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US Army Corps of Engineers

Water Resources Support Center
Institute for Water Resources

(2)



National Operation and Maintenance Program Plan of Improvement



Policy and Procedures Options Study for Project Operation and Maintenance



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IWR Report 93-R-11

“The Corps is evolving in a direction contrary to current management theory and diametrically opposed to the trend in other Federal and non-Federal entities with similar missions. In today’s world of increasingly expensive technologies, increasing reliance on information systems, and greater interdependence, an organization which consists of 36 related entities, each of which sets its own standards on information systems, workload tracking, and organizational structure - while building ever-increasing levels of internal review - will find it very difficult to become, or remain, cost effective”

**- Management Analysis, Inc.
8 September 1992**



**POLICY AND PROCEDURES OPTIONS STUDY
FOR PROJECT OPERATION AND MAINTENANCE**

**NATIONAL OPERATION AND MAINTENANCE PROGRAM PLAN OF
IMPROVEMENT**

for

**OPERATIONS, CONSTRUCTION AND READINESS DIVISION
DIRECTORATE OF CIVIL WORKS
U.S. ARMY CORPS OF ENGINEERS**

by

**INSTITUTE FOR WATER RESOURCES
WATER RESOURCES SUPPORT CENTER
U.S. ARMY CORPS OF ENGINEERS**

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103



REPLY TO
ATTENTION OF

30 AUG 1993

Honorable Leon E. Panetta
Director
U.S. Office of Management and Budget
Washington, D. C. 20503

Dear Mr. Panetta:

Approximately two years ago, the Army Corps of Engineers, under the direction of this office, initiated a comprehensive study with the objective of assuring that Federal expenditures for operation and maintenance of Corps projects provide justified levels of service in the least cost manner.

A report summarizing the findings and conclusions of that study is enclosed. The report also describes actions now underway to fully define and facilitate implementation of those items which will have the greatest net beneficial effect on the program. As those actions are completed, over time, we expect to propose specific policy and procedure changes, as may be appropriate.

Sincerely,

G. Edward Dickey
Acting Assistant Secretary of the Army
(Civil Works)

Enclosure



DEPARTMENT OF THE ARMY

U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

16 AUG 1993

REPLY TO
ATTENTION OF:

CECW-O

MEMORANDUM FOR Acting Assistant Secretary of the Army
(Civil Works)

SUBJECT: Summary of Findings of the Policy and Procedures
Options Study for Project Operations and Maintenance

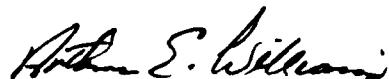
1. I am providing you with the report which summarizes the findings and conclusions of the contractor for the subject study. The report also presents the U.S. Army Corps of Engineers preliminary response to the findings and describes follow-up actions now being undertaken by the Corps to implement improvements to the Civil Works Operation and Maintenance (O&M) Program.
2. The contractor identified 101 practices where improvements can be made in the program efficiency. We have completed an initial review of the contractor's study and have assembled task groups to fully define and facilitate implementation of those policy and procedures options which are of the highest priority and which will have the greatest net beneficial effect on the O&M Program. Many of the identified improvements will require extensive Headquarters involvement developing criteria to standardize budgeting procedures, operating criteria and organizational structures and functions. Other identified improvements are more closely associated with the actual management and operation of projects. These should more readily be implemented by field offices with minimal Headquarters guidance.
3. We have already taken some steps to implement the findings of the O&M Study. The FY 95 budget guidance has been updated to direct additional emphasis toward constraint in the growth of operations features, to encourage field offices to use the study results to implement efficiency improvements and to clarify use of Special Recreation Use Funds. The development of an automated maintenance management system recommended by the contractor has also been initiated. As the task groups develop options to improve the program in response to the contractor's findings, we will be making appropriate recommendations to you for implementation.

CECW-0

SUBJECT: Summary of Findings of the Policy and Procedures
Options Study for Project Operations and Maintenance

4. Printing of the report for distribution to members of Congress and Corps field offices will take about six weeks. The report will be sent to our field offices once copies have been furnished by you to the Office of Management and Budget and concerned committees of the Congress.

Encl



ARTHUR E. WILLIAMS
Lieutenant General, USA
Commanding

PREFACE

The emergence of operation and maintenance expenditures as the single largest individual program in the Civil Works budget provided incentive for a comprehensive review of the program. Financial pressures caused by tight budgets on the one hand, and an ever growing project inventory on the other, provided further impetus to evaluate the way the O&M business was being conducted. Towards that end, the Army Corps of Engineers, under the direction of the Assistant Secretary of the Army for Civil Works {ASA(CW)} has completed a comprehensive study of the Civil Works Operation and Maintenance (O&M) Program. The objective of the study is to assure that Federal expenditures for operation and maintenance of Corps projects provide justified levels of service in the least cost manner. The output of the study is to be policies and procedures (practicable measures) to achieve that objective.

The initial phase of the study began in June 1991 with the award of a contract to a consulting firm, Management Analysis Inc. The use of an outside contractor was deemed essential to assuring an objective as well as a comprehensive review. The Contractor was charged with reviewing the O&M program and project operations to identify options for improvement of current procedures. The Contractor's work, completed in September 1992, was directed by a full time study manager, assisted by a management group composed of staff members from Corps Headquarters and the Institute for Water Resources. A group which included selected Directors of Construction-Operations Divisions and representatives of ASA(CW) reviewed the interim and final products of the Contractor. A steering committee chaired by the Deputy Director of Civil Works and comprised of Civil Works functional element chiefs, other Headquarters representatives, and the Director, Water Resources Support Center provided oversight and general direction.

The second phase of the study, review of the Contractor's findings by the Corps and development of an implementation plan, was directed by Mr. John Elmore, Chief, Operations, Construction and Readiness Division, Directorate of Civil Works, with support from the Institute for Water Resources. The Directors of Construction-Operations for each Corps division office conducted the review and developed the initial implementation plan.

This report, prepared by the Institute for Water Resources staff, is a summary of the Contractor's study and findings and preliminary review by the Corps. The report is presented in two parts. Part I, Plan of Improvement, presents and describes actions which will be undertaken to improve the program. Part II, Study Conduct and Findings, documents the reasons for undertaking the study, how the study was conducted, and presents the study findings and conclusions for those readers who are interested in following the process that supports the need for the improvement actions. Part II presents material primarily extracted from the study Contractor's report and the findings and

conclusions are those of the Contractor. Part I presents the Corps preliminary response to those findings. That response will not be final until a series of task groups complete their work and the chief of engineers makes final recommendations to the ASA(CW) for implementation.

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**NATIONAL OPERATION AND MAINTENANCE PROGRAM
PLAN OF IMPROVEMENT**

**PART I
IMPLEMENTATION PLAN**

I. DECISION PROCESS

After initial review and acceptance of the work performed by the contractor, the Corps began a process to consider study conclusions. There were four study themes - Program Development, Execution, and Monitoring; Intensive Management; Productivity of Existing Program; and Modernization and Maintenance. The Contractor identified 106 separate issues for the four study themes and presented options under each issue. Due to overlap and redundancy, that number was consolidated to 101 separate issues for further consideration. An implementation group composed of Directors of Division Construction-Operations organizations was assembled to analyze the 101 integrated issues and identify the corresponding options which could have a beneficial impact on the manner in which the Corps' operation and maintenance program is carried out. The most appropriate options in the collective opinion of the group were proposed for implementation. Although all issues developed by the Contractor are presented in this report (Part II, Section \), the implementation group developed a high priority plan (HPP) which they believed contained the options which were most practical and had the greatest potential for efficiency improvement. A summary of the group's conclusions is presented in Tables 1, 1A, and 1B. All of the remaining issues, not included in the HPP were generally considered to fall into one of three categories: 1) recommendations that were expected to have a relatively lesser impact on the cost of doing business and/or involved implementation difficulties, 2) recommendations that were limited in scope and which could be implemented on a project-by-project basis (the FY95 budget guidance encourages the districts to employ project specific recommendations that would produce operational efficiencies such that may be freed for the purpose of reducing maintenance backlogs), and 3) issues that were inherent to other on-going Corps initiatives such as the recreation study. A complete review of the rationale used by the group in developing the HPP is presented in Part I, Sections II, III and IV.

The HPP prepared by the Directors of Divisions Construction-Operations organizations was then reviewed by Corps Headquarters (HQUSACE) functional elements having an interest in the O&M program. Subsequently, the HPP was modified and four committees composed of Headquarters and field personnel were instituted for the purpose of planning formal adoption of the best options. The committees have been tasked to analyze all of the issues identified by the Contractor and, recognizing that many of the issues were in fact symptomatic of larger overarching organizational needs, consider complementary improvements, not necessarily identified by the Contractor,

IMPLEMENTATION PLAN

but nonetheless potentially capable of contributing to a more cost-effective program. The implementation activities of the four committees are described in Part I, Section V.

II. HIGH PRIORITY PLAN

The 101 issues were grouped into three categories: 1) PROGRAMMATIC, pertaining to budget preparation, execution, reporting and monitoring; 2) GENERAL PROJECT MANAGEMENT, involving overall or Corps-wide organizational implications; and 3) FUNCTIONAL AREA, linking the delivery of specific services or agency outputs to measures that will improve productivity. The groups recommendations for the 101 issues are summarized in a Table in Part I, Section IV. Of the 62 issues which the group believes had the most merit for implementation, 43 were adjudged to be of the highest priority. The High Priority Plan for each of the three categories is described in the following paragraphs.

