- Recognize the interdependence of life and the physical environment.
- Seek balance and synergy among human development activities and natural systems.
- Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.
- Seek ways and means to assess and mitigate cumulative impacts to the environment,
- Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.
- Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective.

These principles underscore the need for revitalizing the Corps' existing infrastructure.

Watershed Principles: Revitalization of Corps projects, especially reservoirs, must consider the principles of watershed management. A recently released Watershed Perspective for the Civil Works Program focus on a broad set of

principles for watershed resources management. The watershed approach is based on:

- Seeking sustainable water resources management
- Integrating water and related land resources management
- Considering future water resource needs
- Coordinating planning and management
- Promoting interagency cooperation
- Encouraging public participation
- Evaluating the monetary and non-monetary trade-offs
- Establishing interdisciplinary teams
- Applying adaptive management

Inasmuch as revitalization is adaptive management, these general principles, in conjunction with the environmental operating principles, may be taken as a guide to developing and executing revitalization plans.

Other Management Tools in Place: There are several other significant management tools relating to navigation projects. There are no parallel tools for lake and LFDR projects. These are:

- Dredged Material Management Plans
- Inland Waterways Users Board
- Navigation Data Collection

Adequacy of Policies, Guidance and Management Tools: Review of Corps regulations and related policy guidance disclosed very little guidance directly related to revitalization, except to the extent that ecosystem restoration may be considered revitalization. The review reveals none that provide for continuing monitoring and review of economic performance of existing projects. Further, guidance on monitoring project performance concentrates on inspection, and is passive with respect to overall performance. However, restoration does not encompass creation or enhancement of biodiversity. Generally, the limited guidance is narrowly focused within functional areas. None of the pertinent ERs and management tools reviewed contains guidance regarding the potential deterioration of level of protection due to urbanization of upstream watersheds. Inspection programs are not likely to detect and quantify increased discharges due to urbanization in the upstream watershed.

Views of Other Organizations:

American Rivers Coalition. In a press release dated September 14, 2000, titled "Top 10 Reforms for the Army Corps of Engineers", the American Rivers Coalition raised many concerns about the Corps and its missions. Most of their concerns relate to proposed projects. However, one of their top ten reforms indicated that the Corps only replaces a fraction of the wetlands and other habitat their projects destroy based on the theory that a few artificially managed acres of habitat can replace the natural functions of ecosystems. The Coalition recommended that the Corps be required to replace each acre of habitat destroyed by Corps levees and dams with a similar acre of habitat, and mitigation should be completed at the same time civil works projects are constructed.

World Commission on Dams. In November 2000, the World Commission On Dams published a comprehensive report, *Dams And Development*, *A New Framework*. The report responds to the debate surrounding the building of large dams around the world. The views of the Commission suggest that there are universal shortcomings in optimum development and usage of dams. Such shortcomings may appear to not be applicable to the United States in view of its expansive and robust water resources development programs, laws and policies. However, there are growing unmet demands and unresolved conflicts that argue to the contrary. Nevertheless, the present report concentrates on existing projects, as there have been no large dams authorized and constructed in this Nation in over 30 years, partly a result of concerns such as those iterated by the Commission.

FRAMEWORK FOR REVITALIZATION.

A framework for revitalization must address economic, environmental and social objectives for a wide variety of circumstances at the project, system and program levels, for four different project types, involving two variable

attributes: degree of problems and level of opportunities. Superimposed on these attributes is the assignment of responsibilities between the Federal government and non-Federal sponsors. A revitalization program, theoretically, would have to assess and quantify the entirety of this complex of attributes for all projects.

Harbor Projects. The principal problem facing harbor projects is the increasing cost of environmentally acceptable dredged material disposal. The increased costs, together with the vagaries of demand, may have resulted in some projects, large and small, becoming economically marginal, if not uneconomic, to continue to maintain. Harbor projects have few if any untapped resources to present opportunities to improve economic efficiency, or to offset inefficiency. Present policies and management tools are insufficient for identifying inefficient projects, curtailing maintenance and/or disposing of the projects. If tools were developed to identify such projects, the larger question would be how to deal with the social, political and regional economic impacts of discontinuing maintenance.

Inland Waterways. The concern of the present study is that the magnitude of the Corps' maintenance backlog overshadows the need for revitalization, such that the latter may be relegated to a low priority. A second concern is that there is evidence that some portions of the systems may be being maintained at a net cost economically, while posing difficult environmental challenges. The potentials for revitalization of the inland navigation systems to provide additional services are limited, but there may be limited opportunities to manipulate pool levels to store additional water for short periods, and to use it to augment flows during low flow periods. There also may be unrealized opportunities for environmental restoration and enhancement, such as creating small sub-impoundments and wetlands, or creating vegetative buffers against surface pollutant runoff.

Reservoir and Lake Projects. Intensive recreational usage of Corps Lakes is far greater than contemplated decades ago. Other demands also have increased, but less universally. These demands are mostly for water supply, hydropower and low flow augmentation for navigation. The demands vary greatly by region and by proximity to urbanizing areas. Some older projects provided for purposes no longer needed, such as storage for releases to maintain downstream navigation where locks and dams subsequently have been constructed. There is no nationwide inventory of such projects to assess to what extent the unneeded storage has been converted to other beneficial uses. Some projects may have experienced significant amounts of sediment accumulation beyond the quantity projected for the original design, and/or distributed in locations within the reservoir not provided for originally. Again, there is no nationwide inventory to confirm the scope of the problem. Potentials and opportunities can be found in the untapped capabilities of existing lakes to meet present and future demands beyond those for which the projects were authorized and constructed. Untapped capabilities are associated with the three basic lake resources: storage capacity, lake surface and project land.

Local Flood Damage Reduction Projects. Substantial deterioration in degree of protection due to urbanization of upstream watersheds is a serious problem for some projects, especially for levee and floodwall projects in rapidly urbanizing watersheds. Overtopping of levees and floodwalls can result in catastrophic consequences including loss of life. Inspection programs are not likely to detect and quantify increased discharges due to urbanization in the upstream watershed. Because LFDR projects have little resources, they present very limited potential and few opportunities for revitalization. However, though mainly a non-Federal responsibility, there may be opportunities at many projects to develop or expand waterside recreation areas and facilities, nature trails, etc.

Relative Potentials. The following table displays a subjective comparison of relative

potentials for problems and opportunities from a program perspective.

Relative Potentials for Problems From High = 1 to Very Low = 6				
Attribute Type	**Harbors**	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
Economic	1 – High	4 – Low to Moderate	6 – Very Low	4 – Low to moderate
Environmental	1 – High	3 – Moderate	5 - Low	4 – Low to moderate
Overall	**1 – High**	**3.5 – Moderate**	**5.5 - Low**	**4 - Low to moderate**

Relative Potentials for Opportunities From High = 6 to Very Low = 1				
Attribute Type	**Harbors**	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
Economic	1 - Very Low	2 – Low	3 – Low to Moderate	2 - Low
Environmental	1 - Very Low	3 – Low to Moderate	4 - Moderate	2 - Low
Overall	**1 – Very Low**	**2.5 - Low to Moderate**	**3.5 - Moderate**	**2 - Low**

Composite Relative Potentials for Problems and Opportunities From 1 = High Problem Potential, Very Low Opportunity Potential to 6 = Very Low Problem Potential, High Opportunity Potential				
	Harbors	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
All Attribute Types	**1- Very Low**	**3 - Moderate**	**4.5 – Moderate to High**	**3.0 - Moderate**

These comparisons indicate that potential problems outweigh potential opportunities, and that harbors and lakes are at opposite ends of the range. The comparisons also suggest a rank ordering of problems and opportunities, by project type, in relation to apparent degrees of potential programmatic net gains of a revitalization program. The frequency of occurrence of problems and opportunities could not be considered because few pertinent surveys, inventories and other similar inquiries have been made to date.

A PROGRAMATIC APPROACH to REVITALIZATION.

Revitalization objectives can best be achieved by development of a targeted program incorporating efficient management tools and supported by revitalized policy guidance and legislative initiative.

Areas of Concentration. Programmatically, the framework should concentrate on the areas of greatest potential for problems and of greatest

potential for opportunities, such that net programmatic gains can be achieved most efficiently. Inland waterways projects economic and environmental opportunities. Priority should be given to a programmatic effort to identify uneconomic navigation projects, and to dispose of them in an orderly fashion. Next, priority should be given to identifying LFDR projects having economic problems resulting from deteriorating level of protection due to urbanization. Unlike navigation project economic problems, the LFDR problems are related to project deficiencies, not to lack of demand or use. Certain projects may be well known as having significant, but unresolved problems. Others may have a significant potential to meet known demands, but the limitations of existing project authorization deters attempts to adapt to the known demands. These "red flag" projects should be placed high in the priority for revitalization action.

Policy and Guidance Requirements to Support Program. Existing policies need to be updated and streamlined to overcome their deficiencies, and to facilitate desirable management, program development and budgetary initiatives. Most important is the development of umbrella policy guidance in the Water Resources Policies and Authorities series of ERs. Whether or not a substantive revitalization program is undertaken as suggested here, Corps policies and guidance need considerable improvement to encourage and facilitate revitalization. Corps regulations and related policy guidance need to provide for continuing monitoring and review of economic performance of existing projects. Also, pertinent guidance needs to be improved to reflect cross-functional coordination among the policy, planning, engineering, operations and emergency management functions.

LEGISLATIVE INITIATIVES. Because of information and data deficiencies and the need for more in-depth assessment of the problems and opportunities outlined here, legislative initiative is indicated which first would authorize such an assessment. The ultimate objective of the assessment would be a second legislative initiative seeking authorization of a long-term program to implement revitalization measures. Legislative initiative to seek authorization of an assessment study should define the basic necessary steps of a preliminary action plan. It also should establish study objectives and ultimate implementation objectives. The study objectives should include the preparation and submission to Congress of a report detailing, and recommending authorization of, a revitalization program. Initiative to authorize implementation of a revitalization program should incorporate the findings of the assessment study.

STEPS TO REVITALIZATION. A series of steps will be necessary to undertake a revitalization program. The following presents the general steps, together with suggested options for their accomplishment.

Preliminary Stage:

- Confirm the findings and assessments of this framework study
    - Through critique by selected experts, or
    - Through a multi-functional task group
- Develop a preliminary plan of action for accomplishing subsequent steps
    - To proceed directly to next step, or
    - To support legislative initiative for a comprehensive study with General Investigations funding

Study Stage:

- Undertake a preliminary assessment to further define and quantify the potential scope of problems and opportunities
    - Proceed without specific study authority with multiple sources of funding – mainly O&M or
    - Await study authorization
    - By task group, or
    - By assignment to MSCs, Districts and Centers of Expertise
- Develop policy guidance sufficient to support plan development and implementation
- Develop a complete plan of action
    - Include procedural guidance for executing the plan, or
    - Make first step of plan the development of procedural guidance

Implementation Stage:

- Implement program plan of action
    - Proceed without specific program authorization (using existing authorities, including Section 216, requiring feasibility reports to Congress on a project-by-project basis, or
    - Await program authorization allowing defined project modifications without further authorization.

CONCLUSIONS AND RECOMMENDATIONS.

There are problematic misperceptions concerning the Corps' family of water resources projects. An underlying goal of any effort to revitalize Corps projects must be to disabuse water resources professionals as well as the public of their perceptions that project age and changing demands equate to antiquation, and among some Corps managers, that project authorizations equate to a mandate to perpetually operate and maintain projects as authorized without regard to changed circumstances. These views have contributed to passive stewardship of vital resources.

As used here, "revitalization" is meant to imply the improvement and/or increase in beneficial outputs, short of project replacement. Revitalization encompasses rehabilitation and restoration, but also includes increased or new beneficial exploitation of underutilized assets. However, the study also finds a range of substantial problems facing some existing projects and their ability to fulfill intended and authorized purposes. More problematic is a substantial lack of policies, guidance and management tools to recognize and resolve existing and potential project deficiencies, much less to facilitate revitalization.

A framework for revitalization of Corps projects must be ambitious by necessity. It must be viewed and dealt with in context, that context being the missions of the Corps' Civil Works Program. Conversely, mission accomplishment must consider that the "devil is in the detail". At the program, or National level, the accumulative problems and issues may reflect on budgetary and mission integrity.

The varying capabilities of projects to meet changing water and related land resources needs and priorities need to be actively addressed. The four types of projects – harbors, inland waterways, reservoirs and lakes, and LFDRs – are fundamentally different, and must be addressed separately, though they do share some common objectives. All projects should:

- Demonstrate economic efficiency; i.e., the benefits of continuing OMRR&R must be confirmed to exceed the costs thereof,
- Maximize economic efficiency in accordance with the water resources development objectives set forth in the P&G
- Provide maximum contribution to ecosystem restoration, enhancement and creation, and
- Provide for optimum public well being over a long time horizon, subject to continuous management oversight.

A successful revitalization program will require engraining a Corps-wide perspective that continuous oversight and stewardship of the Corps family of projects are the responsibility of all Corps managers across all functional areas at all levels. It will depend on a substantial, long-term agency-wide commitment, and the support of the Administration and Congress.

It is recommended that the Corps undertake, with all due diligence, the series of steps necessary to undertake a revitalization program as presented herein.

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I – INTRODUCTION

PURPOSE AND OBJECTIVES

This report presents the results of a preliminary study to explore ways in which the Corps of Engineers might improve the effectiveness and productivity of the navigation, flood damage reduction and multiple purpose projects that the Corps has constructed over the past 160 years. The Corps presently has stewardship responsibility for operation and maintenance of about 1,600 projects, and has oversight and inspection responsibilities for hundreds of local flood damage reduction (LFDR) projects for which local governmental agencies have assumed operation and maintenance responsibility. The aging of many of these projects generates concerns that some projects may no longer be, or need to be, serving the purposes for which they were authorized and developed; and, that other projects may not be meeting changing needs and opportunities. The study focused on the varying capabilities of these projects to meet changing water and related land resources needs and priorities, and on the adequacy of present policies and statutory authorities to ensure improved responsiveness.

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For each category, or type, consideration was given to:

- Authorized purposes
- Existing uses and capabilities
- Potential "unmet" needs and opportunities
- Limitations of current management tools and Corps policies
- Limitations imposed by statutory authorities
- Impediments to management
- Case examples of relevant situations
- External research and approaches to revitalization

The study differentiated between those major changes (e.g., re-allocation of reservoir storage from established purposes to new or expanded purposes) that might require further Congressional authorization, and those changes that could be accomplished within specific project authorization provisions or other, generic authorities.

Ecosystem restoration projects are not included for analysis because they are considered revitalization projects on their own merits. However, the Corps' ecosystem restoration authority is one vehicle for revitalizing other projects.

The report presents an approach and framework for assessing revitalization opportunities associated with both Corps

operated and non-Federal sponsor operated projects. The approach and framework should be instrumental in determining, for individual projects and systems of projects, the continued federal interest, changes in the water resource issues since project authorization and construction, and revitalization needs and associated funding. The report also presents potential policy changes, including legislative initiatives, which may be needed to facilitate project and program revitalization. The ultimate objective is to enhance project economic and environmental performance.

NATURE AND ORIGIN OF CONCERNS

As the Nation grows and grows older, the adequacy and condition of its public works infrastructure is an increasing concern. One source of concern, when contemplating the Nation's infrastructure in general, is an ambiguous vision of decaying facilities and crumbling structures. Although the Corps has an increasing project operation and maintenance budget, it also has a large and growing backlog of deferred maintenance. At the same time, the projects are growing older. But, the Corps civil works projects, in general, are far more durable and in better physical condition than most other categories of public works. The Corps has in place a battery of management tools to ensure that all projects are adequately maintained, perhaps in perpetuity, subject mainly to budgetary constraints. Over the past decade, the Corps completed a comprehensive operation and maintenance improvement program that thoroughly streamlined all aspects of its O&M program.

However, there are increasing concerns that while both demands and values are changing, the Corps' management of existing projects is not responding to those changes. Underlying these concerns is the further concern that some projects may not be fulfilling their original purposes, or that the original demands for which projects were developed to meet have dissipated or no longer exist. An example of the latter is the concern expressed by two members of Congress in a letter to the Chief of Engineers, questioning the need and propriety of continued maintenance of several projects.[1] The projects in question involved continuing maintenance of a navigation channel for a very small number of barges and the resulting damages to surrounding habitat and fisheries, and of several small harbor projects serving primarily recreation and having little or no commercial traffic. While review of the concerns about these specific projects might be insightful, generically the concerns do not represent new issues. They do suggest, however, that there needs to be improvement in management, including accountability and communication, of these complex and difficult situations.

These observations suggest a tiered set of interrelated concerns:

- Some projects are not being adequately maintained to serve intended, authorized purposes
- Some projects should not continue to be maintained
    - Because their services are no longer needed at a level to justify expenditures
    - Because adverse environmental and/or social effects outweigh beneficial economic effects
- Some projects are being adequately maintained to serve intended, authorized purposes, but
    - Are not meeting increasing demands on authorized, existing functions
    - Are not being adapted to changing demands
        - While demands for authorized purposes are constant or increasing
        - While demands for authorized purposes are diminishing

The first of the above concerns is assumed a resolvable condition under current policy and programs. This study focuses on the remaining concerns. As will be seen, these concerns

[1] Letter from Senators Voinovich and Graham, Transportation and Infrastructure Subcommittee, to LTG Flowers dated April 3, 2001

present themselves very differently for each of the four major types of projects.

REHABILITATION VS RESTORATION VS REVITALIZATION

"Rehabilitation" refers to major repairs of structural components, and repair or replacement of operating equipment, to ensure proper functioning for authorized purposes. "Restoration" refers to returning a degraded asset (especially environmental and cultural) to its original, desired condition. "Revitalization", as used here, is meant to imply the improvement and/or increase in beneficial outputs, short of project replacement. Revitalization encompasses rehabilitation and restoration, but also includes increased or new beneficial exploitation of underutilized assets.

Age is not a dominant factor in determining the useful and productive life of a project. Its importance as a factor in determining the need for rehabilitation varies greatly by type of project. However, age does generate concerns as to the present viability of a project, both for fulfilling authorized purposes, and for meeting changing and/or increasing needs. Because "changing needs" may be a reduction in demand, or in the worth of a particular output, consideration of rehabilitation, restoration or revitalization must also consider the ramifications of a project's underlying viability.

BACKGROUND

Beginning in the 1800s, the Corps has constructed about 1,000 harbor projects, of which 929 presently are maintained.[2] During that period, it also has constructed[3] an inland and intracoastal network of 12,000 miles of commercial navigation channels and 230 lock and dam projects. During the 20th century, the Corps of Engineers constructed 377 dam and reservoir projects and hundreds of LFDR projects. Each of these groups of projects presents very different attributes and challenges.

Harbors

Harbors by definition are places that offer vessels some degree of shelter from winds, waves, and other natural phenomena. Ports are those locations within harbors where terminal facilities are available to serve vessels and to load and unload passengers and cargo. Harbor works principally include "deepening" the harbor by dredging channels to provide access to and from the ocean. Though harbor works often include other features, such as jetties, breakwaters and turning basins[4], they generally are referred to as harbor and channel projects or, simply, harbor projects.

To a varying extent, virtually all of the nation's harbors require extensive dredging to establish and/or maintain depths required to provide access to ports by seagoing vessels. The United States has almost no naturally deep harbors. There are some notable exceptions, such as Valdez Harbor and Dutch Harbor, Alaska, and portions of Puget Sound, Washington. All other major harbors in the lower 48 states require periodic dredging, as do most of the lesser harbors.

Historically, the Federal government has assumed responsibility for providing and maintaining harbor and channel projects through the Corps of Engineers. Generally, landside port development has been the responsibility of local government and private enterprise. This report focuses on the maintenance of harbor projects, both individually and as a national system, recognizing the demands of the dependent ports in the interest of United States commerce.

Ports in the United States are fundamental to the nation's economic system, and have been at the center of questions provoking debate and discussion over the last twenty years:

- Are they adequate to serve the nation's present and future needs?
- How should dredging be managed to minimize the environmental impacts?
- Who should pay for ongoing dredging and disposal of sediments?

[2] Some of the earliest projects fell into disuse and were abandoned. Others have been subsumed in larger projects.

[3] The term "constructed", as used here, includes dredging of channels.

[4] An enlarged portion of the deepened channel in which ships have room to turn around

Ports are developed to meet the needs of shippers and to integrate the sea and land-based transportation systems. Ports are part of the distribution system that delivers products and raw materials into and out of the country, and are an essential part of its economic system. As an example, a 1994 report by the Interagency Working Group on the Dredging Process (hereafter referred to as "the Interagency Report") declared that approximately 95% of all U.S. imports and exports pass through U.S. ports.