A. PROGRAMMATIC

The Contractor identified 21 proposed actions in the programmatic category. Of that total, options were selected that would address 13 issues. A discussion of proposed revisions to current practices is presented in the following paragraphs. Actions are underway to complete the necessary revisions this fiscal year for incorporation into the Annual Budget guidance for Fiscal Year (FY) 1996.

The group agreed that the O&M budget process could be streamlined and simplified because the value added by much of the current effort is questionable. Several actions were identified in this study which could improve management of the O&M program through changes in budget development, execution, reporting, and monitoring. Implemented together, these measures will more equitably allocate resources on a Corps-wide basis and reduce the annual budget submittal documentation for the relatively fixed requirements of projects.

The concept of these changes is to rebuild the levels 1 and 2 baseline requirements for each project in accordance with new, more stringent definitions of baseline effort reflected in a revised funding level matrix. Once definitive baseline requirements are developed Corps-wide, subsequent years' budget submittals for baseline requirements could be limited to a single baseline work package with an adjustment for inflation for each project. This could reduce by about 75% the over 20,000 work items contained in the overall Corps O&M budget submittal. Any new baseline funding demands over \$25,000 that result from new programs or policies would be accommodated by listing each as a separate line item in project budget submittal for the first three years of the program.

These changes can be implemented through appropriate revisions to the Annual Budget Engineering Circular (EC) 11-2-xxx. Implementation should begin with a work group effort in FY 93 to develop new funding level descriptions and a new funding level matrix. The new procedure of incorporating all baseline funding requirements into a single work package for each project or feature and the requirement to separately list any new baseline funding demands over \$25,000 will be effective for the FY 96 budget submittal. These changes in the budget process will greatly reduce (after the first cycle of rebuilding the baseline funding requirements) the volume of documentation that accompanies a budget submittal. The result should be a higher quality budget product by making it possible to concentrate more on the dynamic non-baseline O&M work packages both at district level during budget preparation and at division and headquarters review.

Another budget related reform that could benefit program development and execution concerns the out-year budget process. The potential exists to modify this process to provide additional utility as a mid-range planning tool for periodic and non-recurring O&M work.

The current out-year budget process includes a 10-year O&M budget projection prepared each year as part of the annual budget preparation cycle. This 10-year projection is of limited usefulness because out-year programs are submitted by project with no further breakdown beyond the total amount for each project. Additionally, specific periodic or non-recurring needs are not formally planned for beyond the Budget Year.

The O&M program, however, consists of both fixed or baseline expenditures and variable (periodic, non-recurring) expenditures. The current process for preparing the out-year programs does not provide optimal mid-range (e.g., 5-year) planning input for this variable portion of the O&M program.

To address the need for a mid-range planning tool, the Corps should prepare a detailed 5-year budget projection for periodic and non-recurring work items above a certain cost threshold. Funding constraints for the out-years' budget project would be assigned at division level in order to place some discipline in the process. However, the degree of constraint could vary by year, being less in the out-years of the 5-year projections with the final year (Budget Year +4) being unconstrained. The unconstrained year could reflect the level of Unaccomplished Maintenance and Repair (UMAR) identified as described in Section IB5. Using this concept gives dual purpose to the 5-year budget projection; as a mid-range planning tool and a means of documenting and managing the backlog of maintenance at projects. Provision for a 5-year budget projection should be made through modification to the Automated Budgeting System (ABS) to include a 5-year data requirement and revisions to the FY 96 Budget EC.

IMPLEMENTATION PLAN

The limited capability of Corps' automated financial systems is universally recognized. The two most prominent automated systems associated with O&M programming in use today are ABS and the Corps of Engineers Management Information System (COEMIS). There are serious shortcomings in turnaround time for financial reports, and with interface between the ABS and COEMIS systems. These and other related issues will supposedly be addressed by the Corps of Engineers Financial Management System (CEFMS), the successor to COEMIS that will be incrementally deployed Corps-wide over the next three years. Therefore, no recommendations for global changes in the ABS/COEMIS systems are now appropriate.

However, there are some relatively minor things that can be done with ABS that will help until more comprehensive solutions are available. Improvements should be made to facilitate automated entry of data at the project level. While some "home grown" systems have been developed for this purpose, a standard PC-based format is needed that would standardize the budget development process at the lowest level. This would eliminate the entire step currently required to manually enter these submittals into the ABS for consolidation at the district level. Data entry errors from this extra step will be eliminated, and there will be a reduction in time required to prepare the project budget submittals. A method to automate data entry into the ABS project level is now being developed as part of the Improvement of Operations Management Techniques (IOMT) research and development program. It is currently under test in the Portland District. This system should be perfected and fielded Corps-wide as soon as possible.

A further minor change is needed in the ABS to improve management oversight. Currently, ABS does not provide for a separate breakout of Supervisory and Administrative (S&A) Feature Cost Codes (FCC's) (FCC 619 for operations and 635 for maintenance), nor for the Engineering and Design (E&D) FCC (FCC 634) in the budget submittals. Rather, costs associated with these FCC's are imbedded in the budgeted amounts for the remaining operation and maintenance FCC's. These FCC's are tracked separately, however, for actual expenditures. As a result, it is difficult to make comparisons between budgeted amounts and expenditures by FCC without first backing out these S&A and E&D FCC's from the original budgeted amounts. To facilitate tracking, the S&A and E&D FCC's should be listed separately in the ABS budget submission. This will highlight costs associated with these items in the budget submittal rather than their being obscured in a multitude of work packages. Implementation of this item should be effected in FY 93 by revision to the Budget EC for FY 95 and appropriate changes to the ABS.

In the same implementation time frame and same manner, a larger field should be provided for the justification of work items in the ABS budget development system. The present field size does not allow for an adequate description of the purpose and need for many work items in the budget submittal, especially for special maintenance need.

In the area of performance measures, among the parameters tracked at the HQUSACE Command Management Review are expenditure and obligation goals for each Corps' division and district. Currently, the O&M program is required to meet a 94% expenditure goal and a 97% obligation goal. The Contractor believes that these goals drive decisions toward inefficient allocation of resources. The group finds these goals are important in achieving high utilization of all resources available. Both the HQUSACE Operations Division and Programs Division monitor these standards, however, both apply these goals to a different funding base. In preparing the Command Management Review, Programs Division applies these standards to the "basic schedule," which reflects start of year funding expectations. Operations Division, however, applies these standards to the "current schedule," which reflects changes during the year. In the interest of consistency in applying the performance measures for expenditure and obligations, all elements should use the current schedule as the funding base. The current schedule is a realistic indication of the funds a district or division had available for expenditure during the year and thus is the better measure of program execution.

In December 1992 Programs Division, HQUSACE, issued guidance to use the current schedule against which to measure program execution for meeting expenditure and obligation goals.

Some problems have been observed in accurate recording and tracking of O&M expenditures. Part of the problem is that the FCC definitions provided in ER 37-2-10 are not adequate. Some activities do not fit under any of the existing definitions, or the definitions may not be clear. Provision should be made for specific additional sub-FCCs and accounting element definitions. Implementation of this item should be deferred until CEFMS is fielded Corps-wide, which is expected to occur by FY 96.

Some inaccuracies in recording expenditures stem from activities of multi-functional personnel--those who perform work under various FCCs on a regular basis. These personnel sometimes find it difficult to record this time appropriately. Overall, the Contractor reported that instances of non-compliance with Corps' guidance regarding the proper recording of expenditures were numerous. Additional emphasis is needed on the importance of accurately recording expenditures. HQ should issue guidance reinforcing the existing 1-hour rule. Also, Divisions should monitor District adherence to the 1-hour rule during Command/Staff visits. A recently completed Cost of Doing Business Report by the Engineer Inspector General also recommended that HQUSACE issue clear guidance on the use of the 1-hour rule. It is expected that this guidance will be issued.

The original BY budget submission, or President's budget, is prepared almost two years in advance of the actual Budget Year. During the course of these interim two years, conditions and priorities may change at the project, district and division levels. The Corps provides for two adjusted

submittals to be prepared during this interim period in order to incorporate these changes into the O&M budget request. First, an adjusted BY budget is prepared following the original President's Budget submission. Then, immediately prior to the start of the budget year, a work allowance request is prepared which is the basis for the actual funding allocated to a project for execution during the budget year.

While the original BY President's Budget submittal undergoes extensive scrutiny for compliance with funding priorities, etc., the two subsequent adjustments traditionally are subject to much less stringent review. The result, in some instances, has been that work items that fell below the funding line in the original BY submittal were reinstated without challenge in one of the adjustment cycles. This problem was addressed by the more stringent reprogramming guidance regarding unbudgeted work contained in the FY 92 and FY 93 Annual O&M Work Allowance Guidance Memos. This guidance, along with Division's closer scrutiny of District's compliance, is expected to alleviate the problem of lower priority work finding its way into the execution program.

The Corps lacks a comprehensive recapitalization program to provide for sinking funds for major modifications and improvements to existing structures. Existing recapitalization methodologies consist of the few navigation rehabilitation projects funded out of the Construction General appropriation and cost shared with the Inland Waterway Trust Fund, and participation by the Power Marketing Agencies in rehabilitation of hydropower structures. Adoption of a sinking fund concept for major maintenance and rehabilitation of Corps-owned structures is desirable. Funding could come from external sources (project beneficiaries) and/or the O&M appropriation. Implementation should emanate from HQUSACE with necessary coordination with the ASA(CW), Congress, users, and power management agencies. Legislation will be required.

The group noted considerable volatility of funding requirements for Corps dredging projects, with budgeted amounts sometimes exceeding expenditures by a significant amount. Closer correlation between budgeted amounts and expenditures on dredging projects would contribute to more efficient allocation decisions for the use of Corps' resources. Consistent, Corps-wide guidance regarding how to determine the amount to budget for dredging projects is needed. HQ should convene a group to prepare budget guidance for dredging projects and include the guidance in the dredging regulation. Guidance available for use in preparing the FY 96 budget should be the goal.

B. GENERAL PROJECT MANAGEMENT

Of the 29 issues categorized by the Contractor as "general project management," it was determined that implementation of options in four general areas was of high priority. These areas, addressing 9 specific issues in this category, are discussed in the following paragraphs.

1. Standardized Organization Structure

Districts utilize different Operations organizational structures to manage the Civil Works mission. There are also organizational structures and reporting hierarchies unique to individual projects. These varying organizational structures lead to ineffective staffing and communications, ill defined responsibilities and attendant loss of efficiency. The group believes that a standardized Corps district/project function statement and organization structure should be developed and implemented. The cost of developing the regulations and reorganizing, will be more than offset by improving communications, providing efficient staffing and establishing clear command, control and execution responsibilities. The regulations should be issued in FY 94 to be initiated in FY 95 with full implementation by the end of FY 97.

2. Corps-wide Database

The lack of an adequate standard Corps-wide database limits the Corps ability to effectively manage and accurately measure the performance of the O&M program. A typical project maintains up to 300 forms for reporting to district, division and headquarters. Each management level reviews and analyzes data to monitor activities and make managerial decisions. There is some automation; however, most work is performed manually at the project level and automated at the district. Data needs are developed functionally with limited cross function review for joint use of data. The impact of the current practice is: the same data collected in several different ways results in inefficiencies; requests are difficult to fill in a timely manner; and software incompatibility is inefficient.

The group found that data essential to proper management of the program should be determined and a standard Corps-wide database to process that data be developed. The resources required to develop the database and resolve compatibility and linkage problems are far outweighed by the advantages of such a system. The advantages of standardization and consistency will reduce resource requirements and increase management and execution efficiency. The implementation schedule should be as follows:

FY 93 - FY 94 - Determine what data is essential to effectively manage the program.

FY 95 - FY 96 - Develop and test standardized system.

FY 97 - Implement program.

3. Contracting Methods

Each individual district (and sometimes project) uses various types of contracting methods for O&M work. These variations cause inefficiencies. Additional costs are incurred and considerable time is required due to current contractual procedures, advertisement and award processes. Standardized contracts should be developed with specific reference to indefinite quantity repair and

multiple-site contracts. Standardization of contracts and execution will reduce use of resources, improve the budgeting process and enhance scheduling. It is expected that significant cost savings and reduction in procurement time can be achieved. The new contract guidance should be developed for implementation in FY 95.

4. Unaccomplished Maintenance and Repair (UMAR)

Currently, there is no standard Corps-wide system for identification and tracking of UMAR. Although UMAR has been defined and the budget EC provides for an annual update, results are inconsistent and incomplete. Many projects have an informal system of recording UMAR but the information is not reviewed and reported above the project level. As a result of the current practice, the total needs of the O&M program, both currently and historically, are not identified. Because the total universe of UMAR is not identified, any comparison or prioritization of needs would be flawed. Consequently, critical maintenance or repair could be deferred and funds expended inefficiently.

An annual project UMAR reporting procedure should be established. This procedure would effect the identification, amount and tracking of UMAR. Reporting would be accomplished utilizing consistent guidelines for developing the required information. The resultant report would provide information necessary to include in the earlier described 5-year budget projection, make cost-effective funding allocations, better manage the program, and to present a defensible position regarding the magnitude of the UMAR component of the O&M program. The implementation effort should be initiated immediately for completion by the beginning of FY 94.

C. FUNCTIONAL AREA

Following are discussions of elements from the functional area issues that were selected to warrant high priority attention. These general areas would impact 21 of the 51 issues identified by the Contractor.

1. Flood Control Levee Inspection

The Contractor suggested that a rating system be developed for the condition of Corps-built, locally operated flood protection projects with dams, dikes and levees to reduce the cost of inspections. Flood control projects with excellent histories of maintenance would only be inspected by Corps' staff biennially. Those with fair to poor records of local sponsor maintenance would receive a lower rating and would continue to be inspected annually. Further, engineers at the nearest Corps' projects could perform annual and biennial inspections of completed works rather than district staff.

These recommendations should be implemented with minor changes. Structures should be inspected after major floods regardless of maintenance histories. Also, periods between inspections could be even longer than biennially, if no flooding had occurred since the last inspection, and if previous inspections of maintenance had resulted in high ratings.

This change of policy would give the districts suitable guidance for the inspection of Corps-built, local flood protection projects and still allow a reasonable method to reduce costs with minimal added risk. Travel and inspection costs would also be reduced by having engineers from local Corps' projects perform routine inspections. The responsibility for assuring that maintenance is accomplished would be shifted more to the local sponsors, as it should be, while reducing coordination effort with Corps' inspectors.

Rewriting of the regulation to include this recommendation could be accomplished this fiscal year.

2. Hydropower Plant Remote Control

There is potential for reducing staffing and operational costs of Corps' hydropower plants by converting them, "where practical and cost-effective," to remote control. Some operational functions could then be consolidated into a regional control center. Currently, there is no Corps-wide policy or guidance addressing the criteria that should be considered when evaluating the risks, costs and benefits of remote controlled plants.

A policy should be written so that districts can systematically and uniformly determine the appropriate action when planning the future status of power plants. Thus, the districts would have institutional support for decisions should they decide to implement, or not to implement, the remote control alternatives.

While there are obvious operational cost savings for remoting power plants, there are several disadvantages that could influence a decision. The cost of plant modifications, the function of the plant other than for power production, emergency response times, and climatological differences are some of the factors which must be evaluated as a part of a risk and cost/benefit analysis. Any policy established should focus on an evaluation methodology only. The decision to study and implement a plan for remote control should be at the district level.

3. Lock Dewatering Schedules

The Contractor suggested that consistency between districts and cost-effectiveness of major maintenance activities could be enhanced if all navigation locks were dewatered on a regular, multi-year schedule.

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The group believed that the dewatering of locks should be accomplished on a regular schedule, and that HQUSACE should develop a policy to establish dewatering schedules for maintenance and inspection of navigation locks at regular intervals. The policy should address the consideration of customer input, equitable and scheduled funding, and staffing.

The cost of implementation would involve the development of the policy and studies to determine the appropriate schedules for each waterway. The benefits would be derived from the customer's ability to plan around lock closures, better utilization of Corps staffing, the time and effort saved through routine planning of lock dewatering, and from the routine scheduling expenditures. The development of the policy and the schedules should be accomplished by the end of FY 94.

4. Navigation Lock Operations

The Contractor made recommendations on navigation lock procedures in three separate areas, which should be consolidated into a single regulation.

The first action is to develop a uniform policy so that vessel crews would be responsible for securing vessels in the lock chamber. Although guidance on this issue already exists, it should be reenforced and exceptions made only when lock design or safety considerations make it impractical for a vessel crew to secure its own vessel.

The second area of consideration is in staffing. Staffing could be reduced when a vessel crew is given responsibility for securing its vessel. The Contractor also identified that some Corps locks employ full time, 24-hour a day staffs, even though the locks are seasonally closed. Alternatives for assuring the security of the locks should be explored. The Contractor estimated considerable savings if alarms and fences were used for security instead of full time staff. The group believes that the estimated savings make this a worthwhile area in which to issue guidance so that the districts will be encouraged to consider alternatives.

The third area that should be addressed in a navigation lock policy is equipment. Various equipment that could be installed in these facilities has the potential to reduce costs and/or increase safety. Besides the alarms and fences discussed above, closed circuit TV could be used by lock operators to observe vessel positioning, prevent or respond to accidents or attempted theft of Corps equipment, and monitor the functioning of lock filling and emptying mechanisms. These also may allow staffing to be reduced.

The group believes these ideas should be incorporated into a regulation on navigation locks. The districts would then have guidance to review their processes with the goal of providing uniform operations throughout the Corps at the lowest costs and staffing levels.

Implementation of this issue would have to be accomplished over several years. Defining a policy could be done in FY 93. Reducing staffing by attrition and budgeting of equipment changes would not be fully implemented until FY 98.

5. Hydrographic Surveys

Hydrographic surveys required in conjunction with project maintenance and dredging activities were identified by the consultant as an area of potential management improvement. Critical in surveys is the combination of cost effectiveness, accuracy/quality and timeliness. Current practices, along with the longer term effects of having "professionalized" the Operations management staff, result in the need for and the opportunity to revise hydrographic survey policies and practices.

The primary change proposed is to clearly identify that the Operations Division is responsible for the hydrographic survey function. Clearly, this is not a unilateral decision since it will involve Contracting and Engineering elements. Equally clearly, the timeliness, coordination and quality of hydrographic surveys is most singularly the appropriate responsibility of the Operations Division. Having crews furnished from one organizational element, equipment from another source and contract administration the responsibility of yet another element decreases the responsiveness to dynamic, real world requirements. Focusing the responsibility within Operations would be consistent with the "Project Management" concept and be cost effective.

Explicitly, this proposal includes consideration of such "in-house" equipment and crews as are available; the normal "contract administration" in the field; the decisions relating to need and frequency; and survey methodology. In those cases where the Operations requirements are to be met by "contract" survey, Operations would be responsible for the scope of work definition, funding and field administration, while working with Engineering on selection and contract award and administration.