The primary users of ports are shippers who link with rail and highway transportation systems. They are principally private sector owners and operators who deliver cargo. The owners and operators of ports are frequently quasi-government organizations such as state or multi-state port authorities, or departments of local governments. Since ports are critical points in the distribution of materials and products, governments are actively involved in the planning and decision-making. Numerous private businesses derive primary and secondary economic benefits from ports; they have vested interest in the efficient operation and continued development of the port system.

From an economic development perspective, the Federal government is heavily involved. The Corps of Engineers investigates proposed harbor development projects to determine the resultant benefits and costs to the country and the degree to which the projects support the nation's needs for ports for defense and strategic reasons. When projects are economically justifiable, the Federal government provides funding for, and contracting of, the needed dredging and maintenance. States contribute economic plans and regional development strategies and compete for increasing shares of the shipping business by providing support and financial leverage to implement development plans.

By their nature, harbors are located in environmentally sensitive areas. Many are located in estuaries, which are those portions of watersheds where rivers meet the sea, while others are in bays. Both of these environments are potentially highly productive ecosystems, although many have been adversely affected by pollution from development and use. These ecosystems provide a wide range of habitats for many species of plants and animals. Coastal areas also provide the natural resources for human development. They have historically been sources of fertile land for development, naturally protected areas for ports and transportation systems, sources of water for municipalities and industry, and sources of food.

From an environmental protection perspective, estuaries, rivers, bays, and the ocean are the fundamental resources that are protected under a large number of Federal and state laws and regulations. The process of complying with environmental regulations for testing, siting, and disposal of dredged material is complicated and requirements vary from region-to-region. Local governments and public citizen groups are also major players in developing strategies for protection of environmental resources. The various layers of environmental regulations often lead to the erection of barriers that impede navigation planning and port operations, and can significantly affect the cost of maintaining and improving ports.

The Corps maintains all 929 harbors at an annual cost of about $485,000,000[5] - nearly 1/3 of the Corps' annual Operation and Maintenance (O&M) budget. These harbor and channel navigation projects either support ocean-going vessels, (referred to hereinafter simply as "harbor projects") or provide harbors along the inland waterways (referred to hereinafter as "inland harbors").[6]

Each harbor project was specifically authorized by Congress. Most of the existing projects evolved in increments of depth (as well as length, width and configuration), with each added increment authorized in response to the demands of commerce. A small percentage of projects are not currently maintained to their originally constructed depths due to declines in commerce and, occasionally, lack of dredged material disposal space.

[5] Based on long-term average in constant 1994 dollars

[6] Inland harbors are not part of the fuel-taxed inland waterways system.

Of the 929 harbor projects, 299 are "deep draft" harbors and 630 are "shallow-draft" coastal and inland harbors. For convenience and practicality, the demarcation between deep draft and shallow draft traditionally has been 14 feet. Thus, deep draft projects, as referred to herein, include all individual projects with navigable depths over 14 feet. The 299 existing deep draft projects comprise the nation's deep draft port system; a somewhat amorphous composite of loosely inter-related projects serving oceangoing commerce that are highly dependent upon land-based port facilities and transportation modes. The port and ancillary activities served by each project are at once interdependent and competitive with those at other projects. These relationships have local, regional, national and international aspects. The deep draft harbor projects are maintained by the Corps at an average annual cost of about $400,000,000[7].

The 630 shallow draft projects are maintained at a cost averaging about $85,000,000 annually. The shallow draft projects serve small sea-going vessels such as commercial fishing trawlers and offshore workboats. Many also serve barges that ply the inland waterways. Shallow draft harbors also include "harbors of refuge" and similar harbors that protect small craft from storms. The purpose of these projects is not to provide a navigable depth for navigation (whether commercial or recreational), but to prevent damages and save lives.

Funding for Corps dredging of harbors and navigation channels comes from several sources, depending on the nature of the activity. The Corps essentially performs two types of navigation work: (1) maintenance dredging of existing authorized channel depths; and (2) new construction, which usually involves deepening and/or widening a navigation project. Until Congress passed the Water Resources Development Act of 1986 (WRDA'86) and its subsequent amendments, annual funding for maintenance dredging was drawn from the General Fund as a Corps budget appropriation. WRDA'86 created the Harbor Maintenance Trust Fund (HMTF) and its source of revenue, the Harbor Maintenance Tax. The HMTF is funded by the actual port users (shippers) to pay for all maintenance dredging of deep draft and shallow draft harbors. The HMTF is controlled by Congress, which appropriates money from the fund in response to the Corps' annual budget requests.

Inland Waterways

The Nation's inland waterways are systems of locks and dams and channel projects designed to handle principally barged commodities. The systems comprise 27 inland and intracoastal waterway segments as statutorily defined by PL 95-502, October 21, 1978, as amended by Public Law 99-662, November 17, 1986, in conjunction with establishment of fuel taxes on system users.[8] The systems also include small tributary segments that are not fuel-taxed, and that no longer carry significant commercial traffic. The defined segments are listed in APPENDIX A. Twenty-five of the segments are interconnected, while the Columbia River and AIWW segments act as independent systems. The system centers on the mainstem arteries of the Mississippi, Ohio, Illinois, and Tennessee Rivers and the Gulf Intracoastal Waterway. But more than a dozen key tributary waterways feed traffic to and from the mainstem channels and permit vital economic development in communities far removed from the principal waterways.

The Inland Waterways Fuel Tax was established to support inland waterway infrastructure development and rehabilitation. Commercial users are required to pay this tax on fuel consumed in inland waterway transportation. Revenues from the tax are deposited in the Inland Waterways Trust Fund and fund 50% of the cost of inland navigation construction projects each year as authorized. The amount of tax paid by commercial users in 2001 is $.20 per gallon of fuel. This amounts to

[7] In 1994 dollars

[8] Excluded waterways maintained by the Corps include the Fox River Waterway, Wisconsin, and portions of the Kentucky River and the Green and Barren rivers, Kentucky. These projects are in caretaker status and have not been used for commercial navigation for many years. The Corps is disposing of all three projects.

over a $100 million contribution annually to the Inland Waterways Trust Fund. Additionally, a tax of $.043 per gallon of fuel is paid toward General Treasury revenues and utilized for deficit reduction.

Reflecting the concept of "Users Pay," Section 302 of the Water Resources Development Act of 1986 (Public Law 99-662) (WRDA '86) established the Inland Waterways Users Board (the Board) as a federal advisory committee to give commercial users a strong voice in the investment decision-making it was supporting by its cost sharing tax payments. The eleven-member Board represents all geographic areas on the fuel-taxed inland waterways system of the United States. The composition of the Board also reflects a balanced industry focus, including shipper and carrier members from companies of different sizes and specializing in the transport of different commodities.

The principal responsibility of the Board is to recommend to the Congress, the Secretary of the Army and the U.S. Army Corps of Engineers the prioritization of new and replacement inland navigation construction and major rehabilitation projects. The Board uses a prioritization format to objectively identify differences between proposed projects. This ranking tool examines eight project factors; condition, capacity and future demand, costs and benefits, operating and safety considerations, traffic delays, environmental concerns, timing, and public and political support for projects. The Board typically meets three times a year to accomplish its business, with the meetings open to the public. The Board's recommendations reflect its independent judgment, and are presented in an annual report to the Secretary of the Army and to the Congress.

It is important to note that the Inland Waterways Trust Fund is established to support new construction (including replacement projects) and major rehabilitation, and that it does not support operation, maintenance and routine rehabilitation. Although the Board has a strong, vested interest in O&M, its advisory responsibilities deal only with matters involving the Trust Fund.

Reservoirs and Lakes

The first federal Flood Control Act was enacted in 1917 following disastrous floods throughout the Mississippi and Ohio River basins in 1912 and 1913, and the devastating, life-threatening situation in the Sacramento River basin caused by hydraulic mining operations. Since that time, the Nation's $30 billion (actual dollars at time of expenditure) investment in flood damage reduction structures has prevented about $300 billion in flood damages. With continued proper maintenance, they will continue to reap similar benefits for decades to come.

Flood and coastal storm damage reduction projects and services provided by the Corps are intended to save lives and reduce the level of property damage incurred by floods and storms. Most of the Corps' new flood and coastal storm damage reduction projects are constructed as joint ventures between the federal government and non-federal sponsors. New projects, all of which are non-reservoir projects, once built, are typically owned, operated and maintained by the sponsors. These LFDR projects are discussed in the following section.

The Corps, however, has ongoing stewardship responsibilities for the large flood control and multipurpose reservoirs that it built largely at Federal expense prior to the adoption of project cost sharing with the Water Resources Development Act of 1986 (WRDA'86).[9] The 377 reservoir and lake projects were authorized and constructed for the purposes of, primarily, flood control and, secondarily, allied purposes including recreation, water supply, hydropower, low flow augmentation (for navigation and maintenance of minimum dry weather flows), fish and wildlife conservation and irrigation.[10] All of these projects include flood control as their primary purpose. A few include flood

[9] For all practical purposes, no new lake projects have been authorized for construction since 1970.

[10] Corps navigation dams, built in conjunction with locks for vessel passage, form pools behind them; however most do not store water for any purpose. These are not considered "dams and reservoirs", for purposes of this report.

control only.[11] The others are multiple purpose projects, most of which include, at least, recreation as a secondary purpose. Very few include storage specifically authorized for irrigation use.

Reservoir and lake projects are operated and maintained by the Corps at Federal expense, except for revenues and reimbursements for vendible outputs (i.e., water supply, hydroelectric power, irrigation and recreation). Such purposes as water supply, hydropower and recreation are encompassed by the term "allied purposes" because those purposes are not Corps missions, but may be pursued only in conjunction with mission purposes as multiple purpose development opportunities arise. Mission purposes are flood control (or flood damage reduction), navigation and ecosystem restoration. The Corps does not pursue single purpose water supply, hydropower, recreation or irrigation projects.

During the 1970's, Congress declared that the Corps' dam and reservoir projects should be called "lake" projects.[12] Most all have been renamed by law to include "lake" in their title; for example "Bluestone Dam and Reservoir" on New River in West Virginia, is now "Bluestone Lake". The name changes reflect the perspective of the millions of people yearly who use the lakes for recreation and fishing.

The composite of the outputs of Corps lakes nationwide are considerable. The Corps provides reliable, efficient, and cost-effective power and related services to power marketing agencies, and the Federal Energy Regulatory Commission. The Corps operates 75 hydroelectric powerhouses having an installed capacity of about 21,000 megawatts, producing nearly 80 billion kilowatt-hours per year, which is one fourth of the Nation's hydroelectric power - or about 3% of total U.S. electric capacity. All costs for producing the power are recovered through marketing, with revenues in excess of $550 million annually.

The Corps continues to consider the potential hydropower development during the planning process for all water resources projects involving dams and reservoirs. In most instances today, however, non-Federal interests develop hydropower facilities at Corps projects under licensing agreements specified in the Federal Power Act. Sixty-seven non-Federal hydropower plants with a combined capacity of nearly 2,000 megawatts are in operation at Corps projects.

There are about 4,350 recreation areas at Corps reservoir projects, of which 1,850 are operated by state and local governments and other entities. Corps-operated sites receive nearly 380 million visits each year, second only to facilities managed by the National Park service. The direct and indirect effects of the economic activity generated by these visitors have resulted in more than 600,000 jobs and over $20 billion in private sector employment income.

The Corps has dedicated about 10,000,000 acre-feet of water supply storage space in numerous multiple purpose reservoirs throughout the Nation. The bulk of this storage space is for municipal and industrial (M&I) supply. The national total of all municipal and industrial (M&I) water supply storage contained in Corps reservoir projects by Corps division is shown in Table 1. [13]

[11] These projects are "dry" reservoirs that retain, or "store", water only during floods.

[12] Projects with no permanent, or rear around, storage are not considered reservoirs, and are not affected by the name change (e.g., Mount Morris Dam).

[13] [13] U.S. Army Corps of Engineers, Institute for Water Resources, 1996, Water Supply Handbook: A Handbook on Water Supply Planning and Resource Management. IWR Report 96-PS-4

Table 1
M&I Water Supply Storage in Corps Reservoirs
By Corps Division

Division	Number of Projects	Storage Space (Acre-Feet)			
		Present Use	Future Use		Total
			Under Contract	Not Under Contract	
North Atlantic	7	138,450	4,000	0	142,450
South Atlantic	10	120,626	96,740	0	217,366
Great Lakes and Ohio River	17	577,940	51,269	2,200	631,409
Mississippi Valley	6	181,900	0	187,750	369,650
Northwestern	12	184,360	531,380	91,500	807,240
Southwestern	64	4,873,217	1,515,150	497,249	6,885,616
South Pacific	2	258,900	212,000	0	470,900
Total	118	6,335,393	2,410,539	778,699	9,524,631

Agricultural water supply is included in Corps reservoir projects in the Western States under repayment agreements between the Bureau of Reclamation and the local sponsors.[14] There are no agricultural water supply agreements in Corps reservoir projects in the Eastern states.

Irrigation storage included in the 47 completed projects that include agricultural water supply is shown by region in Table 2. The 47 completed projects include about 772 thousand acre-feet of "specific" irrigation storage space and another 52.7 million acre-feet of storage classified as "joint". This joint storage can be used for flood control, navigation and/or hydroelectric power as well as for irrigation purposes.

[14] Section 8 of the 1944 Flood Control Act provides that Corps reservoirs may include the irrigation purpose upon the recommendation of the Secretary of the Interior in conformity with Reclamation Law. The Chief of Engineers considers that Section 8 applies only in the 17 Western States to which the Reclamation Law applies. In these 17 Western States, the repayment arrangements and agreements for irrigation water from Corps reservoirs is administered by the Bureau of Reclamation.

Table 2
Summary of Irrigation Storage in Corps Reservoirs
By Corps Division

Division	Number of Projects	Storage Reserved for Irrigation (Acre-Feet)		
		Specific Storage	Joint Storage	Total Storage
Northwestern	30	312,000	48,627,900	48,939,900
Southwestern	2	63,800	0	63,800
South Pacific	15	396,500	4,036,600	4,433,100
Total	47	772,300	52,664,500	53,436,800

LFDR Projects

There are no nationally aggregated data on the number of LFDR projects the Corps has constructed, and for which local communities have assumed O&M responsibility. Several hundred projects have been constructed which were specifically authorized by Congress. There are hundreds more which have been constructed under continuing authority for small flood control projects provided by Section 205 of the 1948 Flood Control Act, as amended. That Act also provided continuing authority for very small snagging and clearing projects. Hundreds of snagging and clearing projects have been undertaken to reduce flooding on small streams. Each Corps District is responsible for periodic inspection of these projects to assure that they are being maintained in by local sponsoring communities in the manner to which they agreed.

Types of LFDR measures include channel modifications, levees, floodwalls, diversion channels, ice-control structures, bridge modifications, and appurtenant works. Small dams are used infrequently to retard flood flows from small tributary streams, and to complement other measures employed. Non-structural measures often are used to reduce the susceptibility of flood plain development to flood damage without significantly altering the nature or extent of flooding. They do this by changing the use made of the flood plains, or by accommodating existing uses to the flood hazard. They can be considered independently or in combination with structural measures. Examples are flood proofing, flood warning and preparedness systems, regulation of flood plain uses, and permanent evacuation. Floodproofing is modification of structures to minimize flood damages by such methods as sealing walls, closing off openings, protecting plumbing and utilities and installing pumps and valves.

Floodproofing by raising-in-place lifts structures such that their first floors are less subject to flooding. There are practical limitations to how high above ground level a house may be raised. For floodproofing existing structures, typical methods employ jacking up the house and constructing foundation walls for the raised house to rest upon. For structural integrity during floods, and to preclude use of the newly enclosed space under the house for habitable purposes, grilled openings are left at ground level so that water may enter as the flood rises. To allow trapped air to escape (rather than let the upper levels be buoyed off their foundation), vents are placed at the top of the foundation wall.

Permanent evacuation is the removal of structures from the floodplain. Existing structures either are demolished or physically moved to their new flood “free” location. If demolished, replacements may or may not have to be constructed at off-floodplain sites, depending on the availability of similar structures on the market, or upon the desires of

the occupant/owners who may wish to move to another region. Typically, once the structure is removed, the abandoned site is cleared, graded and seeded. Property title is held by the government or otherwise sufficiently encumbered to preclude uses incompatible with FPM objectives.

COMMONALITIES AND DIFFERENCES AMONG THE FOUR MAJOR TYPES

As the background discussion suggests, there are few commonalities and major differences among the four types of projects. To highlight the commonalities and differences, following are generalized, comparative attributes of the four types in four categories: physical and operational, economic, environmental, and budgeting and funding.

Physical and Operational

- Harbor projects, nominally, have no moving parts and no structures to operate and maintain. Construction is a matter of initial dredging. Maintenance is a matter of periodic re-dredging. No lands are required or acquired. Exceptions are for those projects where dredged material must be confined for environmental reasons, in which case containment levees and dewatering facilities require both lands and O&M. Harbor projects never need replacement, but may be expanded (lengthened and/or deepened) in response to demand.
- Inland waterway locks and dams have complex structures and extensive moving parts requiring constant operation and maintenance. Generally, the projects require only a few acres of land adjacent to the facility. The projects create pools of navigable water generally within the natural streambanks or, in certain places, within ordinary high water levels if overbank. Most lock and dam projects store no water except that incidental to maintaining the navigable pool. Exceptions include lock and dam projects on the Columbia River. Locks and dams may be, and often are, replaced by larger projects in response to the demands of commerce.
- Lake projects require massive structures and limited moving parts to periodically adjust water release rates. Extensive lands are required and usually are acquired in fee simple title, though some older projects depend partly on "flowage" easements. Dams (non-navigation) can be, but almost never are, replaced, mainly because stringent dam safety requirements ensure that they may be maintained in perpetuity.[15] Also, they usually are constructed to the maximum height allowed by site conditions such that enlargement is not possible. Operation involves control of outflows to adjust lake levels during the year, and management of recreation facilities.
- LFDR projects vary considerably in construction and structural components. They comprise varying combinations of levees, floodwalls, channel modification and diversions. Where levees and floodwalls are involved, generally there also are pumping stations required to pump interior drainage past the line of protection (i.e., through or over the levee or floodwall). The projects are operated only during times of flooding; thus, operation and maintenance are minimal (for example, relative to harbor projects). Channel improvements tend to require more maintenance than floodwalls or levees because of sedimentation, bank erosion and growth of woody vegetation that can impede flood flow. Levees require mowing and maintenance of riverward toes subject to erosion. Land acquisition is limited to that required for the structures themselves and for maintenance access and, for certain projects, for public access for recreation. Channel improvements require no operation. Levees and floodwalls require operation

[15] No Corps of Engineers dam has ever failed.

to close gated openings and to pump interior drainage.

Economic

- Harbor projects generally have high annual costs for O&M relative to the initial investment (or first costs). If confined disposal is required, O&M costs can be far greater than may have been anticipated when the present project was undertaken. Benefits are as variable as the demands of commerce. There are no resources that afford opportunities for increased economic gain.
- Inland Waterways generally have moderate O&M costs relative to first costs. Benefits are as variable as the demands of commerce. There is limited potential for improved economic efficiency where operating mechanisms could be improved to decrease lockage time (but at some environmental cost).
- Reservoirs and lakes have low O&M costs relative to first costs. Benefits generally grow over time, based on normally increasing demands for recreation and storage withdrawals for other purposes, as well as intensified use of previously flood prone lands downstream. There are opportunities in an unknown number of cases to convert excess or surplus storage capacity to other purposes.
- LFDR projects have moderate to low annual costs relative to first costs. O&M costs are somewhat episodic depending on magnitude and frequency of flooding. Benefits generally grow over time, because of intensified use of previously flood prone lands. There is little opportunity for increased economic gain, except for the possibility to enhance project land and facilities for recreation use.

Environmental

- Harbor projects tend to have continuing adverse environmental effects. These effects are highly variable from project to project. The effects vary depending on levels of contaminants in dredged material and propensity for ship accidents. Potential for beneficial environmental initiatives is nearly nil, except where uncontaminated sediments can be used to create wetlands, or possibly to construct dikes for aquaculture.
- Inland Waterways tend to have continuing adverse environmental effects, but generally of far less magnitude than is associated with many harbor projects. Some waterways, or long segments thereof, require little or no dredging. Contaminants in dredged material generally are far less than in that in harbors. There may be limited opportunities to manipulate pool levels to store water for short periods, or to manipulate dam gate operation to increase oxygenation during non-flood periods (although this technique already is used in many cases).
- Reservoir and Lake projects have relatively little continuing adverse environmental effects once constructed. However, the projects may be subject to environmental degradation from recreation facility overuse, pollution from upstream sources or excessive siltation. There are opportunities in an unknown number of cases to convert excess or surplus storage capacity for water quality control. There may be many opportunities for small improvements in reservoir and land management to achieve significant environmental enhancements.
- LFDR projects tend to have little or no continuing adverse environmental effects. There are few resources (e.g., land) for application of environmental enhancements. There is some potential that projects including channel modification could be further modified to provide a more natural environment and significant ecosystem restoration.

Budgeting and Funding

- Harbor projects new construction is cost-shared with non-Federal sponsors. The Federal share is funded from General Fund appropriations. Maintenance is funded from the Harbor Maintenance Trust Fund.
- Inland Waterways new construction, including major replacements, is funded entirely from the Inland Waterways Trust Fund. Operation and maintenance is funded from General Fund appropriations.
- Reservoir and Lake operation and maintenance is funded from appropriations from the General Fund, supplemented by users' fees to defray costs of O&M of recreation facilities. New construction, if any, would be funded from General Fund appropriations.
- LFDR projects new construction is cost-shared with non-Federal sponsors. The Federal share is funded from General Fund appropriations. Operation and maintenance is funded entirely by non-Federal sponsors.

I I – DEFINING THE SCOPE AND MAGNITUDE OF PROBLEMS AND OPPORTUNITIES

A MATRIX OF PROBLEMS, OPPORTUNITIES AND ISSUES

There are discrete basic levels of management: project level, system level and program (nationwide) level. The attributes of each level vary considerably among the four project types. In addition to the basic levels of management and the four types of projects, there are economic, environmental and social considerations peculiar to each level and type. Another set of attributes comprises financial and budgetary considerations. Finally, there is the range of magnitude within which problems and issues exist or might arise. The magnitude implications vary with each level. At the project level, major problems and issues may evoke questions of statutory authority, intent of Congress, and continuing project viability. At the program level, major problems and issues may reflect on budgetary and mission integrity.

Superimposed on this multi-dimensional matrix, and essential to this study, is the concept of revitalization in which opportunities for beneficial changes are pursued proactively. Revitalization must consider potentials and opportunities including latent demands and those that may be induced. Because of the disparate nature of the challenges among types, and of the management tools in place for each, this report discusses each type separately; and, within each type, explores the complex of problems, issues and opportunities at each level.

PROBLEMS AND OPPORTUNITIES: HARBORS

Over the past two decades, several factors have developed to create an increasing challenge for the Corps of Engineers and its non-Federal partners in operating and maintaining the nation's harbors, particularly in the area of the management of dredged material. These factors include substantial and continuous increases in the demands of commerce, rapid evolution of shipping practices (such as containerization and intermodalism), increasing awareness of mounting environmental problems, more stringent environmental protection programs affecting coastal and ocean waters, tight budgetary constraints, continuing population shifts to coastal areas, and generally increased non-Federal responsibilities in the development and management of navigation projects. As a result, management of the nation's harbor system in general, and management of dredged material specifically, has become a contentious problem encompassing all phases of harbor project development and operation; from planning new projects or enlargements, to maintaining existing projects.

Resources and Demands

Harbor projects have no resources beyond that for which the project was constructed, except in limited cases where uncontaminated dredged material might be used for beneficial purposes. The most common beneficial use is for wetland creation. However, in these cases the beneficial use often may be the only environmentally acceptable disposal method. Demands on harbor projects include only the demands of commerce for navigability. Demand exceeding project capacity can only be met by enlarging the project. Because ports compete among themselves for business, some ports may decline in use even during an expanding economy. The demands, and the competition among ports, also are affected by the evolution of ship sizes in the world fleet. Thus, demands on some harbors, and the transportation savings benefits they once provided, may decline substantially over time. These variable demands affect harbors of all sizes.

Harbors of refuge and similar shallow draft projects differ from most projects in that they are not subject to the same demands or prone to the same problems. They generally consist of

breakwaters, and require minimal dredging of an entrance channel.

Needs and Conflicts

Once the navigation channel has been constructed to its authorized depth, it requires periodic maintenance dredging. Most dredged channels in the U.S. experience sediment deposition at varying rates and maintenance dredging is required to ensure that these channels continue to provide safe passage to vessels at the projects' authorized depths. Compared to the initial construction phase of a dredging project, maintenance work generally proceeds relatively smoothly. Since the difficulty of obtaining disposal permits has already been overcome, the major environmental hurdle is the securing of water quality permits at the point of dredging, unless the disposal areas are near capacity or the sediments to be dredged are so highly contaminated as to violate the disposal area's discharge permit. Many projects have been using the same areas to dispose of maintenance dredging material for more than 30 years, predating the modern environmental movement and its attendant regulations. The Corps now is replacing these sites and taking on the challenge of getting new sites on-line before the old sites become full.

The substantial problems attendant to disposal were addressed in depth in the May 1996 IWR "Report on the Need for Changes in Dredged Material Management Policy". That report showed that the 20 most expensive to maintain deep draft projects (out of 299 nationwide) consume over 50% of annual deep draft O&M expenditures (for years 1977 through 1994). Shallow draft projects show a similar disparity: 20 projects account for over 40% of annual shallow draft O&M expenditures. While some of these harbors rank highly in terms of cargo tonnage and valuation, many do not.[16] This disparity suggests that some projects may be economically marginal or uneconomic. Substantial impediments to cost versus usage comparisons, at the time of the 1996 report, were the lack of data for all projects and the lack of a bridge to correlate port data to harbor data. Many harbor projects serve several ports (e.g., Mississippi River from Baton Rouge to the Gulf) and a few ports are served by more than one harbor project (e.g., Port of New York/New Jersey).

Potentials and Opportunities

Because harbor projects have little or no resources, they have little or no potential, and offer few opportunities, for meeting changing water resources needs and related environmental beneficial effects. In the few instances where uncontaminated sediments can be put to beneficial uses, they do represent significant environmental opportunities.

PROBLEMS AND OPPORTUNITIES: INLAND WATERWAYS

Resources and Demands

The inland waterways as systems have substantial capacity for meeting steadily increasing demands for their intended and authorized purpose, commercial navigation. They also have proven to be major recreational resources for pleasure boating and related activities. For other purposes, the waterways have limited resources, varying from segment to segment. Because the lower Mississippi and most of the intracoastal waterways have no locks and dams, they have no other significant water resources beyond their natural resources. The remaining waterways have "stair steps" of pools formed by locks and dams. While, in most cases, the pools were intended and designed solely for navigation purposes, they do store water except during floods. However, withdrawal of water from the pools is limited to less than the flow of the river, or no more than could be withdrawn if there were no navigation project. The net advantage is increased physical head that facilitates withdrawals and reduces pumping costs (e.g., for municipal and industrial water supply).

Some projects serve purposes in addition to navigation, most notably 46 projects that include hydroelectric power generating plants. Most of these plants are "run-of-the-river" in design, in that they depend on normal river flows, and no

[16] "National Harbors Program: Report on the Need for Changes in Dredged Material Disposal Policy". IWR, May 1996. Pp.41-42.

storage is included in the pools specifically for power generation.

Needs and Conflicts

This study does not concern the potential need to expand capacity of those portions of the systems (e.g., the Upper Mississippi) for which the demands of commerce exceed existing capacity. Responding to those demands goes beyond revitalization, and is the subject of other extensive studies. However, there is evidence that some portions of the systems may be being maintained at a net cost economically, while posing difficult environmental challenges. A case example, the Apalachicola River, is discussed subsequently in this report.

The Inland Waterways Users Board's concerns do not necessarily extend to O&M *per se* because O&M expenditures are not funded by the Inland Waterways Trust Fund. However, major rehabilitation is funded from the Trust Fund. In its Annual Report to Congress for 2001, the Board expressed the following concerns:

"A critical element of assessing the condition of the Nation's navigation infrastructure is the backlog of maintenance for U.S. Army Corps of Engineers projects. The Corps has been extensively reviewing the size and nature of their maintenance backlog inventory at the direction of Lieutenant General Flowers, the Chief of Engineers. The value of the maintenance backlog for FY 2002 is currently estimated to be approximately $835 million. The navigation share is about 65 percent or $545 million of which $354 million is for inland waterways. This is an indication of the deteriorating condition of our aging navigation infrastructure. More than 45 percent of the locks and dams operated by the U.S. Army Corps of Engineers are over 50 years old. The Board is greatly concerned about the large amount of maintenance backlog and its growing size. Prolonging the performance of necessary maintenance materially and adversely affects the service provided by these navigation projects. It also leads to further deterioration and accelerates the need for major rehabilitation work sooner than would be required and often at higher costs. If unchecked for an extended period, it could ultimately lead to the need for replacement projects years before otherwise needed. The Board encourages the U.S. Army Corps of Engineers to continue the efforts at reducing the maintenance backlog. Furthermore, the Board suggests that additional funds be appropriated for the Civil Works program over the next several years to be dedicated to reducing the large maintenance backlog to an insignificant amount.

"The Board strongly supports inland navigation construction and rehabilitation projects that are affordable within the existing fuel tax rate structure, income of the Inland Waterways Trust Fund and matching federal funds. The Board is convinced that project costs can be reduced through innovative design and construction techniques. It is a much better bargain to build the projects awaiting construction in a timely and cost efficient manner and at significantly reduced costs, than to realize only one or two of these new starts each decade at inflated costs. Alternatively, should the Congress approve projects absent cost reductions, additional scarce federal resources will be spent and increased pressure will be exerted to impose additional fuel taxes, which could render our inland and coastal shallow draft system largely noncompetitive and obsolete. The recommended investment program should reflect these cost reduction targets."

Potentials and Opportunities

The physical head advantage combined with river flow provides limited potential for hydroelectric power generation. There may be limited opportunities to manipulate pool levels to store additional water for short periods, and to use it to augment flows during low flow periods. Whether or not that is possible, dam gate operation should be manipulated to increase oxygenation during non-flood periods. The increase in dissolved oxygen can substantially improve waste assimilation and aquatic habitat. Although this technique already is used in many cases, programmatic management could ensure that all navigation dams are operated to maximize oxygenation. The net advantage is increased physical head that facilitates

withdrawals and reduces pumping costs (e.g., for municipal and industrial water supply). .

In those cases where navigation pools are not contained entirely within banks, there may be unrealized opportunities for environmental restoration and enhancement, such as creating small sub-impoundments and wetlands, or creating vegetative buffers against surface pollutant runoff.

Case Example: Apalachicola River, Florida, Inland Waterway

Recent History

The Apalachicola River stem of the Apalachicola/ Chattahoochee/ Flint (ACF) waterway has been the subject of criticism as an example of uneconomic and environmentally damaging segments of the Inland Waterway System. The following discussion of recent history is taken largely from an information paper prepared by the Corps' Mobile District. [17] The full information paper is included as Appendix B.

The water resources of the ACF River Basin have been developed to serve multiple purposes, including flood control, navigation, hydropower, water supply, water quality, recreation, and fish and wildlife enhancement. A basin-wide development plan, authorized by the River and Harbor Act of 1945 and modified in 1946, consisted of three multi-purpose reservoirs on the Chattahoochee above Columbus, Georgia (only two were constructed); three multi-purpose reservoirs on the Flint River above Albany, Georgia (none were constructed); and six locks and dams (three were constructed). Navigation was to be provided by (1) dredging, cutoffs, training works, and other open river methods; (2) a series of locks and dams; and (3) flow regulation from upstream storage projects.

The project ultimately constructed consisted of a 9- by 100-foot navigation channel along 107 miles of the Apalachicola River between the Gulf Intracoastal Waterway and Jim Woodruff Lock and Dam. From there the navigation channel extends 155 miles up the Chattahoochee River to Columbus, Georgia, and Phenix City, Alabama, and 28 miles up the Flint River to Bainbridge, Georgia.

The controlling depth for navigation has often been less than the authorized 9 feet during a large portion of the normal low flow period of the summer and fall each year. Over the period 1970-1999, a 9-foot channel has been available only about 62 percent of the time and a 7.5-foot channel 82 percent of the time. Over the years conditions placed on water quality certification have imposed increasing restrictions on dredged material disposal area usage, required an extensive monitoring program, and the re-opening of sloughs along the river. These actions limited dredged material capacity and increased maintenance costs. A new management technique, mechanical redistribution, was initiated in 1987 and has been used primarily at one disposal site within the controlling reach of the river. However, the five-year water quality certification issued in 1999 prohibits the continued use of this technique.

As much as 1.2 million tons of cargo moved on the ACF in 1985, but traffic has continually declined since then as difficulties in maintaining the project and providing a reliable channel have increased. Presently less than 400,000 tons move on the waterway. The principal commodity is sand and gravel, which is not dependent upon navigable depths on the Apalachicola River and can move economically at shallower depths than can some other commodities. The next most important products are petroleum products and fertilizers.

The 1998 Operation and Maintenance (O&M) Cost Savings Initiative established benchmark values for project performance (output and cost) and identified those projects, the performance of which, did not meet the benchmark. For inland navigation, the benchmark value, based on O&M cost per ton-mile, was $0.02. Projects with a value greater than this benchmark were candidates for evaluation to identify savings in O&M costs. The value for the ACF was $0.113. [18]

[17] From Mobile District Website, January 25, 2002 (www.sam.usace.army.mil/infoalph.html)

[18] From Mobile District Website, January 25, 2002 (www.sam.usace.army.mil/infoalph.html)

Findings of Inland Waterways Tributaries Study

In August 2001, the Institute for Water Resources completed a limited study on "Inland Waterways Tributaries: Role and Value to the Inland Navigation System". The study concluded, with appropriate caveats for use of generalized and somewhat dated data, that in fact the annual O&M costs for the ACF waterway segment exceeded transportation savings for the period of analysis from 1990 through 1994.[19]

Fiscal Year 2002 Appropriations Act

The Fiscal Year 2002 Appropriations Act contained the following provision:

"…Provided further, That the project for the Apalachicola, Chattahoochee, and Flint Rivers Navigation, authorized by section 2 of the River and Harbor Act of March 2, 1945 (Public Law 79–14) and modified by the first section of the River and Harbor Act of 1946 (60 Stat. 635, chapter 595), is modified to authorize the Secretary, as part of navigation maintenance activities, to develop and implement a plan to be integrated into the long-term dredged material management plan being developed for the Corley Slough reach, as required by conditions of the State of Florida water quality certification, for periodically removing sandy dredged material from the disposal area known as Site 40, located at mile 36.5 of the Apalachicola River, and from other disposal sites that the Secretary may determine to be needed for the purpose of reuse of the disposal areas, by transporting and depositing the sand for environmentally acceptable beneficial uses in coastal areas of Florida to be determined in coordination with the State of Florida: Provided further, That the Secretary is authorized to acquire all lands, easements, and rights-of-way that may be determined by the Secretary, in consultation with the affected State, to be required for dredged material disposal areas to implement a long-term dredge material management plan: Provided further, That the long-term management plan shall be developed in coordination with the State of Florida no later than 2 years from the date of enactment of this Act: Provided further, That, of the funds herein, $4,900,000 shall be made available for these purposes and $8,000,000 shall be made available for normal operation and maintenance of the Apalachicola, Chattahoochee, and Flint Rivers navigation project."

The $8 million amount is slightly less than the average normal O&M expenditures incurred during the period 1990 through 1994. The President's budget request for FY 2002 included only $1,237,000 for the project. The request stated as a general principle:

"In the operation and maintenance program, the budget gives priority among port and harbor and inland waterway activities to those that support high commercial navigation use, and redirects funds from lower-priority activities, such as recreational harbors and low commercial-use inland waterway segments."

The budget request for FY 2003 includes $1,444,000 for the project.

Implications

All indications are that the ACF system has been uneconomically maintained for a period of years, and that the District has gone to great lengths to minimize O&M costs, partly because of environmental considerations. It is apparent that all cost-cutting measures have been undertaken short of discontinuing maintenance and disposing of the project. Disposition studies have not yet begun to assess non-commercial navigation alternatives, potential impacts, opportunities for environmental restoration, and revised reservoir water control operations.

Determination of the contribution of tributary, or end, segments to transportation savings requires system analysis. The end segment produces movements over other parts of the system. The end segment makes possible the resultant savings; but so does the other portion of the system over which the commodities move. An extremely data dependent model is required to apportion both

[19] "Inland Waterways Tributaries: Role and Value to the Inland Navigation System". Table entitled: "Inland Waterway System Tributaries: Cost and Contribution; 1998 Tons, Estimated Commodity Value & Transportation Savings, and Average (90-94) O&M Cost". Navigation and Water Resources Applications Division, August 2001

benefits and costs between the end segment and the remainder of the system.

The IWR limited analysis in 2001 used one such model, but with seven year old data. It is presumed that the benchmark cost per ton-mile values established by the 1998 Operation and Maintenance (O&M) Cost Savings Initiative were based on the same or similar system model. However, it is not clear that the estimated (1998) ACF cost per ton-mile value captured the system throughput benefits.

It has been, and still is difficult, if not impracticable, for Districts to independently maintain ongoing analyses of current economic viability of their projects that are parts of the inland waterways system. Centralized, improved data collection and analysis would alleviate the problem.

PROBLEMS AND OPPORTUNITIES: RESERVOIRS AND LAKES

All of the Corps' dam and reservoir projects were constructed before ecosystem restoration became a priority mission. In fact, nearly all were constructed before enactment of the National Environmental Policy Act in 1970. Since then, all of the operating projects have been subjected to environmental assessment, and substantial investment has been made in improvements for environmental quality including ecosystem restoration.

Intensive recreational usage of Corps Lakes is far greater than contemplated decades ago. Other demands also have increased, but less universally. These demands are mostly for water supply, hydropower and low flow augmentation for navigation. The demands vary greatly by region and by proximity to urbanizing areas. However, a small number of projects are underutilized for intended purposes, while a substantial number are not operated at all for all authorized purposes. These are projects that include storage for future water supply usage that has not materialized, most notably in Oklahoma, and some older projects that provided for purposes no longer needed, such as storage for releases to maintain downstream navigation where locks and dams subsequently have been constructed. There is no nationwide inventory of such projects to assess to what extent the unused storage has been converted to other beneficial uses.

Resources and Demands

Characteristics

Revitalization of Corps Lake Projects involves not only addressing increasing and changing demands, but also taking maximum advantage of opportunities presented by all lake resources. All Corps lake projects have two basic resources: storage capacity and land. These resources vary substantially from project to project. Storage capacity is the capacity of the reservoir to contain water if filled to the crest of the dam's emergency spillway. When the reservoir is empty, of course there is no lake; when it is full, it no longer can control floods. In between is a partially filled level best suited to serve its intended purposes.

For any reservoir, allowances must be made for sedimentation to accumulate over the physical life of the project. Most reservoirs have been designed by the Corps to contain the sediment projected to accumulate at least over 100 years. That volume cannot be relied upon for flood storage in the future, but in the meantime the reserved space may be used to store water to form a lake. That lake becomes available for recreation and related uses.[20] For single-purpose flood control projects, the balance of the storage space remains empty until needed to store floodwater. This space is referred to as the flood control pool. If more space is needed to store water for other purposes such as water supply, the original construction of the dam must be to a higher elevation to create a larger reservoir. Site conditions dictate whether a higher dam is possible and, if so, the added cost for construction. Except in unusual circumstances, raising the height of an existing dam would be prohibitively expensive. In many cases, such rising would not be possible because of topographic limitations.

Essentially, the storage capacity resource represents both existing and potential

[20] Usually, recreation does not become a purpose unless significant specific facilities costs are incurred to enhance recreation usage. However, in some instances, storage is authorized to provide a larger recreation lake.

resources for a range of purposes. However, each existing lake project has established an ecological life of its own. This ecological resource may be considered a *de facto* project purpose. Changing permanent or seasonal pool levels would have a substantial impact on the ecosystem. However, a new ecosystem would establish itself over a period of years.

Land resources also vary considerably. In the earlier projects, land acquisition was limited to fee interest in the land to be permanently inundated by the lake, and within about 300 feet horizontally thereof. For lands that would be flooded periodically and temporarily, only flowage easements were acquired. In later projects, flood control pool lands were acquired in fee title. In the late 1950's, Corps acquisition policy was changed further to require that sufficient land was acquired in fee title to ensure minimal conflicts with reservoir usage, and to reduce severance damages. The additional lands serve as a buffer to protect the lake and have intrinsic value suitable to a lake environment. In mountainous country, land acquisition for most projects extends to the ridgelines around a majority of each lake. These changes in acquisition policy have resulted in marked differences in the character of development around lakes. Many older projects have substantial private development (e.g., residences and camps) around their perimeters, while lakes formed over the last 40 years have almost no private development close to the lake.