Further opportunities may be available: to upgrade field equipment and related communications techniques; to provide rapid "read-out" or "plotting"; to redirect dredging effort; conclude work; and complete and release expensive dredging plant more promptly.

Finally, a uniform "cost accounting procedure" needs to be established and enforced based on the 607.11 FCC. This will allow improved data for cost analysis and estimating purposes.

Implementation of the above will require rewriting/updating of several Engineering Regulations (ERs) and should be able to be accomplished within one calendar year from adoption of this proposal.

6. Boundary Inspection

The requirements in ER 1130-2-400 to check all boundary lines every two years and to report missing monuments annually should be modified. Corps lands abut private, commercial, or local government owned or leased land as well as the lands of other Federal agencies. The Contractor recommended that boundary lines with other Federal agencies be re-monumented every four years and that cost-sharing boundary surveys with other agencies should be explored.

The group agreed with the Contractor's evaluation and suggested even further modification. Normally, there are no problems associated with encroachments when other governmental agencies own adjacent land, or when terrain, vegetation, or other natural barriers or man-made structures allow boundaries to be easily identified. In these cases, requiring re-monumentation biennially may not be cost effective nor the best usage of staff. Flexibility should be written into the ER to allow local managers more discretion in deciding when and how boundary surveys are accomplished and emphasize the need to concentrate on areas where non-governmental land owners are adjacent to our lands. The frequency of mandatory re-monumentation needs to be evaluated and a more sensible approach taken in sharing responsibilities and costs with other agencies. This proposal can be implemented this FY by revising the ER, as appropriate. In developing this proposal the need to properly maintain existing lines should be emphasized.

7. Communications Programs

Each District (sometimes each Project Office) individually develops interpretive programs. Many are very well done and could have wide, multiple application. The option proposed was the development of "generic" programs by HQUSACE for use throughout the Corps. The group found that the "generic" programs would be relatively expensive to develop and less popular than field-generated programs. Accordingly, existing examples of excellence should be shared. Further, this concept should be expanded beyond the interpretive program to include all Operations programs from hydropower through recreation to water safety. A mechanism that allows the identification, cataloging, and visibility of field-generated programs on a nationwide basis is needed.

The proposal is that a contractor develop a system for getting an abstract of existent programs in the field, and establish an electronic "catalogue" to be available through Corps Mail. The "catalogue" would initially include: title; abstract; point of contact at origin of program; availability; format; and cost information. This procedure would allow a much broader exchange, reduce redundancy and promote excellence. Eventually, an "issues" communication in conjunction with field "programs" could be utilized to improve communications throughout our organization. Implementation would span about two years.

8. Periodic Inspections

Current regulations require periodic inspections of Corps' projects on a regular five-year basis. The purpose of the inspection is to assure structural integrity and identify any other problems that may threaten the safety of the project. The district's Engineering Division is responsible for assembling the group of experts who will inspect the project. The cost of the inspection is charged to the O&M account for the project.

There is concern that, in some instances, inspections have been conducted on a more frequent basis and the size of the inspection team has been too large. These actions increase the O&M cost of the project and outweigh the concomitant benefit. Districts should assure that the inspection period conforms with current guidance and closely monitor the size and composition of the inspection teams.

III PEER REVIEW

The group, in analyzing the Contractor's findings, recognized that inconsistent and incorrect application of some policies and procedures was costly and confusing. More centralized control would be one option to address this problem. The group believed that a better approach would be to correct the problem where and when it exists rather than exercising greater central control.

That approach would establish a HQUSACE led "Peer Review Team" to review, on a periodic basis, field processes and practices. The team would follow the model of the established Military Construction's Design Construction Evaluation (DCE) teams. The team, led by HQUSACE staff, would be composed primarily of field staff, whose findings would be reported to the District Commander. The team would perform significant on-site training as well as bring major items to the attention of the facility command. The size of the team and the "review period" should be closely monitored to assure that the process is not excessively costly. This process would provide an opportunity to the headquarters' staff to assure that the full range of USACE developed policies were being implemented, and facilitate feedback from the field staff. The dialogue would provide "value added" in both directions (field-headquarters). Guidance to implement peer review is currently being developed by HQUSACE. Although the concept as described above remains intact, details such as team composition and procedures may differ.

IV. REMAINING ISSUES

A. IMPLEMENTATION SUMMARY

As each issue was considered for implementation, a summary report was developed for each item. Tables 1, 1A, and 1B, Implementation Summary, are a matrix of information extracted from each of the individual reports. In Table 1, 1A, and 1B, the "Implementation" column refers to the decision to implement the Contractor's Proposed Option or Action Item. In some cases the Corps has proposed a different option to solve the problem identified by the Contractor. The "Implementation Priority" column refers to the Corps' alternative Implementation Proposal. Those individual reports will be utilized as the basis for further implementation decisions, concerning need and timing, as the impact of the HPP is audited. Many of the remaining actions, while not directly considered for immediate implementation, will be impacted to some degree by the HPP. The Group's recommendations are summarized below.

	<u>Yes</u>	<u>No</u>	<u>Defer</u>	<u>Total</u>
Programmatic	13	8	--	21
General Project Management	23	3	3	29
Functional Area	26	14	11	51
Total	62	25	14	101

All of the problems, identified by the Contractor which resulted in the 101 Action Items were recognized to exist by the Corps. However, many of the 25 "no" issues, most notably in the functional areas, are of more limited scope and are issues for which existing guidance is being interpreted differently or not being followed by some segments of the organization. These types of issues can be resolved by focusing the attention of the entire organization on these problem areas by several media including HQ issued letters, regional workshops, checklists for command inspections, peer reviews, and performance measures. Examples of remaining issues for each category are discussed below:

B. PROGRAMMATIC

The programmatic HPP, while not directly including, at this time, some of the High Impact selected options by the Contractor, will nevertheless impact on those issues. The Contractor suggests that the dredging functions be budgeted and managed separately from other O&M functions. There are also selected options to establish contingency funds and manage all funding decisions for work items at HQ. The group believed changing the method by which the budget is prepared, issuing new guidance for development of the dredging budget, and continuing the current practice of managing periodic and non-recurring work items will accomplish the objective of the

study. Implementation of the HPP should effect a closer correlation between budgets and expenditures and result in an equitable distribution of funds based on national priorities, without inflicting wide swings on district workload. As indicated above, the new budget and execution process will be monitored to determine if further modifications will be necessary to achieve the study objective.

As part of the High Impact Plan, the Contractor proposed new summary exhibits for exposition of the O&M program in budget requests. The exhibits would be intended to present the program consistent with the new proposed way of developing the budget and simplify and clarify the composition of the O&M, General program. This issue resulted from concerns expressed by those who review the Corps' budget request. The group did not include this issue as part of the HPP, but deferred the decision to HQ to develop appropriate presentations once the HPP is implemented. Exhibit 1 is an example of a summary developed by the Contractor (the numbers in the exhibit are for illustrative purposes only). This exhibit could be developed by project, district, division, function and/or FCC, as appropriate.

C. GENERAL PROJECT MANAGEMENT

The HPP implementation proposals in the "general project management" area are those that the group believed would contribute the most toward organization standardization, operational consistency and enhanced management capability. The HPP includes all of the Contractor's High Impact Plan proposals, with one exception, and incorporates other short-and-long term proposals. The exception, development of a Corps-wide automated maintenance management systems, while not included in the HPP, was adjudged to have merit for long-term implementation. After further consideration of the need for a standardized automated maintenance management system, actions have been taken to initiate the development of such a system. This system, which would allow for comparisons of workload, work flow, and productivity, would be complementary to implementation of standardized organization functions and structure and compatible automated data collection and processing systems. Implementation is scheduled for FY 95. An example of a short-term proposal which the group believed should be implemented is the delegation to area/resident/project-managers new procurement authority limits. This is the type of proposal for which sufficient authority exists and can be brought to the attention of those districts, for implementation as practical, through one of the media described above.

IMPLEMENTATION PLAN

BUDGET EXPENDITURES	OPERATION	MAINTENANCE	TOTAL
BASELINE REQUIREMENTS			
Hired Labor	\$325	\$115	\$440
Contracts	100	85	185
Materials and Supplies	40	30	70
Dredging		375	375
All Other	25	5	30
TOTAL BASELINE REQUIREMENTS	\$490	\$610	\$1100
VARIABLE REQUIREMENTS			
Major Rehabilitation		\$75	\$75
Periodic Maintenance		125	125
Major Maintenance		40	40
Equipment Replacement	5	45	50
Dredging		75	75
Special Studies	2	3	5
New Programs	23	2	25
All Other	5		5
TOTAL VARIABLE REQUIREMENTS	\$35	\$365	\$400
TOTAL REQUIREMENTS	\$525	\$975	\$1500

**EXHIBIT 1 - SAMPLE CORPS FY 199__ O&M BUDGET SUMMARY EXHIBIT
"BASELINE-VARIABLE" PRESENTATION (millions)**

D. FUNCTIONAL AREA

1. General

Those issues, evaluated by the Contractor as having high impact in the functional areas, but not included in the HPP, were either items to be deferred for decision depending upon the outcome of ongoing studies or of limited regional concerns. Five of the "no" decisions were in the hydrographic survey function. The group believed an overall review of the policies and practices for that function is of high priority; therefore, all issues associated with the hydrographic function will be revisited in that review. Eleven issues were deferred for decision until completion of ongoing studies in dredging and recreation functions.