The interface between project lands and the lake is characterized by substantial fluctuations in lake levels from season to season, and year to year. The more uses of the lake resources, the greater the relative fluctuations. Whereas the interface could be of substantial importance to biodiversity, the fluctuations, sometimes constant and rapid, can be a considerable negative attribute.

Authorized and Operating Purposes

In 1992, the Corps completed an inventory of all Corps dam and reservoir projects to identify the purposes for which each project is authorized, and the purposes for which each project is being operated. Differences in authorized versus operating purposes are noted project by project in the report on the inventory.[21] The report notes that most purposes served by Corps reservoirs fall into eight categories: flood control, navigation, hydroelectric power, irrigation, municipal/industrial water supply, water quality, fish/wildlife, and recreation. Each category represents a variety of purposes that appear in authorizing laws. For example, the fish/wildlife category includes such purpose as sport fishing and wildlife, fisheries habitat, and wildlife preservation. Some purposes authorized by Congress that do not fit conveniently into any one category include: sediment control, low flow augmentation (without stipulation as to specific purpose), drainage and water control, saltwater intrusion (abatement thereof), groundwater recharge, water conservation (without stipulation), and preservation of the Everglades National Park.

The laws authorizing project purposes may be grouped in three categories: laws initially authorizing construction of the project; laws specific to the project enacted subsequent to construction; and, laws that apply generally to all Corps reservoirs. In the latter category, the following laws have the greatest relevance to Corps reservoirs:

- PL 78-534, Flood Control Act of 1944 provides authority to add recreation as a purpose; to contract for use of surplus water for domestic purposes; and, for reservoirs in the 17 western states, to include storage for irrigation.
- PL 85-500, Title III, water Supply Act of 1958 provides authority to include storage for M&I water supply.
- PL 85-624, Fish and Wildlife Coordination Act of 1958 (provides authority to modify projects to conserve fish and wildlife.
- PL 92-500, Federal Water Pollution Control Act Amendments of 1972 establishes a goal to establish and maintain the quality of the Nation's

[21] Authorized and Operating Purposes of Corps of Engineers Reservoirs. Department of the Army, U.S. Army Corps of Engineers. July 1992 (2nd printing, with revisions, November 1994)

water, and requires that, in the planning of any Corps reservoir, consideration be given to inclusion of storage for regulation of streamflow.[22]

- PL 93-205, Endangered Species Act of 1973 provides authority for operating projects to protect threatened or endangered species.

Review of the inventoried purposes discloses that the majority of projects are being operated and maintained for all authorized purposes and only for those purposes. As listed in Table 3, some 64 projects, however, are not being operated for all authorized purposes.

Table 3
Projects Not Operating for All Authorized Purposes[23]
Showing purposes for which projects are not being operated

1. Kanopolis Lake, Kansas City District – Hydropower, Irrigation (requires pool raise), Navigation (no storage)[24]
2. Pomme de Terre Lake, Kansas City District – Navigation (no storage), Water supply (no storage)
3. Pamona Lake, Kansas City District – Navigation
4. Rathbun Lake, Kansas City District – Navigation
5. Wilson Lake, Kansas City District – Navigation, Irrigation
6. Big Bend Dam-Lake Sharpe, Omaha District – Irrigation
7. Bowman-Haley Lake, Omaha District – Water supply (storage unknown)
8. Fort Randall Dam-Lake Francis Case, Omaha District – Irrigation
9. Gavins Point–Lewis and Clark Lake, Omaha District – Irrigation
10. Oahe Dam-Lake Oahe, Omaha District – Irrigation
11. Raystown Lake, Baltimore District – Hydropower
12. Gathright Dam and Lake Moomaw, Norfolk District – Hydropower
13. Menasha Lock and Dam-Lake Winnebago, Detroit District – Navigation
14. Coralville Lake, Rock Island District – Water supply (no space)
15. Red Rock Dam and Lake Red Rock, Rock Island District – Hydropower, Water supply (no storage, superseded by Saylorville auth.)
16. Gull Lake, St. Paul District – Navigation (1880, Upper Miss L&D obviated)
17. Leech Lake, St. Paul District – Navigation (1880, Upper Miss L&D obviated)
18. Cross Lake (Pine River Dam), St. Paul District – Navigation (1880, Upper Miss L&D obviated)
19. Pokegama Dam, St. Paul District - Navigation (1880, Upper Miss L&D obviated)
20. Sandy Lake, St. Paul District – Navigation (1880, Upper Miss L&D obviated)
21. Blue River Lake, Portland District – Navigation (storage unknown), Hydropower
22. Cottage Grove Lake, Portland District – Navigation (storage unknown)
23. Cougar Lake, Portland District - Navigation (storage unknown)
24. Detroit Lake, Portland District – Navigation (storage unknown)
25. Dorena Lake, Portland District – Navigation (storage unknown)
26. Fall Creek Lake, Portland District – Navigation (storage unknown)
27. Fern Ridge Lake, Portland District – Navigation (storage unknown)
28. Foster Dam, Portland District – Navigation (storage unknown)
29. Green Peter Lake, Portland District – Navigation (storage unknown)
30. Hills Creek Lake, Portland District – Navigation (storage unknown)
31. Lookout Point Lake, Portland District – Navigation (storage unknown)
32. 32. Willow Creek Lake, Portland District – Water supply (storage unknown), Irrigation (storage unknown)

[22] Section 65 of the Water Resources Development Act of 1974 permits conversion of water quality storage in authorized reservoirs to another use when EPA determines such storage is unnecessary.

[23] Source: Authorized and Operating Purposes of Corps of Engineers Reservoirs. Department of the Army, U.S. Army Corps of Engineers. July 1992 (2nd printing, with revisions, November 1994)

[24] Cited authority for navigation and hydropower (PL 78-534) appears incorrect

Table 3 (Continued)
Projects Not Operating for All Authorized Purposes[25]

33. Howard A. Hanson Dam, Seattle District - Water supply (storage unknown), Water quality (storage unknown), Irrigation (storage unknown)
34. Bluestone Lake, Huntington District – Hydropower (storage unknown) (limited facilities)
35. Burnsville Lake, Huntington District – Low flow (storage unknown)
36. Burr Oak Lake-Tom Jenkins Dam, Huntington District - Low flow (storage unknown)
37. Laurel River Lake, Nashville District – Flood Control
38. Allatoona Lake, Mobile District – Navigation (storage unknown)
39. Carters Dam and Lake, Mobile District – Navigation (storage unknown)
40. William "Bill" Dannelly Lake-Miller's Ferry L&D, Mobile District - FC (no storage)
41. Okatinnee Lake, Mobile District – Water supply (storage not used)
42. Hartwell Dam and Lake, Savannah District – Navigation (storage unknown)
43. J. Strom Thurmond Dam and Lake, Savannah District – Navigation (storage not used)
44. John H. Kerr Dam and Reservoir, Wilmington District – Low flow (storage unknown)
45. Lake Mendocino (Coyote Valley Dam), – Irrigation (storage unknown)
46. Martis Creek Lake, Sacramento District – Water supply (storage not used)
47. Alamo Lake, Los Angeles District – Hydropower
48. Hansen Dam, Los Angeles District – Water conservation, Recreation (modification in planning, 1994)
49. Belton Lake, Fort Worth District – Hydropower
50. Benbrook Lake, Fort Worth District – Navigation (storage used for M&I Water Supply)
51. Canyon Lake, Fort Worth District – Hydropower
52. Grapevine Lake, Fort Worth District – Navigation (storage used for M&I)
53. Sam Rayburn Lake – Navigation (conservation storage)
54. Town Bluff Dam-B.A. Steinhagen Lake, Fort Worth District - Hydropower (local operation of dam facilities)
55. Dequeen Lake, Little Rock District – Hydropower (no storage)
56. Dierks Lake, Little Rock District – Hydropower (no storage)
57. Nimrod Lake, Little Rock District – Hydropower (no storage)
58. Canton Lake, Tulsa District – Irrigation (storage not contracted)
59. Lake Texoma-Dennison Dam, Tulsa District – Navigation (no storage)
60. Fall River Lake, Tulsa District – Water supply (no storage)
61. Fort Supply Lake, Tulsa District – Water conservation (converted to Water supply)
62. Great Salt Plains Lake, Tulsa District – Water conservation (storage not used)
63. Optima Lake, Tulsa District – Water supply (storage unknown)
64. Waurika Lake, Tulsa District – Irrigation (storage unused)

[25] Source: Authorized and Operating Purposes of Corps of Engineers Reservoirs. Department of the Army, U.S. Army Corps of Engineers. July 1992 (2nd printing, with revisions, November 1994)

These projects include 30 projects authorized, prior to construction; to include storage for navigation (for releases to maintain navigable depths downstream during draught), but where commercial navigation never developed, or a system of locks and dams subsequently was built. Some 13 projects were authorized to include hydropower, but hydropower development subsequently was determined to be economically infeasible. Twelve projects were authorized to include storage for water supply, but the demand never materialized. Seven projects were authorized to include storage for the related purposes of water quality control, low flow augmentation or conservation. In two of these latter seven projects, storage has been converted to water supply; in three projects, storage is included, but is not being used for intended purposes[26]; and, in two projects, the status of the storage is not indicated in the referenced inventory.

Conversely, three projects are being operated for water conservation, although not authorized. However, in these projects, no dedicated storage is required because only temporary storage of floodwater is used to recharge groundwater. Finally, there is one project, Laurel River Lake, which is not being operated for the authorized purpose of flood control.[27] Table 3 thus constitutes a core list for targeted assessment of untapped potentials.

Project Conditions and Rehabilitation Needs

For purposes of this study, all lake projects are assumed to be in sound condition and fully operable with respect to satisfying authorized purposes, with the following exceptions:

- Depreciated capacities due to sedimentation
- Polluted inflows and storage
- Deteriorated ecosystems

It may be assumed that the Corps' inspection, maintenance and dam safety assurance efforts will perpetually assure the structural and functional integrity of each project's dam and operating facilities (e.g., spillway and outlet works). To that extent, rehabilitation needs are not germane to this inquiry. However, some projects may have experienced significant amounts of sediment accumulation beyond the quantity projected for the original design, and/or distributed in locations within the reservoir not provided for originally. Sediment deposits in pools above the designated sediment pool reduce the capacity of those pools and their ability to store water for intended purposes such as flood control and water supply. There likely are only a small number of projects where there have been substantial reductions in storage capacities for operating purposes. However, there is no nationwide inventory to confirm the scope of the problem.

Sedimentation also has other deteriorating effects. Accumulations in the upper reaches of pools used for recreation purposes, though often not a significant encroachment on storage capacity, can result in mudflats and reduce the area of the pool suitable for recreation. Similarly, such accumulations can destroy shallow water ecosystems.

Pollutants in water flowing into a reservoir from watershed sources beyond project boundaries can adversely affect usage of the lake for certain purposes, including water supply, recreation and fishing, as well as otherwise harming aquatic ecosystems. The Corps has no direct authority to resolve such pollution problems, except as may be accomplished through coordination with other agencies and the public.

Degradation of ecosystems can occur not only through sedimentation and off-project pollution, but also from overuse and abuse of the project. Although the Corps has thorough and aggressive stewardship policies in place, the magnitude of demand on some projects can be difficult to control. While project managers and Corps Districts are well aware of these sources of resource degradation, there is no nationwide

[26] Present usage is not noted in referenced inventory.

[27] While Table 4 and its source indicate that the project is not operated for flood control, Nashville District website public information indicates that Laurel River Lake has about 45,000 acre-feet of flood control storage capacity.

inventory of the scope and magnitude of the problems.

Demand Variability

The demand for lake project outputs and services varies greatly by region, and by proximity to population centers and to other infrastructure. Demand may present itself in varying forms when compared to individual lake resources. If the demand is singular, there may or may not be lake resources to meet all or part of that demand. If there are multiple demands, they may or may not be competing. If competing, there may be sufficient lake resources for either, but not both; or, there may be sufficient resources to partially meet both demands. The demands may be local, regional or inter-State. They may originate in or out of the watershed at different scales of watershed/basin definition. Also, certain demands may be latent in that lake resources are not recognized as a potential source for meeting the demand. For these reasons, demands do not manifest themselves clearly.

Needs and Conflicts

Too often, projects and systems experiencing excess demands or new demands become known as conflict arises, often generating controversy. Examples are Lake Sidney Lanier in Georgia, and the system within which it operates. The system includes both lake projects and inland navigation projects in the Apalachicola-Chattahoochee-Flint (ACF) Rivers basin in Alabama, Florida and Georgia. The competing demands of this system are described subsequently as a case example. Larger examples of systems with conflicts in demand include the Columbia River system and the Missouri River system. These and other systems with complex and extensive demands and conflicts have been, and continue to be, the subject of numerous special studies and legislation aimed at resolution.

The present study is concerned more with lake systems and projects that have not reached the point of contentious conflict and special legislation. However, there is no nationwide inventory of projects and systems experiencing excess demands or new demands and, except anecdotally, there is limited understanding of the degree to which Corps Districts are aware of latent demands. For example, there may be water supply needs in the region that could be supplied by a lake, but the potential of the lake to meet that need, in some cases, is not recognized. The potential is not recognized because excess, or surplus, storage has not been recognized. The excess may appear not to exist because any reallocation would appear to infringe on other authorized and dedicated purposes. Excess capacities are discussed in the following paragraphs.

Potentials and Opportunities

Potentials and opportunities can be found in the untapped capabilities of existing lakes to meet present and future demands beyond those for which the projects were authorized and constructed. Some demands may be latent in that the association between the demands and potential capabilities has not been recognized. Some capabilities, once recognized, may lend themselves to induced demand. For example, industrial development might be induced to locate near a newly recognized source of water.

Untapped capabilities are associated with the three basic lake resources: storage capacity, lake surface and project land. There may be potential to capture excess capacity, to increase lake surface area, and to enhance usage of project land.

Excess Capacities

Excess capacity may be found in some projects where capacity assigned to flood storage is more than necessary to maximize reductions in peak flood flows. This situation may occur where the reservoir has been constructed to the maximum size that the dam site topography would allow. In some cases, dams were constructed to the highest practicable level, partly because of hydrologic uncertainties at the time[28], and because emergency spillway cuts could be minimized, thereby at least partially offsetting the costs of larger dams. One consideration in the trade-off decisions was that at some distant future time there might be a need

[28] In most cases, the period of record now is more than 30 years longer than at the time of pre-construction studies.

for added permanent storage. However, institutional memories concerning specific projects may not be able to retrieve that information readily.

The possibility of excess flood control capacity, for any given project, might be gleaned from consideration of that capacity, as measured in inches of runoff from the contributing drainage area, in relation to regional hydrologic characteristics, topographic factors and size of drainage area. Comparison to flood control capacities of other reservoirs in the same general region and similar topography would serve as an indicator. For gross example, there are reservoirs in eastern Kentucky that have considerably more flood control storage (in inches of runoff) than reservoirs in neighboring watersheds.[29]

Excess capacity related to water supply is surplus storage that is not needed to meet present demand. Whether or not it may be needed in the future may or may not be certain. Updated projective analyses would be required to determine whether the surplus storage could be used for other purposes, either temporarily or permanently.

Potential Uses for Excess Capacity and Storage

Excess flood control capacity may be converted to year-around or seasonal storage for several purposes: to meet increased water supply demand; to increase the recreation pool level; and, to increase discharges during low flow conditions to improve downstream water quality. Converting the excess flood control capacity for water supply or water quality purposes will increase recreation pool levels, subject to increased drawdown. The excess capacity may be converted solely to raise the recreation pool level. Surplus water supply storage may be used to increase water quality releases, but subject to drawdown of the recreation pool.

Increased releases to improve downstream water quality represent a major opportunity for contributing to riverine ecosystem restoration. If small increments of increases could be gained from numerous reservoirs, considerable improvement of water quality in major rivers could be achieved at minimal cost. The importance of the potential cumulative increases is heightened by the trend toward more extensive and prolonged drought in most regions of the Nation. Also, minimum in-stream flow releases and seasonal high pulse releases may offer a sizable potential for meeting downstream ecosystem needs.

Lake Surface Increases

Increased permanent pool levels for recreation purposes, though problematic, could be valuable modifications in instances where topographic and development conditions are favorable. Reservoirs in which small pool raises would result in large increases in pool area would be candidates for consideration. However, many other factors must be considered. (Refer to the Dewey Lake case example discussed subsequently.)

Wetland Creation

The perimeters of year-around and seasonal pools often include areas of potential wetlands were it not for pool fluctuation and drawdown. Small levees or berms and drainage control could convert these areas into productive wetlands.

Sub-impoundments

Small dams creating sub-impoundments could be built in a variety of locations and elevations within reservoirs. These dams could be built within project boundaries near the head of a reservoir or on tributary arms for a variety of purposes. If no land acquisition is required and the sub-impoundments are used to improve the provision of authorized purposes, further authorization may not be required. The sub-impoundments would displace storage from any pools or pools in which they are located.

Fish Aquaculture

Surplus storage could be reallocated for fish aquaculture where it would be used both as a supply source for a closed system and as a source of hydraulic power to drive re-circulation pumps if needed. With the fish facilities located immediately downstream of the dam, the discharge water may just be a diversion of normal low flows and may not require depletion

[29] The author recalls debates in the 1970s among planners and hydrologists regarding this aspect of these projects.

of storage. It should be possible to find flood "free" land just downstream of some dams and have more than sufficient energy head.

Expansion of Lands

In some cases, land acquisition may be a viable solution to overuse, damage from uncontrolled lake access, or to provide a buffer against related pollution. It may allow improved vehicular flow through relocation of roads to better alignments away from lakeside, thus also reducing lake pollution from vehicles. In other cases, added lands might provide better recreation opportunities with minimal impact on the lake. Or, added lands might be desirable in connection with establishing lake-associated wetlands. The nature of the acquisition would depend upon the specific purposes and uses. Responsibilities may be with non-Federal sponsors, or shared.

Case Example: Lake Mendocino (Coyote Valley Dam), California

In 1997, the San Francisco District submitted an Initial Appraisal report on Lake Mendocino, California, under the authority of Section 216 of the River and Harbors and Flood Control Act of 1970. The following discussion is summarized from the Initial Appraisal (IA), major excerpts of which are included as Appendix C.

The IA reviewed the adequacy of water supplies in the upper Russian River and explored the advisability of increasing the capacity of Lake Mendocino by raising Coyote Dam from its design capacity of 122,500 acre-feet (AF) to199,000 AF. The purpose of the IA was to define whether there may be a federal interest in raising Coyote Dam in order to provide an increase in the Upper basins available water supply for Municipal & Industrial, agricultural and recreational purposes. This analysis focused on the water supply needs of the Upper Russian River basin only.

The rapid growth of Mendocino, Sonoma and Marin counties after World War II created an expanded need for water. In response to this need the Corps, in cooperation with Sonoma County, proposed a series of multi-purpose projects to increase the availability of water in the area. One of these projects was the construction of the Coyote Dam. The dam was constructed to impound the Russian River and create Lake Mendocino thereby increasing the availability of water for Municipal & Industrial, agricultural and recreational purposes. The initial stage of Coyote Dams construction was completed in 1959 with an original containment of 122,500 acre-feet (AF). The dam was designed to be built in two stages, with the second stage being constructed when the water supply capacity of Coyote Dam became inadequate.

Lake Mendocino currently has a capacity of 118,900 acre-feet (the current capacity has fallen from the original capacity of 122,500 acre feet (AF) because of siltation) and drains an area of approximately 105 square miles (sq. mi.).

The most likely alternative to a raised Coyote Dam would be the construction of an alternative reservoir or reservoirs. This conclusion is supported by a previous Corps study, Flood Control And Allied Purposes, Russian River, California, June 1972. This report studied the possibility of additional water supply projects in the basin and did a more detailed study on two alternatives, the Forsythe Creek Dam and the Redwood Valley Creek Dam. Both of these potential dam sites are optimally located in the Upper basin and would be able to geographically serve the same users as would a raised Coyote Dam.

Table 4 presents the estimated capacities of Redwood Valley Creek Dam and Forsythe Creek Dam. The table also presents the proposed increase in capacity for Coyote Dam.

Table 4
Alternative Dam Sites Lake Capabilities

Dam	Capacity
Redwood Valley Creek Dam	23,700 AF
Forsythe Creek Dam	57,200 AF
Coyote Dam	Incremental increase from raising the dam 76,500 AF

As can be seen from the table, in order to match the increased capacity of a raised Coyote Dam both Redwood Valley Creek Dam and Forsythe Creek Dam would have to be constructed. The combined first costs for the Forsythe Creek dam and the Redwood Valley Creek dam, $198,000,000, are the benefits to the Coyote Dam raising project. The cost of constructing the project is $42,000,000; therefore, the B/C ratio is 4.71:1.00. The Initial Appraisal recommended that the next phase of the study process be undertaken and that a reconnaissance level study is warranted.

Although the Initial Appraisal report was completed in 1997, work has not begun on the next phase of feasibility studies. However, when other agencies' decisions affecting exact needs are made, a full reconnaissance study may proceed immediately to confirm the findings of the initial appraisal, and, if confirmed, to proceed to the full feasibility study phase. The initial appraisal serves to expedite subsequent studies required to achieve Congressional authorization.

While Lake Mendocino is an unusual case, it demonstrates the complexity of planning, decision-making and authorization just to get to the implementation stage. Advance planning for anticipated needs is critical to meeting future needs before they
become needs and shortfalls. In the instant case, the project was originally planned and designed in anticipation of future increased water supply demand, greatly simplifying the process (and reducing prospective costs). Few other lake projects would have that advantage.

Case Example: Dewey Lake, Kentucky

In the 1960's, Congress, at the request of state and local interests, asked the Corps to determine the feasibility of raising the recreation pool level of Dewey Lake in eastern Kentucky. The purpose would be to substantially enlarge the recreation pool acreage to better accommodate heavy recreational use. Huntington District studies indicated that the recreation pool could be raised seasonally by as much as 10 feet without significant impact on the project's flood control function. However, topographic and other site studies showed that, while the recreation pool area could be increased by several hundred acres, the reservoir walls around the perimeter would be extremely steep. Access to the lake would be seriously worsened, and there would be no reasonably level areas around the lake for any lakeside recreation facilities such as picnic areas, beaches or parking. Congress was thus advised and the proposal was abandoned.

The Dewey Lake case shows that it may be possible at other lakes, where topography is more amenable, to increase recreation pool levels to increase recreation capacities. Alternatively, the case shows that even at Dewey Lake, as well as other lakes, storage (e.g., for water supply or water quality control) may be increased without significant effect on the flood control function.

Case Example: Lake Sidney Lanier, Georgia, and the ACF Basin System

Lake Sidney Lanier is in the headwater area of the Chattahoochee River. A large portion of the Atlanta metropolitan area lies within the upper basin. The lake has excessive and conflicting demands. A recent article, "*Is Atlanta drinking the future dry?",* in the Atlanta Journal-Constitution points to the extreme demand placed on the lake.[30]

"Federal water experts on Tuesday presented data that suggest fast-growing metro Atlanta is taking all the water that Lake Lanier and the Chattahoochee River can provide, decades before it was forecast to have reached that limit. If the assessment is verified by data being collected and analyzed in coming weeks, it could stymie new development in the region. Metropolitan Atlanta would have to stop growing, or enact tougher conservation measures, or secure new sources of water, an expensive and politically daunting task.

"South Carolina and Tennessee have warned there would be major battles if Atlanta tried to tap the Savannah or Tennessee River systems. And residents around Lake Allatoona

30 "Is Atlanta drinking the future dry? Corps of Engineers says area may be reaching 2030 levels now." Charles Seabrook. Atlanta Journal-Constitution. May 15, 2002

say they would fight efforts to draw more water from their lake for the metro region.
State environmental officials had predicted metro Atlanta would not exhaust Lanier and the Chattahoochee until 2030. Officials with the Georgia Environmental Protection Division insisted Tuesday their data show that projection is still sound.

"But new water use data presented by the U.S. Army Corps of Engineers suggest the region already is close to reaching -- or in some cases exceeding -- the predicted 2030 levels.
The corps said metro Atlanta, which grew from 3 million residents in 1990 to 4.1 million in 2000, actually exceeded expected water use for 2030 during some of 1999 and 2000.

"Corps officials stressed their information was preliminary. They said they would be compiling additional data over the next several weeks. Water use projections are complicated by the fact they must take into account not just stream withdrawals into drinking water systems, but also discharges from sewage systems. Consumption also can fluctuate with weather conditions -- residents may water their lawns more during droughts, for example. The Corps, which regulates flow in the Chattahoochee by releases from Lanier, must maintain at least 750 cubic feet per second at Peachtree Creek to dilute wastewater and sustain fish and other aquatic life.

"Several water experts who viewed the corps' presentation at a meeting at the federal Environmental Protection Agency's regional office in Atlanta said the information was sufficient to raise the possibility that Atlanta will have to find other sources of water years sooner than expected.

""It's really sad to think that Atlanta will run out of water long ahead of time," said Art Holbrook, head of the West Point Lake Congressional Task Force in LaGrange, which has long been concerned about metro Atlanta's heavy water use. George William Sherk, a Virginia lawyer and water expert who advises the task force, charged that Georgia officials' more optimistic interpretation of water data is lulling the state into a false sense of complacency over Atlanta's water supply.

"EPD Director Harold Reheis maintained that while there are still some uncertainties in the data, the corps' numbers don't appear to contradict the state's conclusions. But other experts, while stressing the need for more information, said the corps' presentation was clearly cause for concern. "It certainly raises the question of whether Atlanta will exceed its water demands before 2030," said Aris Georgakakos, director of the Georgia Water Resources Institute at Georgia Tech."

Construction of Buford Dam to form Lake Lanier essentially was completed in 1956 for the authorized purposes of power production, water supply, navigation, and flood control.[31] At normal level, the lake has an area of 38,000 acres. There are 76 recreational areas around the lake supporting an annual visitation of around 7,000,000. There also is intensive private development around the perimeter of, and close to, the lake in the form of camps, cabins and permanent residences. Some of the private development has encroached on lands owned by the government to the extent that it is subject to flooding when the project is operated for flood control. Section 516 of WRDA 2000 establishes a special program to resolve the encroachment problem. Section 516 directs the Secretary of the Army to establish a program: *"(1) to convey to eligible property owners the right to maintain existing structures for human habitation on fee land; or (2) to release eligible property owners from the easement prohibition as it applies to existing structures for human habitation on the flowage easements (if the floor elevation of the human habitation area is above the elevation of 1,085 feet above mean sea level)."*

As planned, the lake experiences substantial drawdown during dry periods, making it less suitable for recreation use and aesthetic

[31] The lake was named after 19th century poet Sidney Clopton Lanier. He was a Georgia native who was inspired by the beauty of this area to write the poem, "Song of the Chattahoochee." Music and nature influenced him as much as his admiration for Romantic poets such as Tennyson and Scott. In 1972, he was honored by the U.S. Postal Service with a commemorative 8-cent stamp for his contribution to literature. (*Source: Mobile District website)*

enjoyment. A maximum drawdown of 19 feet was reached in 1981.

Raising the normal, year-around lake level would encroach on the flood control capacity that already is limited by the encroachments, if not the dam height.[32] The extensive non-encroaching private development practically precludes the option of raising the dam height.

In this example, alternative options are extremely limited and point to the need for consideration of off-site alternatives such as additional reservoirs. Any solution must be a part of a comprehensive urban water management program for the Atlanta region involving multiple jurisdictions and States. Such a program would have to consider such measures as:

- Insuring adequate storage to prevent catastrophic loss from severe future droughts
- Reallocating reservoir storage
- Recharging aquifers
- Reducing demand through conservation
- Increasing supply through direct and indirect re-use through recycling
- Expanding use of non-potable water and dual distribution systems
- Improving leak repair programs
- Diverting and storing storm runoff to increase supplies
- Cooperation among competing users
- Developing integral flood control systems
- Developing river corridor management programs with more effective flood plain regulatory controls and non-regulatory management
- Improving consideration of hydrologic and hydraulic probability and impact variability

Because Lake Lanier is part of the ACF system of projects, system analysis also is required.

[32] Whether there is any excess flood control capacity, without regard to encroachments or any private development, has not been determined by this study.

PROBLEMS AND OPPORTUNITIES: LFDR PROJECTS

Project Resources and Demands

LFDR projects have little resources other than the minimal adjacent lands acquired for the projects. Thus, there are no direct demands on the projects other than to effectively perform their intended function.

Needs and Conflicts

The principal needs and conflicts related to LFDR projects involve urbanization and obstruction of waterfronts. Urbanization can adversely affect LFDR projects in two ways: by sprawling beyond the protected area and perhaps requiring extended protection; and, by increasing runoff rates, thereby increasing flood magnitudes and jeopardizing the level of protection afforded by the existing project. Projects in smaller watersheds having a large percentage of their drainage areas urbanized since project construction may have a substantially lower degree of protection than when originally constructed. Substantial deterioration in degree of protection is a serious problem, especially for levee and floodwall projects. Overtopping of levees and floodwalls can result in catastrophic consequences including loss of life. Inspection programs are not likely to detect and quantify increased discharges due to urbanization in the upstream watershed.

Levees and floodwalls, as opposed to other types of LFDR projects, obstruct views and access to waterfronts and vistas for which there is latent demand. On the other hand, that same obstruction may protect riverine and wetland ecosystems.

Potentials and Opportunities

Because LFDR projects have little resources, they present very limited potential and few opportunities for revitalization. However, though mainly a non-Federal responsibility, there may be opportunities at many projects to develop or expand waterside recreation areas and facilities, nature trails, etc. One possibility is to create additional gated openings to gain access to the water and

waterside lands, as well as to improve views from inside the protected area.

A more pertinent possibility is the Flood Mitigation and Riverine Restoration Program under Section 212 of WRDA 1999 provides the use of permanent floodplain evacuation-riverine ecosystem restoration projects to improve the effectiveness of existing LFDRs. The evacuation would reduce flood damages in unprotected areas while possibly increasing the flood carrying capacity of the floodplain. However, most floodplain evacuation-riverine ecosystem restoration projects would be new projects.

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III – THE STEWARDSHIP CHALLENGE: POLICIES AND PERSPECTIVES

> *"The Corps of Engineers will use a collaborative decision-making process with Federal, state and local agencies in a watershed-based planning and management approach to restore environmental degradation, reduce human and physical losses from disasters and develop our water resources for future generations. Inherent in this strategy are the maintenance of core competencies in engineering and the efficient operation of existing infrastructure."(emphasis added)*

Honorable R.L. Brownlee,
Assistant Secretary of the Army (Civil Works)
(*Acting*)

PRINCIPLES AND GUIDELINES OF THE WATER RESOURCES COUNCIL

The economic and environmental Principles and Guidelines (P&G), promulgated by the U.S. Water Resources Council in 1983, are intended to guide Federal water resources agencies in planning and evaluating proposed projects.[33] However, their applicability may be extended to existing projects by extrapolation as a baseline objective. The P&G were set forth to provide for the formulation and evaluation of reasonable plans, responsive to national, State and local concerns. The P&G state that the Federal objective of water and related land resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, in accordance with national environmental statutes, applicable executive orders, and other Federal planning requirements.[34] These basic principles should extend to decisions regarding existing projects.

The P&G were not intended to encompass ecosystem restoration in the context of water resources projects, and there is no equivalent national policy statement for ecosystem restoration. However, Corps regulations explain that numerous Federal laws and executive orders establish National policy for, and Federal interest in, the protection, restoration, conservation and management of environmental resources.[35] These provisions include compliance requirements and emphasize protecting environmental quality. They also endorse Federal efforts to advance environmental goals, and a number of these general statements declare it national policy that full consideration be given to the opportunities, which projects afford to ecological resources. Recent water resources authorizations have enhanced opportunities for Corps involvement in studies and projects to specifically address objectives related to the restoration of ecological resources and ecosystem management. Specific authorities for new individual studies and projects to restore ecological resources have also been provided in legislation. Examples of legislation that broadly supports Federal involvement in the restoration and protection of ecological resources include:

- Federal Water Project Recreation Act of 1965, as amended
- Water Resource Development Acts of 1986, 1988, 1990, 1992, 1996 and 1999
- Coastal Wetlands Planning, Protection and Restoration Act of 1990 (Title III of P.L. 101-646)

The Corps ecosystem restoration policy is described in more detail in ER 1165-2-501, discussed subsequently. The restoration policy applies to all ecosystem studies and projects. The focus of the guidance is the restoration of degraded ecosystems and ecological resources and not restoration of cultural and historic

[33] "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies". U.S. Water Resources Council. February 1983

[34] The P&G further states: "A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan), unless the Secretary of a department or head of an independent agency grants an exception to this rule".

[35] ER 1105-2-100, Planning Guidance, 22 April 2000

resources, aesthetic resources, or clean up of hazardous and toxic wastes. Corps ecosystem restoration projects may not be able to address every functional and structural characteristic, nor may it be necessary where the nature and degree of impairment are limited to only one or a few of these parameters. Some restoration projects may only be able to address the symptoms of the disturbance or degradation, and not the cause(s).

The authorities through which the Corps can participate in ecosystem restoration and protection studies and project implementation are summarized below.

(1) Congressionally authorized studies, pursued under General Investigations (i.e., new start reconnaissance and feasibility studies) for single-purpose ecosystem restoration or multiple purpose projects which include ecosystem restoration as a purpose.

(2) Programmatic authorities for study, design and implementation of ecosystem restoration and protection projects:

a) Section 1135, Project Modifications for Improvement of the Environment, Water Resources Development Act, WRDA 1986, as amended;

b) Section 206, Aquatic Ecosystem Restoration WRDA 1996, as amended;

c) Section 204, Beneficial Uses of Dredged Material, WRDA 1992, as amended;

d) Dredging of contaminated sediments under Section 312, WRDA 1990, as amended; and

e) Flood Mitigation and Riverine Restoration Program under Section 212 of WRDA 1999.

(3) Existing project authorities for the management of operating projects; e.g., through water control changes, or as part of natural resources management of project lands and waters.

PRESENT POLICIES AND GUIDANCE

A review of all Corps regulations and guidance reveals very little directly related to revitalization except to the extent that ecosystem restoration may be considered revitalization. From an operation and maintenance perspective, Corps policies and regulations are aimed at fulfilling to the maximum extent possible the objectives of Corps projects as they were authorized. The following paragraphs provide an overview of the principal Engineer Regulations (ERs) that contain pertinent policy.

Engineer Regulation 1110-2-100 (Applicable to all projects)

Engineer Regulation 1110-2-100, "Engineering and Design, Periodic Inspection And Continuing Evaluation Of Completed Civil Works Structures" (15 February 1995). This ER provides the policy, defines the objectives and responsibilities, and establishes the procedures to assure the safety, continuing structural integrity, and operational adequacy of major Civil Works projects. It requires that structures whose failure or partial failure could jeopardize the operational integrity of the project, endanger the lives and safety of the public or cause substantial property damage shall be periodically inspected and evaluated to ensure their structural stability, safety, and operational adequacy. It is applicable to all dams, including navigation dams, and LFDR projects. The ER establishes requirements for inspection programs for both Corps operated projects and projects operated by non-Federal sponsors under project cooperation agreements with the Corps.

Engineer Regulation 1110-2-240 (Applicable to lake projects and navigation dams)

Engineer Regulation 1110-2-240, "Engineering and Design; Water Control Management" (8 October 1982), prescribes policies and procedures in carrying out water control management activities, including establishment of water control plans for Corps and non-Corps projects. Authorities for allocation of storage and regulation of projects owned and operated by the Corps of Engineers are contained in authorization acts and referenced project documents. These public laws and project documents usually contain provisions for development of water control plans, and appropriate revisions thereto, under the discretionary authority of the Chief of Engineers. Some modifications in project

operation are permitted under congressional enactments subsequent to original project authorization.

For non-Corps projects, the Corps is responsible for prescribing flood control and navigation regulations for certain reservoir projects constructed or operated by other Federal, non-Federal or private agencies. There are several classes of such projects: those authorized by special acts of Congress; those for which licenses issued by the Federal Energy Regulatory Commission provide that operation shall be in accordance with instructions of the Secretary of the Army; those covered by agreements between the operating agency and the Corps of Engineers; and those that fall under the terms of general legislative and administrative provisions. The ER requires that water control plans will be developed for reservoirs, locks and dams, deregulation and major control structures and interrelated systems to conform with objectives and specific provisions of authorizing legislation and applicable Corps reports.

Engineer Regulation 1110-2-401 (Applicable to LFDR projects)

This regulation is titled "Engineering and Design; Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed By Project Sponsors (30 September 1994)". The regulation provides instructions for the preparation of operation and maintenance manuals outlining the responsibilities of those local sponsors that have entered into binding agreements with the Secretary of the Army to be solely responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R), and to pay 100 percent of the associated project costs.

Engineer Regulation 1110-2-8151 (Applicable to navigation projects)

Engineer Regulation 1110-2-8154: Engineering and Design; "Monitoring Completed Navigation Projects" (31 July 1997)**,** states the objective, outlines the scope, discusses funding, assigns responsibility, and establishes the procedures by which the Corps evaluates planning, design, construction, and operation and maintenance performance of navigation projects. Its intent is to assure the collection of adequate information as a basis for verifying or improving navigation project performance through investigations of project purpose attainment, design procedures, and construction methods. This objective is achieved through (1) normal monitoring and inspection of projects maintained by the Corps; (2) inspection of projects maintained by others; and (3) a national program for intensive monitoring of selected Civil Works navigation projects maintained by the Corps. The latter is the Monitoring Completed Navigation Projects (MCNP) Program. The ER deals with engineering and design performance, not economic performance.

The ER addresses shallow- and deep-draft navigation projects located in rivers, reservoirs, lakes, estuaries, and the coastal zone. The MCNP program complements ongoing project-related reporting, inspection, and monitoring programs. The MCNP program may be implemented as either a comprehensive detailed survey to verify post-construction conditions on a one-time basis or a continuous (repetitive) collection of appropriate prototype data over an extended period.. The MCNP Program can only fund monitoring for completed projects operated and/or maintained by the Corps. The availability of previously collected data will be a factor in the selection of projects for monitoring under the MCNP Program.

Engineer Regulation 1110-2-8154 (Applicable to all projects)

Engineer Regulation 1110-2-8154, "Engineering and Design; Water Quality and Environmental Management for Corps Civil Works Projects" (31 May 1995) establishes a policy for the water quality management program at Corps projects. The Corps' water quality management authority is founded on the Federal Water Pollution Control Act (FWPCA) of 1948 and its amendments, including the Clean Water Act of 1977 and the Water Quality Act of 1987. The FWPCA Amendment of 1972 (PL 92-500) strongly affirms the Federal interest in water quality. Executive Order 12088, Federal Compliance with Pollution Control Standards,

dated 13 October 1978, requires compliance by Federal facilities and activities with applicable pollution control standards in the same manner as any non-Federal entity. To ensure project compliance, the Federal Facilities Compliance Act of 1990 provides for EPA and/or States to inspect Federally owned or Federally operated facilities that are subject to the Clean Water Act of 1977.

The ER states Corps policy as follows:

"The Corps' policy is to take a leadership role in carrying out the goals and objectives of the national policy by managing the nation's water resources that are under our control so that they are protected, maintained, and restored. As steward of project resources, the Corps will not allow degradation of the aquatic resource except as noted in paragraph 6a above. In cases where degradation has occurred, it is the Corps' policy to restore the resource to a biologically productive, diverse, and ecologically robust condition. Corps management responsibilities extend throughout the area influenced by and influencing the water we manage. Because the management of our projects affects environments distant from our property boundaries and is influenced by actions of others also distant from our properties, the Corps must actively pursue a management philosophy committed to partnering with a wide range of resource organizations and interested individuals. It is Corps policy to develop and implement a holistic, environmentally sound water quality management strategy for each project. This strategy must be developed in concert with other authorized project purposes. However, the environment will be addressed as equal in value and importance to other project purposes when developing or carrying out management strategies. The Corps will, at least, manage its projects in accordance with all applicable Federal and state environmental laws, criteria, and standards. It is the goal of the Corps to responsibly manage our projects to maximize their environmental potential. The four pillars of the Army environmental strategy (conservation, prevention, restoration, and compliance) will help guide the Corps policy for water quality management."

The ER requires Division-wide water quality management programs. It also requires Districts to develop specific water quality management objectives for each project, and to outline and implement procedures to meet those objectives. These plans must be reviewed and updated as needed but not less than every 10 years. However, although the ER sets forth numerous generalized objectives, it does not establish requirements for proactive and actionable assessments of projects to determine potential capabilities for improving downstream water quality.