2. Recreation

Seven of the deferrals were in the recreation functional areas, all of which the group adjudged to have merit for implementation, but which should be consistent with the outcome of the recreation study. An extensive and in-depth review of the Corps recreation program has been accomplished. The ASA(CW) on 15 January 1993, directed the Corps to execute revisions of appropriate regulations in accordance with an implementation plan presented on 8 January 1993. This plan established a mechanism to review and develop recreation policy, goals and objectives to be communicated through-out the Corps. Those recreation issues identified in this study and deferred for decision will be reviewed within that context. Decisions concerning two of the issues are provided below.

a. Volunteers. A user manual will be completed and published to include guidance on identifying potential duties that could be performed; recruitment, training, and supervision for these labor sources; and case studies of successful programs.

b. Nationwide Reservation System. A task force will be established that will provide leadership and guidance for Corps participation in an interagency nationwide reservation system.

V. IMPLEMENTATION ACTIVITIES

In reviewing the Contractor's findings, it was recognized that the many individual issues were symptomatic of larger overarching organizational needs. Therefore, Program Improvement Goals were adopted to provide an umbrella under which implementation activities could proceed to achieve those goals as listed below.

- Budget Development and Execution Improvement
- Standardized Organizational Structure and Function

IMPLEMENTATION PLAN

- Standardized Operating Procedures
- Performance Measurement Improvement and Standardized Data Collection and Databases

Four Program Improvement Committees have been established to correspond with each of the above goals. These Committees consist primarily of experienced O&M staff from all Corps organization levels and supplemented with appropriate staff from other Corps elements. Staff from the office of the Assistant Secretary of the Army (OASA(CW)) will also be participating in the work of the Committees and in the decision process. Each Committee will be responsible for developing and producing guidance to meet its respective improvement goal. Appropriate review and approval mechanisms by HQUSACE and OASA(CW) have been established. To accomplish that objective, each Committee will consider all of the Contractor's findings and other relevant input. The Committee on Standardized Operating Procedures will consider and develop guidance for all operating procedures for which standard criteria to be promulgated from HQUSACE is appropriate. To address the concerns discussed in Part I, Section II (page 6), a subgroup has been formed to focus on dredging projects. This subgroup, composed of members of the four committees, will consider improvement of the dredging program through development of guidance for budgeting, execution, monitoring and performance within the context of the overall O&M program.

The implementation schedule for each Committee's product was developed within the context of stated goals herein and is depicted on Exhibits 2, 2A and 2B, Implementation Schedule, and in Tables 1, 1A, and 1B. It will be emphasized in development of the Plan of Improvement that should implementation of items result in a reduction in staff, that reduction will be accomplished through attrition.

Exhibits 2, 2A, and 2B are a schematic diagram depicting the implementation schedule for the HPP by category. A detailed plan for implementing each of the HPP items is being developed. Those items which were not included in the HPP will be reviewed and implemented, as appropriate, as the impact of the HPP is assessed. It should be noted that should implementation of items require a reduction in staff, that reduction will be accomplished through attrition.

The goal of implementing the plan of Improvement is to achieve standardization and consistency, for the 36 related entities, in information systems, operating functions and organization structure -- while reducing levels of internal review -- to remain cost effective. The ultimate objective remains that of the study, to assure that Federal expenditures for operation and maintenance of Corps projects provide justified levels of service in the least cost manner.