Engineer Regulation 1130-2-540 (Applicable mainly to lake projects)

Engineer Regulation 1130-2-540, "Project Operations; Environmental Stewardship Operations and Maintenance Policies" (15 Nov 96), establishes land management policy for Corps administered project lands and water, based on various authorizing legislation and the principles of good environmental stewardship. The ER states:

"It is Corps policy to apply principles of good environmental stewardship to the natural and cultural resources occurring on Corps administered and/or managed lands and waters. For the Corps the term "steward" shall mean manager of those public resources. Environmental stewardship shall include both passive and proactive management to sustain healthy ecosystems and biodiversity, and conserve natural resources, such that Corps lands and waters are left in a condition equal to or better than their condition when acquired, and such that those natural and cultural resources are available to serve the needs of present and future generations."

ER 1130-2-540 makes no reference to revitalization or similar terminology. Essentially, this regulation and the pertinent related statutes and regulations to which it refers, focus on preventing degradation and misuse of the project and its lands and water, notwithstanding its reference to "proactive" management.

Engineer Regulation 1165-2-119 (Applicable to all projects)

ER 1165-2-119, "Water Resources Policies and Authorities: Modifications to Completed Projects" (20 Sep 82) presents policy with regard to Section 216 of the River and Harbors and Flood Control Act of 1970. It states:

"It is a general policy of the Chief of Engineers that completed Corps projects be observed and monitored by the Corps to ascertain whether they continue to function in a satisfactory manner and whether potential exists for better serving the public interest. Such monitoring may be accomplished coincidentally in carrying out existing project inspection programs, as a by-product of contacts with local interests and other Federal agencies, and through the day-to-day observations of on-site Corps personnel charged with project operations. Whenever reporting officers find that changes in a completed project may be desirable, investigations should be undertaken to document the need for and feasibility of project modification. To the extent possible, modifications to completed projects should be accomplished under existing authorities. "... If a needed modification cannot be accomplished using these authorities, additional authorization must be sought."

ER 1165-2-119 further provides that if existing study authorities are not sufficient, then the necessary studies may be pursued under authority of Section 216, which states:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

This guidance implies rather passive monitoring, especially with regard to determining whether potential exists for better serving the public interest. However, it does provide authority for thorough reviews if indicated by the monitoring.

Engineer Regulation 1165-2-501 (Applicable to all projects)

Ecosystem restoration policies are presented in ER 1165-2-501, "Water Resources Policies and Authorities, Civil Works Ecosystem Restoration Policy" (30 September 1999). This ER addresses authorities through which the Corps can examine ecosystem restoration needs and opportunities, and participate in the study, design and implementation of ecosystem restoration and protection projects.

The regulation addresses revitalization of existing projects in that ecosystem restoration may be considered under the authority of Section 1135 of WRDA'86, or in conjunction with studies for the review of completed projects under the authority of Section 216 (See ER 1165-2-119, discussed above). Section 1135 provides authority to modify Corps projects to improve the quality of the environment and restore ecosystem functions impaired by the projects.

The ER states:

"Ecosystem Restoration is one of the primary missions of the Civil Works program. The purpose of Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts will involve a comprehensive examination of the problems contributing to the system degradation, and the development of alternative means for their solution. The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system."...

... "Ecosystem restoration and protection initiatives should be conceived in the context of broader watershed or regional water resources management programs and objectives, which may involve contributive actions by other Federal and non-Federal agencies and other stakeholders. Corps ecosystem restoration projects should utilize engineering and other technical solutions to water and related land resources problems, with emphasis on improving degraded ecosystem function and structure."

ENVIRONMENTAL OPERATING PRINCIPLES

On March 26, 2002, the Chief of Engineers announced the adoption of a set of Environmental Operating Principles that will guide the Corps in all its work. The seven principles ensure that the Corps will:

1. Strive to achieve Environmental Sustainability.
2. Recognize the interdependence of life and the physical environment.
3. Seek balance and synergy among human development activities and natural systems.
4. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.
5. Seek ways and means to assess and mitigate cumulative impacts to the environment;
6. Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.
7. Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective.

These principles underscore the need for revitalizing the Corps' existing infrastructure.

WATERSHED PRINCIPLES

Revitalization of Corps projects, especially reservoirs, must consider the principles of watershed management. A recently released Watershed Perspective for the Civil Works Program focus on a broad set of principles for watershed resources management. The watershed approach is based on:

- Seeking sustainable water resources management
- Integrating water and related land resources management
- Considering future water resource needs
- Coordinating planning and management
- Promoting interagency cooperation
- Encouraging public participation
- Evaluating the monetary and non-monetary trade-offs
- Establishing interdisciplinary teams
- Applying adaptive management

Inasmuch as revitalization is adaptive management, these general principles, in conjunction with the environmental operating principles, may be taken as a guide to developing and executing revitalization plans.

OTHER MANAGEMENT TOOLS IN PLACE

Several other significant management tools relating to navigation projects are described in the following paragraphs. There are no parallel tools for lake and LFDR projects.

Dredged Material Management Plans

In 1995, the Corps undertook a program to improve management of dredged material by directing that all existing and proposed navigation projects will have a dredged material management plan that ensures warranted and environmentally acceptable maintenance of the project. For many of these projects, existing plans are now and will continue to be efficient and environmentally acceptable. For others, historic trends and emerging challenges provide clear indicators that existing plans must be modified to meet future dredged material management needs. The directive required that Dredged Material Management Plans (Management Plans) be prepared, on a priority basis, for all Federal navigation projects, or groups of inter-related harbor projects, or systems of inland waterway projects (or segments) for which:

(1) Existing dredged material disposal sites, including existing confined disposal facilities, are expected to reach capacity or to no longer be available sometime in the next 10 years, or

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

The directive emphasized that "Federal interest in continued O&M of an existing project for its navigation purpose is defined by that project of maximum scale and extent, within

project authorization, for which continued maintenance is warranted in terms of vessel traffic and related factors."

Inland Waterways Users Board

The Inland Waterways Users Board provides guidance to the Corps to assist in management of the inland waterways system. The Corps' support to the Board has resulted in systematic and disciplined information development, data analysis and other management tools, thereby improving the Corps' management. However, because the Inland Waterways Trust Fund was established to support new construction and major rehabilitation, and does not support operation, maintenance and routine rehabilitation, the Board has limited direct interest in the latter. Nevertheless, their knowledge and expertise is an opportune resource for the Corps in O&M management.

Navigation Data Collection

Waterborne Commerce Statistics

The Waterborne Commerce Statistics Center collects statistics used to analyze the feasibility of new projects and to set priorities for new investment, and for the operation, rehabilitation and maintenance of existing projects. Under Federal law, vessel-operating companies must report domestic waterborne commercial movements to the Corps. The types of vessels include: dry cargo ships and tankers, barges (loaded and empty), fishing vessels, towboats (with or without barges in tow), tugboats, crew boats and supply boats to offshore locations, and newly constructed vessels from the shipyards to the point of delivery. Vessels remaining idle during the monthly reporting period are also reported. Movement data acquired by the Center is primarily for the use of the Corps and other government agencies; however, summary statistics, which do not disclose movements of individual companies, are also released to private companies and to the general public.

Lock Performance Monitoring System

The Lock Performance Monitoring System (LPMS) and Lock Characteristics database provides Corps operators, planners, and managers with information on the use, performance, and characteristics of the Corps' national system of locks. LPMS consists of data collected at most Corps-owned and/or Corps-operated locks. Data is collected at each lock and electronically transmitted to the central database that is managed and distributed by the Navigation Data Center. The data, from years 1980 to present, includes the number of vessels and barges locked; type and dates of lockages; durations of, and causes for, periods of lock unavailability; barge type, size, and commodity type; and tonnages carried. Statistics are published monthly for selected key locks and annually for all locks. For Corps personnel only, direct on-line database access is available.

ADEQUACY OF POLICIES, GUIDANCE AND MANAGEMENT TOOLS

Review of Corps regulations and related policy guidance disclosed very little guidance directly related to revitalization, except to the extent that ecosystem restoration may be considered revitalization. The review reveals none that provide for continuing monitoring and review of economic performance of existing projects. Further, guidance on monitoring project performance concentrates on inspection, and is passive with respect to overall performance. However, restoration does not encompass creation or enhancement of biodiversity. Generally, the limited guidance is narrowly focused within functional areas.

The pertinent regulations discussed previously vary considerably in age, the oldest adopted in 1982. They also tend to be narrowly focused within functional areas. The ERs covering continuing evaluation of completed structures (ER 1110-2-100, February 1995), water control management (ER 1110-2-240, October 1982), water quality and environmental management of projects (ER 1110-2-8154, May 1995), and monitoring completed navigation projects (ER 1110-2-8151, July 1997) are in the Engineering and Design series of regulations.

The regulation on environmental stewardship (ER 1130-2-540, November 1996) is one of a series of Project Operations regulations. There is no umbrella regulation covering these subjects in the Water Resource Policies and Authorities series of ERs. The adequacy of policies, guidance and management tools specific to each project type follows.

Adequacy of Policies, Guidance and Management Tools for Harbors

In 1995 Corps headquarters issued a directive requiring that Dredged Material Management Plans (Management Plans) be prepared for all Federal navigation projects (harbors, inland harbors and inland waterways) for which:

(1) Existing dredged material disposal sites, including existing confined disposal facilities, are expected to reach capacity or to no longer be available sometime in the next 10 years, or

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

The directive recognized that "for many projects with readily available maintenance and usage information, a preliminary assessment, based on indicators such as annual O&M costs per ton of cargo, volume and frequency of traffic, and vessel dimensions, may establish the Base Plan and confirm that continued maintenance appears to be warranted." The directive emphasized that "Federal interest in continued O&M of an existing project for its navigation purpose is defined by that project of maximum scale and extent, within project authorization, for which continued maintenance is warranted in terms of vessel traffic and related factors." However, the directive focused on the propriety of dredged material disposal, and did not establish explicit requirements for confirming continuing economic viability, such economic reevaluation when selected indicators fail minimum threshold value tests (or "triggers"). There is no ER or similar policy guidance, or standing, funded program, for evaluating current economic viability of existing harbor projects, some of which may be economically marginal.

In recent years, budgetary policy has attempted to limit O&M funding for "low commercial use" harbors. This policy underscores the fact that there has been no programmatic effort to identify uneconomic projects, if any, and to dispose of them in an orderly fashion. Also, low commercial use, as the term has been used in budgetary actions, is not used in the relative sense in comparison to benefits. Some large projects may have substantial use, but it may be insufficient to justify continuing high O&M costs, especially where more costly disposal methods now are required.

Adequacy of Policies, Guidance and Management Tools for Inland Waterways

Screening of inland navigation projects for continuing economic viability based on generic threshold criteria using limited data is a problem. Project specific criteria using more complete data can be prohibitively expensive and time consuming. There is no ER or similar policy guidance establishing policies, principles and procedures for continuing, systematic review of potentially marginal inland waterways projects.

Engineer Regulation 1110-2-8154 requires "*a holistic, environmentally sound water quality management strategy for each project"*. The ER requires water control management plans be developed for each project that, among other objectives, *"identifies opportunities for water quality improvements to projects or receiving waters and initiate management actions that accomplish those improvements*". However, it does not address navigation dams specifically, and it does not discuss aeration or oxygenation. Also, it does not establish reporting requirements to facilitate programmatic management.

Adequacy of Policies, Guidance and Management Tools for Lakes

Pertinent existing policies and related guidance are extremely limited, except that they point out that the Corps has sufficient authority,

under Section 216, to undertake studies to review the need for modifications to existing projects. However, the guidance in this respect, ER 1165-2-119 was last updated in 1982. Further, the guidance in ER 1165-2-119 is passive as to determining when changes in completed projects may be desirable. The policies do not provide for actively assessing project resources that may be available or suitable for change in usage.

The ER guiding water control management does not establish requirements for proactive and actionable assessments of projects to determine potential capabilities for improving downstream water quality. The only pertinent guidance in the umbrella Water Resources Policies and Authorities series is the ER governing ecosystem restoration policy (1165-2-501, September 1999). That ER does not refer to revitalization, literally or in context. Essentially, that regulation and the pertinent related statutes and regulations to which it refers, focuses on preventing degradation and misuse of the project and its lands and water, notwithstanding the ER's reference to "proactive" management.

Thus, opportunities for meeting present day needs may not be recognized. In some cases, there are known, active conflicts in demands for limited lake resources. The challenge is:

- To determine the extent to which opportunities are being lost and/or conflicts are not being resolved, and,
- To determine what programmatic and policy changes are needed commensurate with the magnitude of the deficiencies

Adequacy of Policies, Guidance and Management Tools for LFDRs

None of the pertinent ERs and management tools reviewed contain guidance regarding the potential deterioration of level of protection due to urbanization of upstream watersheds. Inspection programs are not likely to detect and quantify increased discharges due to urbanization in the upstream watershed.

VIEWS OF OTHER ORGANIZATIONS

American Rivers Coalition

In a press release dated September 14, 2000, titled "Top 10 Reforms for the Army Corps of Engineers", the American Rivers Coalition raised many concerns about the Corps and its missions.[36] Most of their concerns relate to proposed projects. However, one of their top ten reforms stated: "In many cases, the Corps replaces a fraction of the wetlands and other habitat their projects destroy. This is typically based on the theory that a few artificially managed acres of habitat can replace the natural functions of ecosystems. But, the $8 billion Everglades project reflects modern understanding that rivers, wetlands and coastal waters depend on the natural patterns of flow. In some cases, the Corps has simply failed to mitigate for the environmental impacts of their projects. The Corps should be required to replace each acre of habitat destroyed by Corps levees and dams with a similar acre of habitat, and mitigation should be completed at he same time civil works projects are constructed."

In a related undated article, the American Rivers points out "in recent years, Corps spending on habitat restoration has slowly increased, topping $500 million annually. As a result, no federal agency today possesses as much aquatic habitat restoration expertise as the Corps. More importantly, no federal agency has the jurisdiction to repair rivers like the Columbia, Snake, Missouri, Mississippi, and Ohio - large rivers which have been historically altered by the Corps to reduce flood losses and support navigation.

"At first, new federal laws permitted the Corps to modify existing projects to improve aquatic habitat. But, in recent years, the Corps has embarked on large-scale ecosystem restoration, including the restoration of Florida's Everglades and the Upper Mississippi River.

"In the past two years, the Corps of Engineers has planned or constructed more than 50 habitat restoration projects in 25 states, ranging from projects designed to plant seagrass

[36] "Top 10 Reforms for the Army Corps of Engineers". Press Release. September 14, 2000. (http://www.amrivers.org/pressrelease/pressarmycorp9.14.00.htm . February 5, 2002

in the Laguna Madre in Texas to projects which build habitat for migratory waterfowl in the Central Valley of California. Several new restoration programs have been authorized by Congress."

World Commission on Dams

In November 2000, the World Commission On Dams published a comprehensive report, *Dams And Development*, *A New Framework.*[37] The report responds to the debate surrounding the building of large dams around the world. The Commission concluded that: *"[T]here can no longer be any justifiable doubt about the following:*

- *Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable.*
- *In too many cases an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment.*
- *Lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives.*
- *By bringing to the table all those whose rights are involved and who bear the risks associated with different options for water and energy resources development, the conditions for a positive resolution of competing interests and conflicts are created.*
- *Negotiating outcomes will greatly improve the development effectiveness of water and energy projects by eliminating unfavorable projects at an early stage, and by offering as a choice only those options that key stakeholders agree represent the best ones to meet the needs in question."*

"The direction we must take is clear. It is to break through the traditional boundaries of thinking and look at these issues from a different perspective. Our recommendations develop a rationale and framework that responds to this critical need and offers scope for progress that no single perspective can offer on its own. It will ensure that decision-making on water and energy development:

- *reflects a comprehensive approach to integrating social, environmental and economic dimensions of development;*
- *creates greater levels of transparency and certainty for all involved; and*
- *increases levels of confidence in the ability of nations and communities to meet their future water and energy needs."*

"There are no shortcuts to equitable and sustainable development. The evidence of success and failure we present in this report provides the best rationale why the 'business as usual' scenario is neither a feasible nor a desirable option."

In discussing the changing context of water and development, the Commission believes that: *"The key decisions are not about dams as such, but about options for water and energy development. They relate directly to one of the greatest challenges facing the world in this new century – the need to rethink the management of freshwater resources… … The unfolding scenario for water use in many parts of the world is one of increasing concern about access, equity and the response to growing needs. This affects relations:*

- *Within and between nations;*
- *Between rural and urban populations;*
- *Between upstream and downstream interests;*
- *Between agricultural, industrial and domestic sectors; and*
- *Between human needs and the requirements of a healthy environment."*

The views of the Commission suggest that there are universal shortcomings in optimum development and usage of dams. Such shortcomings may appear to not be applicable to

[37] Dams And Development, A New Framework: The Report Of The World Commission On Dams, Earthscan Publications Ltd, London and Sterling, VA, November 2000

the United States in view of its expansive and robust water resources development programs, laws and policies. However, there are growing unmet demands and unresolved conflicts that argue to the contrary. Nevertheless, the present report concentrates on existing projects, as there have been no large dams authorized and constructed in this Nation in over 30 years, partly a result of concerns such as those iterated by the Commission.

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IV – FRAMEWORK FOR REVITALIZATION

OVERVIEW

This study adopted a series of steps to develop a framework for revitalizing Corps projects both programmatically and project-by-project. These steps are:

1. Establish a set of principles and objectives common to all projects of all four types.
2. Develop a multi-dimensional matrix of attributes associated with the issues, problems and opportunities for the four types of projects at the project, system and program levels.
3. Compare the differences to assess the relative degrees and magnitudes of those issues, problems and opportunities.
4. Develop a programmatic approach identifying objectives for each type of project to address the identified issues, problems and opportunities.
5. Develop an approach to prioritizing actions to optimize program management,
6. Identify the additions, changes and improvements in policies and guidance needed to achieve revitalization objectives.

These steps are meant to produce a framework for developing a plan of action, subject to further study and refinement. A plan of action is not attempted here.

A COMMON SET OF PRINCIPLES AND OBJECTIVES

Any initiative to revitalize Corps projects must first consider the whole. From a program perspective, the primary challenges are to weed out marginal projects, and to ensure that all other projects are achieving their maximum potential. Thus, all projects:

- Should provide for optimum public well-being for the foreseeable future, subject to continuous management oversight,
- Should adhere to watershed management and environmental operating principles
- Must demonstrate economic efficiency; i.e., the benefits of continuing OMRR&R must be confirmed to exceed the costs thereof,
- Should maximize economic efficiency in accordance with the water resources development objectives set forth in the P&G, subject to reasonable departures there from to achieve environmental objectives,
- Should provide maximum contribution to ecosystem restoration, enhancement and creation, to the extent guidelines provide for departures from maximum economic efficiency,
- Should not depend solely on State and local certifications, or other approvals, in judging environmental acceptability and,

A COMPLEX OF ATTRIBUTES

A framework for revitalization must address economic, environmental and social objectives for a wide variety of circumstances at the project, system and program levels, for four different project types, involving a two variable attributes: degree of problems and level of opportunities. Superimposed on these attributes is the assignment of responsibilities between the Federal government and non-Federal sponsors. A revitalization program, theoretically, would have to assess and quantify the entirety of this complex of attributes for all projects.

Project problems may be differentiated in eight generalized categories of minimal to maximum degree, as follows:

1. Minor operational deficiencies (operation not optimized to achieve maximum efficiency while fulfilling authorized purposes; opportunities for improvement not recognized)
2. Moderate operational and management deficiencies (operation and management not optimized to achieve

maximum efficiency while fulfilling authorized purposes; opportunities for improvement not recognized)
3. Major deficiencies in fulfilling authorized purposes
4. Major deficiencies in meeting current demands
5. Major deficiencies in fulfilling authorized purposes and in meeting current demands
6. Project incapable of meeting current demands
7. Project incapable of fulfilling authorized purposes
8. Project incapable of fulfilling authorized purposes and meeting current demands

At the system level, the impact on and the implications for the remainder of the system must be considered. At the program level, the aggregate of problems for all projects must be assessed to develop an effective and efficient program.

Levels of revitalization opportunities may be differentiated in eight generalized levels from minimal to maximum, as follows:

1. Minor operational changes to achieve contributions beyond authorized purposes
2. Moderate operational and management changes
3. Major operational and management changes
4. Minor operational changes and structural modifications
5. Moderate operational changes and structural modifications
6. Major operational changes and structural modifications
7. Minor operational changes, structural modifications and off-project development
8. Moderate operational changes and structural modifications and off-project development
9. Major operational changes and structural modifications and off-project development

At the system level, the impact on and the implications for the remainder of the system must be considered. At the program level, the aggregate of opportunities for all projects must be assessed to develop an effective and efficient program.

The type of project and the nature of operational and management changes and structural modifications determine the assignment of responsibilities between the Federal government and non-Federal sponsors. The degree of difficulty in achieving desired outcomes can vary dramatically.

COMPARATIVE ASSESSMENT OF PROBLEMS AND OPPORTUNITIES

The general assessment of problems and opportunities by project type in Section II is summarized here for comparison purposes so that the process of prioritization might begin.

Summary of Problems and Opportunities: Harbor Projects

The principal problem facing harbor projects is the increasing cost of environmentally acceptable dredged material disposal. The increased costs, together with the vagaries of demand, may have resulted in some projects, large and small, becoming economically marginal, if not uneconomic, to continue to maintain. Harbor projects have few if any untapped resources to present opportunities to improve economic efficiency, or to offset inefficiency.

Present policies and management tools are insufficient for identifying inefficient projects, curtailing maintenance and/or disposing of the projects. If tools were developed to identify such projects, the larger question would be how to deal with the social, political and regional economic impacts of discontinuing maintenance.

Summary of Problems and Opportunities: Inland Waterways

The concern of the present study is that the magnitude of the Corps' maintenance backlog overshadows the need for revitalization, such that the latter may be relegated to a low priority. A second concern is that there is evidence that some portions of the systems may be being maintained at a net cost economically, while posing difficult environmental challenges.

The potentials for revitalization of the inland navigation systems to provide additional services are limited, but there may be limited opportunities to manipulate pool levels to store additional water for short periods, and to use it to augment flows during low flow periods. Whether or not that is possible, dam gate operation can be manipulated to increase oxygenation during non-flood periods. The increase in dissolved oxygen can substantially improve waste assimilation and aquatic habitat. The cumulative beneficial effect of improved water quality could be substantial, and achieved at little cost.

In those cases where navigation pools are not contained entirely within banks, there may be unrealized opportunities for environmental restoration and enhancement, such as creating small sub-impoundments and wetlands, or creating vegetative buffers against surface pollutant runoff.

Summary of Problems and Opportunities: Reservoir and Lake Projects

Intensive recreational usage of Corps Lakes is far greater than contemplated decades ago. Other demands also have increased, but less universally. These demands are mostly for water supply, hydropower and low flow augmentation for navigation. The demands vary greatly by region and by proximity to urbanizing areas.

Some older projects provided for purposes no longer needed, such as storage for releases to maintain downstream navigation where locks and dams subsequently have been constructed. There is no nationwide inventory of such projects to assess to what extent the unneeded storage has been converted to other beneficial uses. However, one inventory discloses that there are several dozen-lake projects that are not being operated for all authorized purposes. These projects, as well as others, may have surplus storage.

Some projects may have experienced significant amounts of sediment accumulation beyond the quantity projected for the original design, and/or distributed in locations within the reservoir not provided for originally. There likely are only a small number of projects where there have been substantial reductions in storage capacities for operating purposes. However, there is no nationwide inventory to confirm the scope of the problem.

Sedimentation in the upper reaches of pools used for recreation purposes, though often not a significant encroachment on storage capacity, can result in mudflats and reduce the area of the pool suitable for recreation. Similarly, such accumulations can destroy shallow water ecosystems.

Pollutants in water flowing into a reservoir from watershed sources beyond project boundaries can adversely affect usage of the lake for certain purposes, including water supply, recreation and fishing, as well as otherwise harming aquatic ecosystems. The Corps has no direct authority to resolve such pollution problems, except as may be accomplished through coordination with other agencies and the public.

Projects and systems experiencing excess demands or new demands become known as conflict arises, often generating controversy. These and other systems with complex and extensive demands and conflicts have been, and continue to be, the subject of numerous special studies and legislation aimed at resolution. The present study is concerned more with lake systems and projects that have not reached the point of contentious conflict and special legislation. However, there is no nationwide inventory of projects and systems experiencing excess demands or new demands.

Potentials and opportunities can be found in the untapped capabilities of existing lakes to meet present and future demands beyond those for which the projects were authorized and constructed. Untapped capabilities are associated with the three basic lake resources: storage capacity, lake surface and project land. Significant potentials and opportunities are as follows:

- Excess capacity may be found in some projects where capacity assigned to flood storage is more than necessary to maximize reductions in peak flood flows. Excess capacity related to water supply is surplus storage that is not needed to meet demand. Excess flood

control capacity may be converted to year-around or seasonal storage for several purposes: to meet increased water supply demand; to increase the recreation pool level; and, to increase discharges during low flow conditions to improve downstream water quality. Surplus water supply storage may be used to increase water quality releases, but subject to drawdown of the recreation pool. If small increments of increases could be gained from numerous reservoirs, considerable improvement of water quality in major rivers could be achieved at minimal cost. The importance of the potential cumulative increases is heightened by the trend toward more extensive and prolonged drought in most regions of the Nation.

- Even small reserves of excess capacity may offer a sizable potential for meeting downstream ecosystem needs through minimum in-stream releases and seasonal high pulse releases.
- Increased permanent pool levels for recreation purposes, though problematic, could be valuable modifications in instances where topographic and development conditions are favorable.
- The perimeters of year-around and seasonal pools often include areas of potential wetlands were it not for pool fluctuation and drawdown. Small levees or berms and drainage control could convert these areas into productive wetlands. Small dams creating sub-impoundments could be built for a variety of purposes at various locations within reservoirs.
- Surplus storage could be reallocated for fish aquaculture where it would be used both as a supply source for a closed system and as a source of hydraulic power to drive re-circulation pumps if needed.
- In some cases, land acquisition may be a viable solution to overuse, damage from uncontrolled lake access, or to provide a buffer against related pollution.

Summary of Problems and Opportunities: LFDR Projects

Substantial deterioration in degree of protection due to urbanization of upstream watersheds is a serious problem for some projects, especially for levee and floodwall projects in rapidly urbanizing watersheds. Overtopping of levees and floodwalls can result in catastrophic consequences including loss of life. Inspection programs are not likely to detect and quantify increased discharges due to urbanization in the upstream watershed.

Because LFDR projects have little resources, they present very limited potential and few opportunities for revitalization. However, though mainly a non-Federal responsibility, there may be opportunities at many projects to develop or expand waterside recreation areas and facilities, nature trails, etc.

Relative Potentials Table 5 displays a subjective comparison of relative potentials for problems and opportunities from a program perspective.

Table 5
Relative Potentials

Relative Potentials for Problems From High = 1 to Very Low = 6				
Attribute Type	**Harbors**	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
Economic	1 – High	4 – Low to Moderate	6 – Very Low	4 – Low to moderate
Environmental	1 – High	3 – Moderate	5 - Low	4 – Low to moderate
Overall	**1 – High**	**3.5 – Moderate**	**5.5 - Low**	**4 - Low to moderate**

Relative Potentials for Opportunities From High = 6 to Very Low = 1				
Attribute Type	**Harbors**	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
Economic	1 - Very Low	2 – Low	3 – Low to Moderate	2 - Low
Environmental	1 - Very Low	3 – Low to Moderate	4 - Moderate	2 - Low
Overall	**1 – Very Low**	**2.5 - Low to Moderate**	**3.5 - Moderate**	**2 - Low**

Composite Relative Potentials for Problems and Opportunities From 1 = High Problem Potential, Very Low Opportunity Potential to 6 = Very Low Problem Potential, High Opportunity Potential				
	Harbors	**Inland Waterways**	**Reservoirs and Lakes**	**LFDR Projects**
All Attribute Types	**1- Very Low**	**3 - Moderate**	**4.5 – Moderate to High**	**3.0 - Moderate**

These comparisons indicate that potential problems outweigh potential opportunities, and that harbors and lakes are at opposite ends of the range. The comparisons also suggest a rank ordering of problems and opportunities, by project type, in relation to apparent degrees of potential programmatic net gains of a revitalization program. The frequency of occurrence of problems and opportunities could not be considered because few pertinent surveys, inventories and other similar inquiries have been made to date.

A PROGRAMATIC APPROACH TO REVITALIZATION

Revitalization objectives can best be achieved by development of a targeted program incorporating efficient management tools and

supported by revitalized policy guidance and legislative initiative. The following approach is based on the comparative assessment of problems and opportunities, and of existing policies and guidance and their deficiencies.

Areas of Concentration

Programmatically, the framework should concentrate on the areas of greatest potential for problems and of greatest potential for opportunities, such that net programmatic gains can be achieved most efficiently. As the comparisons discussed above indicate, areas of concentration can be prioritized, highest to lowest, as follows:

1. Harbor projects economic viability problems
2. Inland waterways projects economic viability problems
3. LFDR projects economic problems
4. Harbor projects environmental problems
5. Reservoir and lake projects environmental opportunities
6. Reservoir and lake projects economic opportunities
7. Inland waterway projects environmental problems
8. All others:
    a. LFDR projects economic and environmental opportunities
    b. Harbor projects economic and environmental opportunities
    c. Reservoir and lake projects economic and environmental problems
    d. LFDR projects environmental problems
    e. Inland waterways projects economic and environmental opportunities

Priority should be given to a programmatic effort to identify uneconomic navigation projects, and to dispose of them in an orderly fashion. Next, priority should be given to identifying LFDR projects having economic problems resulting from deteriorating level of protection due to urbanization. Unlike navigation project economic problems, the LFDR problems are related to project deficiencies, not to lack of demand or use.

Red Flag Projects

Certain projects may be well known as having significant, but unresolved problems. Others may have a significant potential to meet known demands, but the limitations of existing project authorization deters attempts to adapt to the known demands. These "red flag" projects should be placed high in the priority for revitalization action.

Components by Project Type

For all types of projects, existing tools need substantial expansion and updating. Additional tools need to be developed, keeping priorities in mind.

Harbors

The database of annual O&M expenditures for harbor projects needs to be updated, analyzed, and compared to commercial usage. Commercial usage data collection and analysis needs to be expanded to the extent practicable; at least to provide sufficient indicators for comparison to cost data. The data bridge correlating port data to harbor project data is critical to relating costs to usage.

Inland Waterways

The effort to evaluate the contributions of tributary waterways in the IWR study on "Inland Waterways Tributaries: Role and Value to the Inland Navigation System" should be continued and formalized as a standing management tool.

An inventory of those navigation dams which provide for purposes other than navigation should be developed. The inventory should distinguish between those for which other purposes are served incidentally to navigation and those that were authorized, designed and constructed to serve other purposes (e.g., store water in excess of that required to maintain sufficient navigation pools).

Management of the inland waterways system should ensure that the operation of all navigation dams should be adjusted to the maximum possible extent to increase oxygenation.

Reservoirs

Revitalization of Corps reservoirs will require development of a screening process to identify and prioritize reservoirs having potential excess capacities, followed by analysis of the screened projects to determine optimum use of the excess capacities. The analysis should include explicit consideration of opportunities possible through lake surface increases, wetland creation, sub-impoundments, fish aquaculture, and expansion of lands for buffering and access. Where reservoirs are operated as parts of a system, typically for flood control, the analyses must consider system implications. It is essential that options and alternatives for revitalization consideration not be constrained by existing project authorizations.

Whether or not excess capacity exists, management of all lakes and systems of lakes should ensure that their operation is adjusted to the maximum possible extent, consistent with management of lake water quality, to increase oxygenation of discharges. Therefore, the screening process should include a mechanism to ensure that such operational adjustments are made.

A secondary objective should be the improvement of stewardship policies and regulations. The need for this improvement may be expected to emerge through discovery as the screening and analysis process proceeds. One important improvement would be to require that management plans, prepared for all Corps administered lands and waters, include provisions for adaptive management in the interest of revitalization.

LFDR Projects

For LFDR projects, tools need to be developed to identify those for which degree of protection has deteriorated. Criteria and procedures need to be developed for evaluating and resolving the deteriorated levels of protection.

Policy and Guidance Requirements to Support Program

Existing policies need to be updated and streamlined to overcome their deficiencies, and to facilitate desirable management, program development and budgetary initiatives. Most important is the development of umbrella policy guidance in the Water Resources Policies and Authorities series of ERs. Whether or not a substantive revitalization program is undertaken as suggested here, Corps policies and guidance need considerable improvement to encourage and facilitate revitalization. Corps regulations and related policy guidance need to provide for continuing monitoring and review of economic performance of existing projects. Also, pertinent guidance needs to be improved to reflect cross-functional coordination among the policy, planning, engineering, operations and emergency management functions. Needed improvements in policies and guidance for each type of project are outlined below.

Guidance for Harbors

Policy guidance for harbors needs to establish explicit requirements and procedures for confirming continuing economic viability of harbor projects, to include economic reevaluation when selected indicators fail minimum threshold value tests (or "triggers"). Centralized data collection and analysis needs to be expanded to support any requirements imposed on Divisions, Districts and centers of expertise.

Guidance for Inland Waterways

Policy guidance for inland waterways needs to establish principles and procedures for continuing, systematic review of potentially marginal projects. Screening projects for continuing economic viability needs is dependent on system analysis and needs to rely more heavily on centralized management. Guidance on water control management needs to address navigation dams specifically, and to establish minimum requirements regarding aeration or oxygenation for improving downstream water quality.

Guidance for Lakes

Policy guidance for lakes and reservoirs need to provide for actively assessing project resources that may be available or suitable for change in usage. ER 1165-2-119, pertaining to Section 216 authority to conduct studies for review of existing projects, needs revised to establish requirements for explicit determinations for all projects as to whether review under Section 216 should be pursued.

The revised guidance should coordinate with ERs 1110-2-240 and 1110-2-8154 guiding water control management and water quality management, respectively. These two ERs, in turn, should establish requirements for proactive and actionable assessments of projects to determine potential capabilities for improving downstream water quality and ecosystem enhancement.

Guidance for LFDRs

LFDR guidance is needed to deal with the potential deterioration of level of protection due to urbanization of upstream watersheds. Such guidance should be developed in conjunction with the study phase of revitalization program to ensure that inspection programs detect and quantify future increased discharges due to urbanization in the upstream watershed.

LEGISLATIVE INITIATIVES

Because of information and data deficiencies and the need for more in-depth assessment of the problems and opportunities outlined here, legislative initiative is indicated which first would authorize such an assessment. The ultimate objective of the assessment would be a second legislative initiative seeking authorization of a long-term program to implement revitalization measures.

Legislative initiative to seek authorization of an assessment study should define the basic necessary steps of a preliminary action plan. It also should establish study objectives and ultimate implementation objectives. The study objectives should include the preparation and submission to Congress of a report detailing, and recommending authorization of, a revitalization program. Initiative to authorize implementation of a revitalization program should incorporate the findings of the assessment study.

STEPS TO REVITALIZATION

A series of steps will be necessary to undertake a revitalization program. The following presents the general steps, together with suggested options for their accomplishment.

Preliminary Stage:

- Confirm the findings and assessments of this framework study
  - Through critique by selected experts, or
  - Through a multi-functional task group
- Develop a preliminary plan of action for accomplishing subsequent steps
  - To proceed directly to next step, or
  - To support legislative initiative for a comprehensive study with General Investigations funding.

Study Stage:

- Undertake a preliminary assessment to further define and quantify the potential scope of problems and opportunities
  - Proceed without specific study authority with multiple sources of funding – mainly O&M or
  - Await study authorization
  - By task group, or
  - By assignment to MSCs, Districts and Centers of Expertise
- Develop policy guidance sufficient to support plan development and implementation
- Develop a complete plan of action
  - Include procedural guidance for executing the plan, or
  - Make first step of plan the development of procedural guidance

Implementation Stage

- Implement program plan of action
  - Proceed without specific program authorization (using existing authorities, including Section 216, requiring feasibility reports to Congress on a project-by-project basis, or
  - Await program authorization allowing defined project modifications without further authorization.

V – CONCLUSIONS AND RECOMMENDATIONS

There are problematic misperceptions concerning the Corps' family of water resources projects. An underlying goal of any effort to revitalize Corps projects must be to disabuse water resources professionals as well as the public of their perceptions that project age and changing demands equate to antiquation, and among some Corps managers, that project authorizations equate to a mandate to perpetually operate and maintain projects as authorized without regard to changed circumstances. These views have contributed to passive stewardship of vital resources.

As used here, "revitalization" is meant to imply the improvement and/or increase in beneficial outputs, short of project replacement. Revitalization encompasses rehabilitation and restoration, but also includes increased or new beneficial exploitation of underutilized assets. However, the study also finds a range of substantial problems facing some existing projects and their ability to fulfill intended and authorized purposes. More problematic is a substantial lack of policies, guidance and management tools to recognize and resolve existing and potential project deficiencies, much less to facilitate revitalization.

A framework for revitalization of Corps projects must be ambitious by necessity. It must be viewed and dealt with in context, that context being the missions of the Corps' Civil Works Program. Conversely, mission accomplishment must consider that the "devil is in the detail". At the program, or National level, the accumulative problems and issues may reflect on budgetary and mission integrity.

The varying capabilities of projects to meet changing water and related land resources needs and priorities need to be actively addressed. The four types of projects – harbors, inland waterways, reservoirs and lakes, and LFDRs – are fundamentally different, and must be addressed separately, though they do share some common objectives. All projects should:

- Demonstrate economic efficiency; i.e., the benefits of continuing OMRR&R must be confirmed to exceed the costs thereof,
- Maximize economic efficiency in accordance with the water resources development objectives set forth in the P&G
- Provide maximum contribution to ecosystem restoration, enhancement and creation, and
- Provide for optimum public well-being over a long time horizon, subject to continuous management oversight.

A successful revitalization program will require engraining a Corps-wide perspective that continuous oversight and stewardship of the Corps family of projects are the responsibility of all Corps managers across all functional areas at all levels. It will depend on a substantial, long-term agency-wide commitment, and the support of the Administration and Congress.

It is recommended that the Corps undertake, with all due diligence, the series of steps necessary to undertake a revitalization program as presented herein.

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APPENDIX A – LIST OF THE FUEL TAXED INLAND AND INTRACOASTAL WATERWAY SYSTEM

Statutory Definitions of
Inland and Intracoastal Fuel Taxed Waterways
of the United States

Source: Public Law 95-502, October 21, 1978.
Public Law 99-662, November 17, 1986.

1. Alabama-Coosa Rivers: From junction with the Tombigbee River at river mile (hereinafter referred to as RM) 0 to junction with Coosa River at RM 314.

2. Allegheny River: From confluence with the Monongahela River to form the Ohio River at RM 0 to the head of the existing project at East Brady, Pennsylvania, RM 72.

3. Apalachicola-Chattahoochee and Flint Rivers (ACF): Apalachicola River from mouth at Apalachicola Bay (intersection with the Gulf Intracoastal Waterway) RM 0 to junction with Chattahoochee and Flint Rivers at RM 107.8. Chattahoochee River from junction with Apalachicola and Flint Rivers at RM 0 to Columbus, Georgia at RM 155 and Flint River, from junction with Apalachicola and Chattahoochee Rivers at RM 0 to Bainbridge, Georgia, at RM 28.

4. Arkansas River (McClellan-Kerr Arkansas River Navigation System): From junction with Mississippi River at RM 0 to Port of Catoosa, Oklahoma, at RM 448.2.

5. Atchafalaya River: From RM 0 at its intersection with the Gulf Intracoastal Waterway at Morgan City, Louisiana, upstream to junction with Red River at RM 116.8.

6. Atlantic Intracoastal Waterway: Two inland waterway routes approximately paralleling the Atlantic coast between Norfolk, Virginia, and Miami, Florida, for 1,192 miles via both the Albermarle and Chesapeake Canal and Great Dismal Swamp Canal routes.

7. Black Warrior-Tombigbee-Mobile Rivers: Black Warrior River System from RM 2.9, Mobile River (at Chickasaw Creek) to confluence with Tombigbee River at RM 45. Tombigbee River (to Demopolis at RM 215.4) to port of Birmingham, RM's 374-411 and upstream to head of navigation on Mulberry Fork (RM 429.6), Locust Fork (RM 407.8), and Sipsey Fork (RM 430.4).

8. Columbia River (Columbia-Snake Rivers Inland Waterways): From the Dalles at RM 191.5 to Pasco, Washington (McNary Pool), at RM 330, Snake River from RM 0 at the mouth to RM 231.5 at Johnson Bar Landing, Idaho.

9. Cumberland River: Junction with Ohio River at RM 0 to head of navigation, upstream to Carthage, Tennessee, at RM 313.5.

10. Green and Barren Rivers: Green River from junction with the Ohio River at RM 0 to head of navigation at RM 149.1.

11. Gulf Intracoastal Waterway: From St. Mark's River, Florida, to Brownsville, Texas, 1,134.5 miles.

12. Illinois Waterway (Calumet-Sag Channel): From the junction of the Illinois River with the Mississippi River RM 0 to Chicago Harbor at Lake Michigan, approximately RM 350.