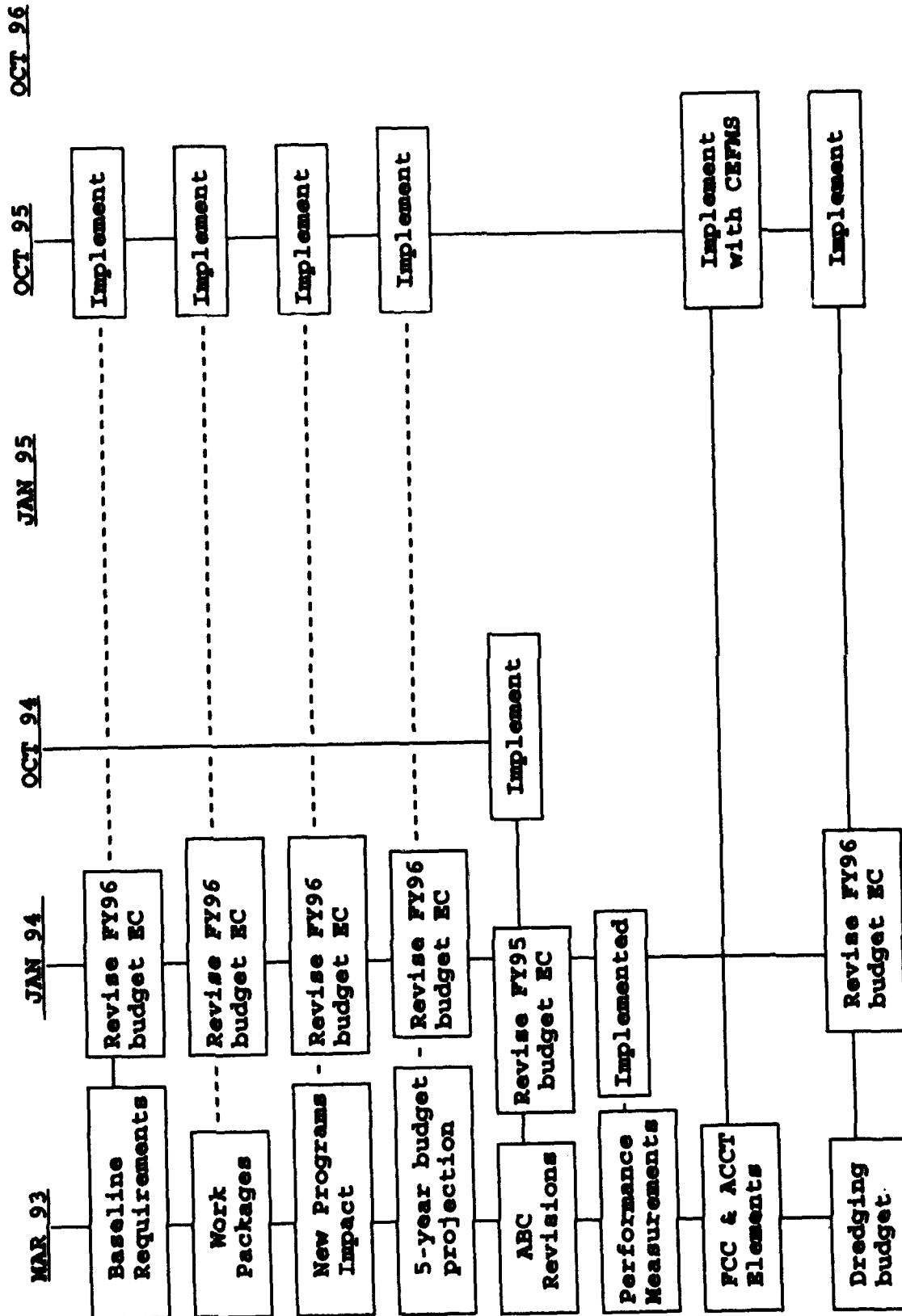


EXHIBIT 2
PROGRAMMATIC HIGH PRIORITY PLAN
IMPLEMENTATION SCHEDULE

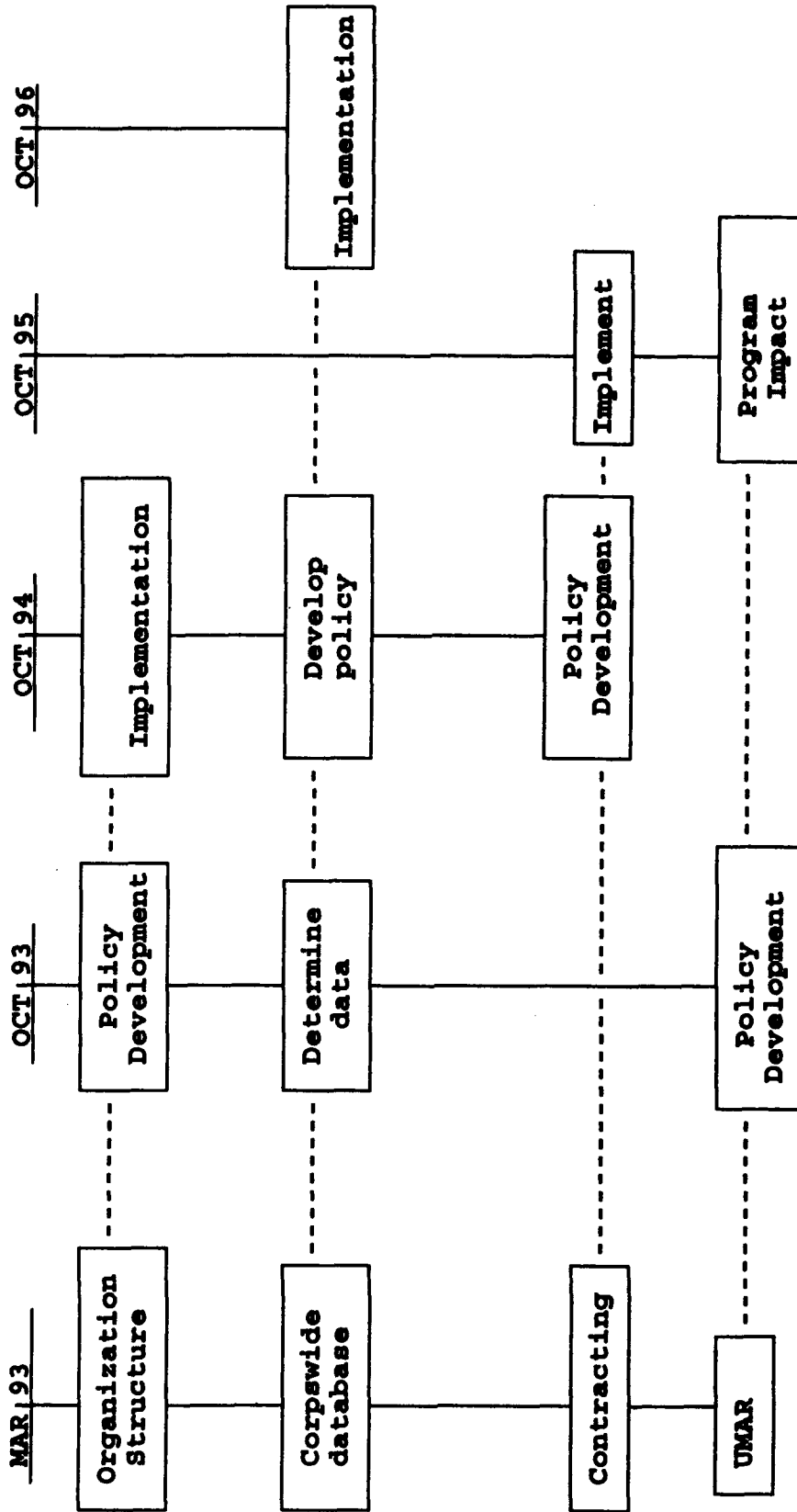


EXHIBIT 2A
GENERAL PROJECT MANAGEMENT HIGH PRIORITY PLAN
IMPLEMENTATION SCHEDULE

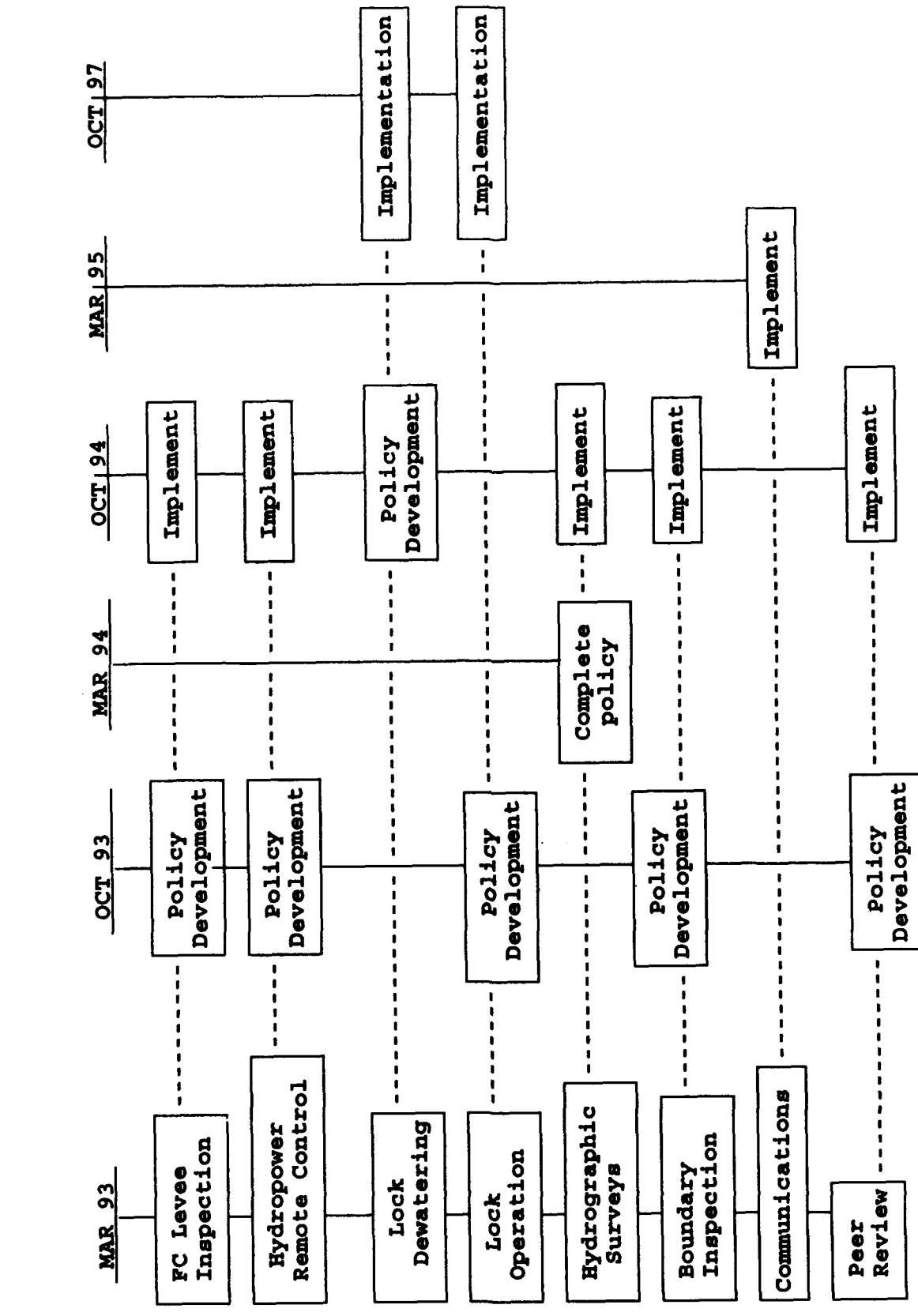


EXHIBIT 2B
FUNCTIONAL AREA HIGH PRIORITY PLAN
IMPLEMENTATION SCHEDULE

IMPLEMENTATION PLAN

**TABLE 1
IMPLEMENTATION SUMMARY
PROGRAMMATIC**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Rebuild O&M funding level 1 and 2 baselines.	YES	Build new baselines.	HIGH	-Reduce preparation effort -Equitable resource allocation	Oct 93
Centralize funding decisions for non-recurring work items.	NO	Continue current practice.	--	Adequately balances national priorities	Oct 93
Fence dredging funds to separate them from other O&M funds.	NO	- Closer scrutiny of budget/exec. - Execute only high priority work.	HIGH	Better and more realistic \$ utilization	Oct 93
Clarify and revise O&M funding level matrix definitions.	YES	Update definitions with new baselines.	HIGH	Improve resource allocation	Oct 93
Prepare a detailed five-year budget for all high cost non-recurring work items.	YES	Prepare 5-year budget for all periodic and non-recurring work.	HIGH	Better management of work items	Oct 93
Require separate line items for new funding demands over \$25,000.	YES	Require separate line items for BY BY-1.	HIGH	Highlights impacts of new \$ demands	Oct 93
Perform random audits of district level reprogramming activities.	NO	- Clarify reprogramming guidance. - Greater division oversight.	HIGH	More consistent execution IAM budget criteria	Jun 94
Drop the O&M expenditure/obligation goals.	NO	NONE	--	Current goals provide incentive	Jun 94
Provide additional FCC sub-features and AE definitions.	YES	- Reinforce 1-hr rule. - Implement with CEFMS.	HIGH	Better cost accounting	Jun 94
Implement a recapitalization program for O&M projects.	YES	Pursue recapitalization program.	HIGH	Greater certainty of rehab	---
Provide additional O&M program summary exhibits for annual O&M budget request.	YES	Should be addressed by HQ.	MEDIUM	HQ - ASA(CE) further consideration	Oct 93

* Target date for committee to develop policy for implementation.

TABLE 1 (continued)
IMPLEMENTATION SUMMARY
PROGRAMMATIC

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Decrease level of detail in baseline budget submittals.	YES	Reduce funding packages to one per project or feature.	HIGH	- Reduced effort - More defensible budget	Oct 93
Develop separate dredging funding policies and procedures.	PARTIAL	Prepare guidance for budget estimates.	HIGH	- Increase accuracy - Budget more defensible	Oct 93
Develop special guidance on developing project dredging budgets.	YES	Same as above.	HIGH	----	Oct 93
Maintain current policies on minimum cost thresholds for major rehabilitation projects.	YES	Maintain current practice.	---	----	Jun 94
Establish a dredging contingency fund at the HQUSACE level.	NO	NONE	---	Current practice sufficient for changing demands	Oct 94
Establish a separate emergency O&M fund at the HQUSACE level for non-dredging work items	NO	NONE	---	No serious disruption of programs by emergencies	Jun 94
Adjust the dollar reprogramming transfer limit for inflation.	NO	NONE	---	Current limit causes few problems	Jun 94
Apply expenditure and obligation goals to current work allowance schedules for CMAs.	YES	Use current schedule and not initial allocation as goal.	HIGH	Incentive to identify excess \$	Compl.