13. Kanawha River: From junction with Ohio River at RM 0 to RM 90.6 at Deepwater, West Virginia.

14. Kaskaskia River: From junction with Mississippi River at RM 0 to RM 36.2 at Fayetteville, Illinois.

15. Kentucky River: From junction with Ohio River at RM 0 to confluence of Middle and North Forks at RM 258.6.

16. Lower Mississippi River: From Baton Rouge, Louisiana, RM 233.9 to Cairo, Illinois, RM 953.8.

17. Upper Mississippi River: From Cairo, Illinois, RM 953.8 to Minneapolis, Minnesota, RM 1,811.4.

18. Missouri River: From junction with Mississippi River at RM 0 to Sioux City, Iowa, at RM 734.8.

19. Monongahela River: From junction with Allegheny River to form the Ohio River at RM 0 to junction of the Tygart and West Fork Rivers, Fairmont, West Virginia, at RM 128.7.

20. Ohio River: From junction with the Mississippi River at RM 0 to junction of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania, at RM 981.

21. Ouachita-Black Rivers: From the mouth of the Black River at its junction with the Red River at RM 0 to RM 351 at Camden, Arkansas.

22. Pearl River: From junction of West Pearl River with the Rigolets at RM 0 to Bogalusa, Louisiana, RM 58.

23. Red River: From RM 0 to the mouth of Cypress Bayou at RM 236.

24. Tennessee River: From junction with Ohio River at RM 0 to confluence with Holstein and French Rivers at RM 652.

25. White River: From RM 9.8 to RM 255 at Newport, Arkansas.

26. Willamette River: From RM 21 upstream of Portland, Oregon, to Harrisburg, Oregon, at RM 194.

27. Tennessee-Tombigbee Waterway: From its confluence with the Tennessee River to the Warrior River at Demopolis, Tennessee.

APPENDIX B – CASE EXAMPLE: Apalachicola River, Florida, Inland Waterway

The Apalachicola River stem of the Apalachicola/ Chattahoochee/ Flint (ACF) waterway has been the subject of criticism as an example of uneconomic and environmentally damaging segments of the Inland Waterway System. The following discussion is excerpted from an Information Paper furnished by the Corps' Mobile District. [38]

The water resources of the Apalachicola/ Chattahoochee/ Flint (ACF) River Basin have been developed to serve multiple purposes, including flood control, navigation, hydropower, water supply, water quality, recreation, and fish and wildlife enhancement. A basin-wide development plan, authorized by the River and Harbor Act of 1945 and modified in 1946, consisted of three multi-purpose reservoirs on the Chattahoochee above Columbus, Georgia (only two were constructed); three multi-purpose reservoirs on the Flint River above Albany, Georgia (none were constructed); and six locks and dams (three were constructed). Navigation was to be provided by (1) dredging, cutoffs, training works, and other open river methods; (2) a series of locks and dams; and (3) flow regulation from upstream storage projects. The project ultimately constructed consisted of a 9- by 100-foot navigation channel along 107 miles of the Apalachicola River between the Gulf Intracoastal Waterway and Jim Woodruff Lock and Dam. From there the navigation channel extends 155 miles up the Chattahoochee River to Columbus, Georgia, and Phenix City, Alabama, and 28 miles up the Flint River to Bainbridge, Georgia.

The project authorization required local interests (six Florida counties along the river) to provide public port facilities and all lands, easements, rights-of-way and disposal areas for maintenance of the navigation channel in the Apalachicola River.

Local interests were reluctant to provide perpetual easements for disposal of maintenance dredged material because of the potential financial liability for the counties. Accordingly, the Corps for the initial construction of the waterway project approved five-year disposal easements. After those easements expired subsequent attempts to obtain further easements were unsuccessful and in 1988 the counties formally rescinded their commitments to provide local sponsorship for the project. Since that time, the Corps has been able to continue to maintain the navigation channel primarily through the use of within-bank disposal areas subject to Federal navigation servitude (i.e., no requirement for easements from local sponsors).

The controlling depth for navigation has often been less than the authorized 9 feet during a large portion of the normal low flow period of the summer and fall each year. Over the period 1970-1999, a 9-foot channel has been available only about 62 percent of the time and a 7.5-foot channel 82 percent of the time. In dry years a 7.5-foot channel may be available only 25 percent of the time. The original design of the project estimated that a discharge from Jim Woodruff Dam of 9,300 cubic feet per second (cfs) together with dredging would provide a 9-foot channel. In the mid-1980's the discharge providing a 9-foot channel was estimated to be 11,000 (an increase of 18%). The majority of the dredging activity in the Apalachicola River occurs between miles 35 and 45 and between miles 76 to 81, accounting for about 40 percent of the annual dredging quantities.

[38] From Mobile District Website, January 25, 2002 (www.sam.usace.army.mil/infoalph.html)

In accordance with the Clean Water Act of 1972, as amended, the Corps obtained water quality certifications from the State of Florida for maintenance dredging in the Apalachicola River, beginning in 1979. Over the years conditions placed on the certification have imposed increasing restrictions on dredged material disposal area usage, required an extensive monitoring program, and the re-opening of sloughs along the river. These actions limited dredged material capacity and increased maintenance costs.

In response to these limitations new management techniques, such as mechanical redistribution, were developed to provide for additional dredged material disposal capacity. Mechanical redistribution was initiated in 1987 and has been used primarily at one disposal site within the controlling reach of the river, and involved the mechanical grading of material from a within banks disposal area into the river during high flows to facilitate transport of the dredged sediment downstream with the river bedload.

Mechanical redistribution was certified in the State of Florida water quality certification issued in 1991, subject to a monitoring program. However, the five-year water quality certification issued in 1999 prohibits the continued use of this technique. Following discussions with navigation users during and after the 1986 drought, the Corps developed a technique to provide for a planned period of navigation called a Navigation Window. This technique involves temporarily storing water in West Point Lake, Walter F. George, and Lake Seminole that then is released over a 10-day to two-week period at a rate to provide for economically navigable depths (at least a 7.5-foot channel) in the Apalachicola River. During the Drought of 1988 a Navigation Window was planned for early September 1988, but sufficient rain occurred so that the Window was not necessary. This technique was employed beginning in 1990 and continued throughout the decade.

Beginning in the mid 1990's, Navigation Windows were scheduled in advance, approximately one per month during the low water months, in order to provide the waterway users a predictable reliable channel. Because channel conditions were also deteriorating, Navigation Windows were used with increasing frequency, as many as six a year, generally between May and December. Maintenance of navigation depths became increasingly dependent upon flows due to continued channel degradation and a lack of adequate dredged material disposal capacity. In the 1990s, the discharges from Jim Woodruff Dam required to provide a limited 8-foot channel during navigation windows ranged from 13,000 cfs to over 20,000 cfs, dependent upon the condition of the dredged channel. With increased water supply and recreational demands in the upstream reservoirs, fluctuations of reservoir levels necessary to support navigation window releases have become increasingly controversial.

As much as 1.2 million tons of cargo moved on the ACF in 1985, but traffic has continually declined since then as difficulties in maintaining the project and providing a reliable channel have increased. Presently less that 400,000 tons move on the waterway. The principal commodity is sand and gravel, which is not dependent upon navigable depths on the Apalachicola River and can move economically at shallower depths than can some other commodities. The next most important products are petroleum products and fertilizers. Studies conducted during the ACT/ACF Comprehensive Study evaluated the potential additional traffic that could economically be moved on the ACF. At the time about 500,000 tons were being moved and the Comprehensive Study indicated that an additional 490,000 tons could potentially move on the waterway.

O&M costs for the ACF navigation project were $6.1 million in FY 1999, consisting of $1.9 million for lock operation and maintenance and $4.2 million for other navigation costs which

includes dredging and snagging, disposal area maintenance, channel condition surveys, etc. The 1998 Operation and Maintenance (O&M) Cost Savings Initiative report was an internal Corps document which contained the results of a comprehensive review of the Corps O&M program with the objective of identifying potential areas of saving O&M costs, while maintaining justified levels of project services. This review established benchmark values for project performance (output and cost) and identified those projects, the performance of which, did not meet the benchmark. For Inland Navigation, the benchmark value, based on O&M cost and ton-miles, was $.02. Projects with a value greater than this benchmark were candidates for evaluation to identify savings in O&M costs. The value for the ACF was $.113.

Discontinuing navigation would have an effect on the commercial activities depending on the waterway for navigation as well as recreational activities that utilize the locks. Some of the special users of the waterway would be especially impacted when an alternative mode of transportation is not readily available or cannot handle the movement because of the physical size of the cargo being moved. A study of de-authorizing navigation would document the potential impacts to other project purposes, to the National and regional economies, and to the environment; changes to maintenance and operation procedures necessitated by deauthorization; opportunities for environmental restoration; and revised reservoir water control operations.

The Army Corps of Engineers feels that before deauthorization of navigation is accomplished in law, a study should be conducted and a post-authorization report prepared that documents potential impacts to other project purposes, changes to maintenance and operation procedures necessitated by deauthorization, opportunities for environmental restoration, and revised reservoir water control operations.

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APPENDIX C – CASE EXAMPLE: Lake Mendocino (Coyote Valley Dam), California, Proposal to Modify for Water Supply

In 1997, the San Francisco District submitted an Initial Appraisal (IA) report on Lake Mendocino, California, under the authority of Section 216 of the River and Harbors and Flood Control Act of 1970. The following discussion is excerpted from that report.

The Initial Appraisal (IA) reviews the adequacy of water supplies in the upper Russian River and explores the advisability of increasing the capacity of Lake Mendocino by raising Coyote Dam from its design capacity of 122,500 acre-feet (AF) to199,000 AF. The purpose of this IA is to define whether there may be a federal interest in raising Coyote Dam in order to provide an increase in the Upper basins available water supply for Municipal & Industrial, agricultural and recreational purposes. This analysis focuses on the water supply needs of the Upper Russian River basin only. The economic benefits presented in this report are derived by estimating the cost of providing an alternative water resource, which would satisfy any shortfall of water in the region in the foreseeable future. This analysis uses the current Federal Discount rate of 7and 1/8th Percent and the 1997 price level.

Description Of The Problem

The rapid growth of Mendocino, Sonoma and Marin counties after World War II created an expanded need for water. In response to this need the Corps, in cooperation with Sonoma County, proposed a series of multi-purpose projects to increase the availability of water in the area. One of these projects was the construction of the Coyote Dam. The dam was constructed to impound the Russian River and create Lake Mendocino thereby increasing the availability of water for Municipal & Industrial, agricultural and recreational purposes. The initial stage of Coyote Dams construction was completed in 1959 with an original containment of 122,500 acre-feet (AF). The dam was also designed to be built in two stages with the expectation that the second stage would be built when the water supply capacity of Coyote Dam became inadequate.

Because of recent developments in the operational policy of the Potter Valley Project (PVP), which will be discussed in the following sections, diversions from the Eel River into the Russian River will in all probability be reduced in the near future. A reduction in diversions from the Eel River to the Russian River via the PVP could jeopardize the continuous supply of water to the Lake Mendocino service area.

Study Area and Background Information

Lake Mendocino is located on the East fork of the Russian River, California. The lake is a multi-purpose project and one part of an interrelated system of water supply for the counties of Mendocino, Sonoma and Marin. The dam site is located approximately 0.8 miles above the mouth of the East Fork and about 96 miles above the mouth of the Russian River. Lake Mendocino currently has a capacity of 118,900 acre-feet (AF) (the current capacity has fallen from the original capacity of 122,500 AF because of siltation) and drains -an area of approximately 105 square miles (sq. mi.).

The Russian River, augmented by diversions from the Eel River through the PVP, provides water for approximately 500,000 residents within the three county area and is also the primary

water supply for agricultural and recreational resources in the Upper basin, which is considered to be from the base of the Coyote Valley Dam to the Dry Creek confluence. There are two federal multi-purpose projects, which supply water to the Russian River basin. The Coyote Valley Dam impounds Lake Mendocino in the Upper basin and Warm Springs Dam impounds Lake Sonoma in the Lower basin. Both facilities serve the purpose of reducing flood damages, providing recreational opportunities, generating hydroelectric power, and creating water supply.

The Sonoma County Water Agency (SCWA) is the local sponsor for the two federal water supply projects and is the senior appropriator of water under California's water rights laws. As the senior appropriator and the local sponsor the SCWA regulates all water supply releases from the two dams and is the primary water wholesaler to municipalities and other consumers in the area.

Water Supply

The water supply issues in the Russian River basin revolve around three key water supply factors. These three key factors are the Eel River, which supplies water to the system through The PVP diversions and the two federal projects in the Russian River basin, Lake Mendocino and Lake Sonoma.

Even though the Eel River is not in the Russian River basin it is an integral part of the Russian River water supply. In 1908, W.W. Van Arsdale and the Eel River Power & Irrigation Company completed construction of a non-consumptive hydroelectric generation project. This project included the construction of a tunnel to divert water from the Eel River, through the mountains, to the East Fork of the Russian River. The project also included a reservoir, which was later replaced by Lake Pillsbury. Since 1908, diversions from the Eel River have been used to generate power. Furthermore, after the water has been used to generate power it is legally abandoned. This abandoned water was used then, and is used now to irrigate agriculture and augment summer flows in the Russian River.

This system was later purchased by Pacific Gas & Electric (PG&E) in 1929 and became known as the Potter Valley Project (PVP). The PVP purchase included Scott dam, which impounds Lake Pillsbury, the Van Arsdale diversion dam and tunnel, and the Potter Valley Power Plant. Under Current law the Federal Energy Regulatory Commission (FERC) licenses the PVP. Under the licensing agreement PG&E is required to maintain the viability of the fishery in the Eel River. As a consequence of this licensing agreement the quantity of water, which can be diverted from the Eel River into the Russian River through the PVP, is subject to change. Annual diversions from the Eel River to the Russian River have averaged 159,000 acre-feet per year (AFY) from 1922 to 1992.

The M&I, agricultural and recreational water supply in the Upper basin of the Russian River, from the Dry Creek confluence (illustrated in Figure 1) to Coyote Dam, is met by maintaining minimum instream flows at the Dry Creek confluence. The users of water in the Upper basin draw from the river in order to satisfy their water needs. In turn the SCWA regulates releases from Coyote Dam (Lake Mendocino) to satisfy those needs and still meet minimum instream flows at the Dry Creek confluence.

The supply of water for the Lower basin and the SCWA service contractors also comes from the Russian River. It to is met by maintaining minimum instream flows. Again the SCWA regulates instream flows so that as the water is extracted from the river by the users, minimum instream flows are maintained. However, instead of Lake Mendocino augmenting the natural

flows to maintain minimum instream flows, as in the Upper basin, the instream flows of the Lower basin are augmented by releases from Lake Sonoma.

The operational policy of the dams with regards to maintaining minimum instream flows is an important part of the water supply schedule. The release schedules for Lake Sonoma and for Lake Mendocino are linked by the Eel River diversions. However, the operational policy of the SCWA can create a separable system. The key to understanding the overall nature of the water supply is to realize that the system is in fact separable.

During the dry months of the year, May through October, the diversions from the Eel River make up the bulk of the instream flow in the Upper basin. Just enough water is released from Lake Mendocino to ensure that minimum instream flows at the Dry Creek confluence are met after the water supply and recreational needs of the Upper basin have been satisfied.

The remaining instream flows of the Upper basin then become the input to the Lower basin. Releases from Lake Sonoma are made only to augment this flow below the Dry Creek confluence and insure that the minimum instream flows are maintained at the mouth of the Russian River.

An important fact to note is that the SCWA treats the two systems independently. If there is a shortage of water in the Lower basin Lake Sonoma, and not Lake Mendocino, is operationally required to make up the shortfall. This means that the two systems can be treated independently.

Issues Affecting Supply

The biggest issue potentially affecting the supply of water to the Upper basin of the Russian River is the operational policy of the PVP. As was mentioned above FERC licenses the PVP. The diversion schedule through the PVP and into the Russian is an integral part of the licensing process. In 1983 a flow agreement was reached. However, as part of the agreement PG&E was required to conduct a 10-year study and to monitor the impacts of the flow schedule on the Eel River fishery. This 10-year study was to analyze the impacts of the flow schedule and to make recommendations on how to protect, restore and/or maintain the fishery resources of the Eel River.

PG&E has completed a draft of the 10-year fishery study required under Article 39 of its license and proposes to modify flows based on the study. The exact flow schedule is still being negotiated with the interested parties but it appears as if a reduction in diversions to the PVP is imminent.

Benefits and Costs

The most likely alternative to a raised Coyote Dam would be the construction of an alternative reservoir or reservoirs. This conclusion is supported by a previous Corps study, FLOOD CONTROL AND ALLIED PURPOSES Russian River, California June 1972. This report studied the possibility of additional water supply projects in the basin and did a more detailed study on two alternatives, the Forsythe Creek Dam and the Redwood Valley Creek Dam. Both of these potential dam sites are optimally located in the Upper basin and would be able to geographically serve the same users as would a raised Coyote Dam.

Table C-1 presents the estimated capacities of Redwood Valley Creek Dam and Forsythe Creek Dam. The table also presents the proposed increase in capacity for Coyote Dam.

Table C-1
Dam Capacities

Dam	***Capacity***
Redwood Valley Creek Dam	*23,700 AF*
Forsythe Creek Dam	*57,200 AF*
Coyote Dam	*Incremental increase from raising the dam 76,500AF*

As can be seen from the table, in order to match the increased capacity of a raised Coyote Dam both Redwood Valley Creek Dam and Forsythe Creek Dam would have to be constructed.

Because the cost of supplying the alternative resource, is the benefit to the Coyote Dam raising project, the estimated costs of building the two alternative dams will be presented. These costs are shown in Table C-2 below.

In order to derive a Benefit to Cost ratio the costs of raising the dam also had to be defined. With an increased capacity the footprint of the dam will be enlarged. This increased footprint will necessitate the inundation of existing infrastructure. The inundation of infrastructure was quantified in the costs so that a comparison of the overall costs could be made to the overall benefits

The 1972 Corps report FLOOD CONTROL AND ALLIED PURPOSES, Russian River California, calculated the estimated first costs of all three alternatives. The cost estimates presented in this report include all costs associated with construction of project facilities, including a contingency allowance, costs of lands and damages, and costs for engineering and design and supervision and administration.[39]

These costs were updated to the current price level using Bureau Of Reclamation Construction Cost Trends. These cost trend tables are specific to dam construction and were felt to be an appropriate updating device.

Table C-2
Dam Costs

Dam	***Cost***
Forsythe Creek Dam	*$135,800,000*
Redwood Valley Creek Dam	*$62,200,000*
Coyote Dam Raising	*$42,000,000*

The combined first costs for the Forsythe Creek dam and the Redwood Valley Creek dam, $198,000,000, are the benefits to the Coyote Dam raising project. The cost of constructing the project is $42,000,000; therefore, the B/C ratio is 4.71:1.00.

Initial Environmental Analysis of Raising Coyote Dam

The increased storage capacity of Coyote Dam would affect its storage and release schedule, which are tied into the releases from Warm Springs Dam on Dry Creek as part of Sonoma County Water Agency's water transmission system. Any modification to the federal project on

[39] FLOOD CONTROL AND ALLIED PURPOSES, Russian River California, 1972

the Russian River, which includes Coyote Dam, has the potential to affect many different parties both along the Russian River and in its watershed.

This project would need to be coordinated with National Marine Fisheries Service, US Fish and Wildlife, Federal Energy Regulatory Committee, California Resources Agency, State Coastal Conservancy, Sonoma County Water Agency, Mendocino County Inland Water and Power Commission, Mendocino County Water Agency, Russian River Flood Control District and Water Conservation Improvement District, North Coast Regional Water Quality Control Board, and State Water Resources Control Board, as well as other Federal, State, local agencies, and those with water diversions rights on the Russian River.

Direct, indirect and cumulative environmental impacts from the raising of Coyote Dam at Lake Mendocino would most likely be to water quality, air quality, recreation (fishing, hunting, boating, hiking, horse riding, public access et cetera), aesthetics, noise, endangered and threatened species, and fishery resources. A more thorough environmental analysis of the proposed project would likely result in the necessity of an Environmental Impact Statement.

Conclusion

Based on this Initial Appraisal it appears as if Raising Coyote Dam is in the federal interest. A comparison of the "Without" project condition to the "With" project condition demonstrates a need for an increased supply of water in the Upper Russian River basin. Furthermore, this initial appraisal has identified a positive B/C ratio of 4.71:1.00. It is therefore recommended that the next phase of the study process be undertaken and that a reconnaissance level study is warranted.