IMPLEMENTATION PLAN

**TABLE 1 (continued)
IMPLEMENTATION SUMMARY
PROGRAMMATIC**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COM-MITTEE ACTION*
Allow projects to implement non-appropriated funds for natural resource and recreation-related work items.	NO	NONE	---	Current regulations adequately address issue	Jun 94
Provide a standardized PC Format for automated entry into the ABS by Projects.	YES	Continue development under IOMT program.	HIGH	Better and more consistent data entry	Oct 93

TABLE 1A
IMPLEMENTATION SUMMARY
GENERAL PROJECT MANAGEMENT

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Develop an updated Corps district/project organizational manual.	YES	Develop standard function and organization structure.	HIGH	<ul style="list-style-type: none"> - Consistency - Effective staffing - Improve communications 	Oct 93
Develop new Corps-wide Maintenance management system.	YES	Revise maintenance management guidelines.	LOW	<ul style="list-style-type: none"> - Eliminate redundancy - Consistency 	Oct 95
Establish an annual report of Corps-wide unaccomplished maintenance and repair costs.	YES	Establish annual reporting procedure for UMAR.	HIGH	<ul style="list-style-type: none"> - Efficient allocation of \$ - Better prioritization 	Oct 93
Reduce emphasis on overhead rates.	YES	De-emphasize.	LOW	<ul style="list-style-type: none"> - Consistency - Accurate comparisons 	Oct 94
Expand the initial cost to output performance analysis to identify cost-output relationships.	YES	Determine essential management data and develop standard data base.	HIGH	<ul style="list-style-type: none"> - Standardization - Compatibility - Reduce resources 	Jun 94

IMPLEMENTATION PLAN

**TABLE 1A (continued)
IMPLEMENTATION SUMMARY
GENERAL PROJECT MANAGEMENT**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Establish new procurement authorities based on size and scope of project(s) managed.	YES	Implement.	MEDIUM	More timely and cost effective procurement	Oct 93
Assign one Operations Division employee to act as liaison to district IMO/LMO staff.	DEFER	Assess as part of standard organization function.	LOW	Review of current practices	Oct 93
Publish a Corps-wide, cross functional O&M newsletter.	YES	See "Communications" in functional area.	HIGH	Improve communications	Mar 94
Set file and data compatibility standards for all types of software.	YES	- Standardize compatibility. - Divisions set purchasing policy.	MEDIUM	Some \$ savings	Apr 95
Establish separate SRUP and non-SRUP sub-FCCs for recreation facility routine O&M vs. non-routine expenditures.	DEFER	Implement - Await outcome of recreation study.	MEDIUM	- Consistency - Better tracking of \$	Jun 94
Modify alternate work schedule guidance to allow seasonal changes.	YES	Revise OM to allow flexibility.	LOW	- Increase productivity - Enhance service	Oct 93
Update and provide electronic copies of all regulations to divisions and districts.	DEFER	Select best option.	LOW	- Operations uniformity - Resource allocation	Oct 95
Digitize only new and frequently used project drawings.	NO	Study need at projects.	LOW	Not widespread problem	Oct 94
Develop a Corps-wide maintenance inspection program.	YES	Implement.	MEDIUM	- Consistency - Performance management	Oct 94
Enforce overhead charge policies regarding rent and ADP through random audits of district cost accounting procedures.	YES	Enforce policies by random audit.	LOW	- Consistency - Standardization	Oct 94
Charge districts for HQUSACE activities based on direct labor before the effective rate is applied.	YES	Implement.	LOW	Equitability	Mar 94

TABLE 1A (continued)
IMPLEMENTATION SUMMARY
GENERAL PROJECT MANAGEMENT

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Bundle similar services at nearby projects into single, multi-site contracts.	YES	Develop standard contract policy and contracts.	HIGH	- Reduced costs - Reduced time - Improved process	Oct 94
Develop Corps Service Contract Guidelines for field activities.	YES	" "	HIGH	" "	Oct 94
Develop indefinite quantity repair contracts for maintenance services.	YES	" "	HIGH	" "	Oct 94
Determine minimum and maximum requirements for spill containment materials.	YES	Provide HQ guidance, verify compliance as part of ERGO inspection.	LOW	- Reduce costs - Improve response	Oct 93
Develop a centralized project data recording, reporting, and maintenance system.	YES	See cost to output database item above.	HIGH		Jun 94
Require that recurring reports be submitted in an electronic format, to be provided by originators.	YES	" "	HIGH		Oct 93
Develop a policy on the type and number of heavy equipment pieces that projects should retain. Require projects to lease heavy equipment from district LMO equipment pools.	YES	Develop a policy for # and type of heavy equipment for project.	MEDIUM	- Better inventory - Efficient allocation - Better justification	Oct 94

IMPLEMENTATION PLAN

**TABLE 1A (continued)
IMPLEMENTATION SUMMARY
GENERAL PROJECT MANAGEMENT**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Revise ER 1130-2-304 to include more project specific equipment information. Update project O&M manuals every 10-15 years.	YES	- Revise ER. - Develop guidelines. - Review & update manuals.	LOW	- Provide current info - Establish consistency	Oct 94 Oct 93
Develop specific data requirements in developing automated systems for general or maintenance management.	YES	Develop guidelines for district/division decision.	LOW	- Regional consistency - Cost savings	Jun 94
Establish one central major maintenance center in each district, by functional area, if feasible.	YES	Develop standard function and organization structure.	HIGH	- Effective use of resources - Consistency	Oct 93
Institute equipment interchangeability review at each district.	NO	Review program at each District to determine need.	LOW	Medium to low impact	Oct 94
Have each district Operations Division staff develop its own technical support requirements.	NO	Continue current practice.	----	Current practice is most acceptable by all functions.	Oct 93
Allow district Operations Divisions to procure technical support from A/G firms where cost effective.					
Analyze cost-effectiveness of program services provided by each division to its districts.	YES	Require cost analysis and allow other sources where \$ savings.	LOW	Cost effectiveness	Oct 95

TABLE 1B
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
<u>HYDROPOWER</u> Convert power plants for remote control operations where cost-effective.	YES	Develop policy and evaluation methodology	HIGH	- Manpower and cost efficiency - Consistent evaluations	Oct 93
Convert unskilled powerhouse laborers to the Wage Grade Scale from the Power Trades Scale.	NO	Current practice	LOW	Current practice mandated by law and union agreements	---
Use the power "generated to requested" ratio as a performance measure.	NO	Use current performance measure	---	Current measure provides productivity incentive.	Jun 94
Allow Engineers assigned to projects to prepare designs and contract specifications within cost/functional area parameters.	NO	See similar item in General Project management	---		Oct 95
<u>FLOOD CONTROL</u> Justify the conversion of spillway gate to remote control on a case-by-case cost basis.	YES	Current practice	---	Current practice is most efficient	Oct 93
Update project and basin water control manuals at least every ten years.	NO	Current practice	---	HOUFACE is currently reviewing and scheduling updates	Oct 93
Reduce the frequency of inspection of some Corps-built, locally operated flood control projects based on past maintenance history. Stress the utilization of field staff to perform routine inspections of remote Corps-built, locally operated flood control projects.	YES	- Reduce inspection frequency - Utilize field staff	HIGH	- More efficient use of staff and dollars - More local control	Oct 93

IMPLEMENTATION PLAN

**TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
<p>RECREATION</p> <p>Review all visitor centers and adjust size or funding to meet resources. Require written justification for visitor center enlargements</p>	DEFER	Should be consistent with National Recreation policy review.	MEDIUM	<ul style="list-style-type: none"> - Implementation of recreation items should be consistent with a national policy - Corps is reviewing overall recreation policy 	Oct 95
<p>Use SRUF funds for routine O&M costs of SRUF areas rather than for expansion projects. Require written justification for SRUF area enlargement/improvement.</p>	DEFER	"	HIGH	<ul style="list-style-type: none"> - Decision to follow action item proposal in FY95 budget guidance 	---
<p>Develop new national "Project Brochure" format. Allow intensive marketing only by underutilized Corps' projects.</p>	DEFER	"	MEDIUM	"	Oct 95
<p>Restrict volunteer awards to certificates at all districts and projects. Submit lists of potential volunteer duties to the District Safety Office for review.</p>	DEFER	"	MEDIUM	"	Apr 94 Oct 93
<p>Consolidate all Corps-operated campsite reservation requests to a single nationwide phone number.</p>	DEFER	"	LOW	"	Oct 95

TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Reduce boundary monumentation maintenance on boundaries shared with other Government agencies.	YES	Modify boundary inspections policy	HIGH	Manpower and dollar efficiency	Oct 93
Reduce boundary inspection frequencies for projects built prior to 1971.	YES	Modify boundary inspections policy	HIGH	Manpower and dollar efficiency	Oct 93
Develop an economic model for use in setting campground operating seasons.	DEFER	Should be consistent with National Recreation policy review.	MEDIUM	----	Oct 95
Centralize generic interpretive program development at the HQUSACE level.	YES	- Develop catalogue of existing programs - Centralize availability - Develop info. exchange system	HIGH	- Reduce dollar - Standardization - Improved information transfer - Improved quality	Mar 95
Sell plots of Corps land up to \$1,000 in value to cure minor encroachments.	YES	Revise guidance to allow non-litigable strategies including sale of small parcels	MEDIUM	- Reduce time and resources - Improved public relations	Oct 93
Issue guidelines on meeting current accessibility requirements for campgrounds cost-effectively.	DEFER	Should be consistent with of National Recreation policy review.	HIGH	----	Oct 95

IMPLEMENTATION PLAN

**TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
<u>NAVIGATION LOCKS</u>					
Establish Corps-wide vessel-securing procedure	YES	Reinforce policy that vessel crews secure vessels	HIGH	Cost and manpower efficiency	Oct 94
Use alarms and fences rather than staff seasonally closed locks during closure periods.	YES	Develop policy for evaluation and implementation of alternatives to staffing	HIGH	Cost and manpower efficiency	Oct 94
Require vessel operators to secure mooring bits to their vessels.	YES	Develop policy for evaluation and implementation of alternatives to staffing	HIGH	Cost and manpower efficiency	Oct 93
Install CCTV to assist in lock monitoring at some locks.					
Adjust staffing at locks to meet seasonal traffic patterns.					
Install CCTV at locks where there is a cost benefit.	YES	Develop policy for evaluation and implementation of alternatives to staffing	HIGH	Cost and manpower efficiency	Oct 93
Utilize Corps-wide procurement of equipment in order to decrease costs and increase standardization of equipment.	NO	Do not implement	LOW	- High costs - Bad experience - Have centralized practical items	Oct 95
Dewater all Corps locks on a regular, multi-year schedule.	YES	Require dewatering schedule for regions or waterways	HIGH	- Maintenance and cost savings - Enhance industry planning	Oct 94
Develop guidelines for setting Five-year Periodic Inspection team composition and size.	PARTIAL	Follow current guidance	HIGH	- Cost and manpower efficiency	Oct 93
Install gate protecting devices/systems at selected Corps-operated locks.	YES	- Coordinate with industry to determine policy	HIGH	Determine industry need and potential for cost-sharing	Oct 93

TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
<p><u>NAVIGATION DREDGING</u></p> <p>Decrease revetment crew sizes and increase operating season.</p> <p>Dissolve productivity inhibiting district revetment agreements, and operate crews more efficiently as separate entities.</p>	DEFER	LMVD should examine issue	MEDIUM	Not a national program wide item	---
Eliminate one Corps hopper dredge and increase operating season for those remaining.	DEFER	Await decision on minimum fleet study	---	Ongoing minimum fleet study will provide basis for decision	---
Do not exceed Federal dredge material test standards without additional state funding.	YES	Enforce current regulation	MEDIUM	States should bear cost of testing above EPA standards	Oct 94
Utilize alternative labor sources for short-term dredge boat requirements.	NO	Review existing TDY policy for cost efficiency	LOW	District specific issue	Oct 95
Compare dredge crew travel cost alternatives.					
Discontinue maintenance on unused dredging equipment.	YES	- Reduce maintenance on unused equipment and "cosmetic" items - Do not follow mil spec	MEDIUM	Monitor impact of reduced maintenance on capability	Oct 93
Reduce cyclical "cosmetic" maintenance on dredge equipment.					
Eliminate military specification-driven maintenance policies for civil works dredges.					
Retain current dredging inspection requirement where cost-effective compared to automated dredge monitoring equipment.	YES	Continue current practice	MEDIUM	Evaluate effectiveness of current practice versus new systems	Oct 95

IMPLEMENTATION PLAN

**TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA**

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Combine small maintenance dredging tasks into a single contract. Use a firm fixed-price contract instrument with option years for annual maintenance dredging requirements when practical.	YES	See similar items in General Project Management	HIGH	-----	Oct 93
Require district Operations Divisions to prepare routine maintenance dredging contracts	NO	Continue current practice	---	-----	Oct 93
Obtain and compare dredging cost estimates from Corps and contractor dredge crews prior to assigning dredging tasks. Obtain detailed cost estimates from Corps dredge crews and hold them responsible for all costs submitted.	NO	Follow current regulations	LOW	- Difficult to obtain and compare estimates - Practice being followed in most cases	Oct 94
Require historical data and other justification prior to advanced maintenance dredging.	NO	Enforce current regulation	MEDIUM		Oct 93
Develop a standardized dredge boat maintenance management system.	YES	Develop standardized reporting format	MEDIUM	Identify software package	Oct 94
Develop standardized upland disposal area testing requirements.	DEFER	Develop standard testing procedure	LOW	Await completion of NES effort	Oct 94

TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
<u>NAVIGATION HYDROGRAPHIC SURVEY</u> Relate hydrographic survey type and frequency to project characteristics.	YES	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	HIGH	- Effectiveness - Accuracy - Quality - Timeliness	Mar 94
Reduce hydrographic survey frequencies for some projects. Utilize depth data from user groups to supplement Corps survey data.	YES	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	HIGH	"	Mar 94
Specify hydrographic survey quality standards and have them performed more cost-effectively.	YES	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	HIGH	"	Mar 94
Use a Government inspector to verify contractor-performed hydrographic survey work, or verify by sampling resurveying.	NO	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	MEDIUM	Enforce current policies and procedures	Mar 94
Require Operations Divisions to manage in-house hydrographic surveys, crews and equipment and contracts at all districts. Require district Operations Divisions to manage all hydrographic survey contracts, but not contractor selection.	YES	See similar item in General Project Management.	HIGH		Oct 94

TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COMMITTEE ACTION*
Mandate the use of Revolving Fund hydrographic survey equipment.	NO	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	LOW	Enforce current policies and procedures	Mar 94
Establish district hydrographic survey equipment stock level standards.	YES	"	MEDIUM	Implement with CEFMS	Oct 95
Change all hydrographic survey expenditures to the appropriate subfeatures of FCC 607.	YES	"	MEDIUM		Oct 95
Develop a standardized, Corps-wide hydrographic survey software package.	DEFER	"	MEDIUM	Needs further technical analysis to assure efficient detail	Oct 95
Use longitudinal hydrographic survey techniques rather than cross-sectional surveying when practical.	YES	"	HIGH		Oct 95
Develop better Corps/Contractor communication processes to facilitate "survey for payment" responses.	NO	"	LOW	Individual districts should determine need for implementation	Oct 95
Require districts to complete and distribute hydrographic survey data within 5 days.	YES	"	MEDIUM	Individual districts should determine need for implementation	Oct 95
Adjust hydrographic survey work schedules to match workload fluctuations.					
Revise the OPM series and grading structure for hydrographic surveyors.					

TABLE 1B (continued)
IMPLEMENTATION SUMMARY
FUNCTIONAL AREA

CONTRACTOR'S ACTION ITEM	IMPLEMENT	IMPLEMENTATION PROPOSAL	IMPLEMENTATION PRIORITY	REASONS FOR DECISIONS	COM-MITTEE ACTION*
Develop and field an automated system for managing all aspects of hydrographic survey information.	NO	Review and revise regulation relating to all hydrographic surveying practices with particular attention to contractors' actions items	LOW	Disadvantages (cost, time) outweigh advantages	Oct 95
Develop standards for the number and types of hydrographic survey vessels and trailers districts should own and maintain. Develop guidelines for the purchase of hydrographic survey communications equipment by districts.	NO		LOW	Decision should be left to district	Oct 95

IMPLEMENTATION PLAN



NATIONAL OPERATION AND MAINTENANCE PROGRAM PLAN OF IMPROVEMENT

PART II STUDY CONDUCT AND FINDINGS

I. INTRODUCTION

The purpose of Part II of this report is to document the Policy and Procedures options study for project Operation and Maintenance (O&M study) as follows:

- Overview of the operation and maintenance program.
- Conduct of the study.
- Assessment of current operation and maintenance practices.
- Opportunities for improvement.

The Operation and Maintenance (O&M) function is the largest component of the U.S. Army Corps of Engineers Civil Works Program. The O&M function accounts for about one-half of the Civil Works expenditures and supports about 55 percent of the total workforce. The approximately 1400 projects in the inventory are geographically dispersed throughout the United States, represent diverse, often competing, functions and serve many different customers.

The program, like all other Federal programs, has come face-to-face with the exigencies of deficit reduction and budgeting limitations. The growth of project inventory, increasing age of projects and customer demand for greater levels of service have placed increasing pressures on constrained resources. Additional factors which further complicate operation and maintenance of projects include: differing maintenance management styles of the various divisions/districts/projects; difficulty of prioritizing and funding project requirements two to two-and-a-half years before actual expenditure; difficulty in predicting, from Headquarters level, the ultimate impacts of directed program cuts on remote field organizations; and, the need to accommodate unfunded requirements which can arise due to factors beyond Corps' control. To continue to provide the most efficient and effective stewardship of the Nation's water resources infrastructure, the Corps' leadership recognized that a comprehensive review of current practices was imperative. This comprehensive study would identify areas in which improvements could be made to current operating and management practices to structure a program that would best utilize available resources.

The Corps, Office of the Assistant Secretary of the Army (Civil Works) and the Office of Management and Budget reached a consensus that a comprehensive study was necessary and timely and should investigate new methods of financing and executing the program. As the Administration

sought approval and funding from Congress for the study, concerns arose regarding some of the proposed investigations. Accordingly, to proceed, it was agreed that divestiture of all or part of a Corps' project, additional contracting out of work performed by Corps' employees, and initiatives that would lead to changes in current procedures for pricing hydropower at Corps' projects, would not be investigated as a part of this study. The study was initiated by awarding a contract in June 1991 to Management Analysis, Inc., a McLean, Va. firm. The contract was completed in September 1992.

II. OVERVIEW OF THE OPERATION AND MAINTENANCE PROGRAM

A. GENERAL

It is the responsibility of the Corps to develop, control, maintain, and conserve the Nation's water resources in accordance with the laws and policies established by Congress and the Administration. Civil Works activities include planning, designing, constructing and operating and maintaining water resources projects. Such works provide for management and improvement of rivers, harbors, and waterways, for navigation, flood control, multiple-use purposes and shore protection projects or programs. Responsibility for the operations, maintenance, repair and replacement program of Civil Works projects has been lodged in the Operations, Construction and Readiness Division of the Civil Works Directorate.

B. EXISTING POLICIES AND PROCEDURES

Laws and policies which provide the authority for operation and maintenance activities of Corps' projects are embodied in regulations which provide guidance on the methods and requirements of the O&M program. This section discusses the existing regulations and policies which govern O&M program activities of operations, maintenance, repair, replacement, and rehabilitation. Operations consists of the daily tasks which allow the project to meet its functional mission in the most efficient possible manner. Maintenance is the performance of scheduled tasks to minimize the possibility of malfunction or breakdown of equipment. Repair is the maintenance required upon failure of equipment. Replacement is the removal of existing equipment and subsequent new installation. Rehabilitation is the refurbishment of equipment or facilities which requires repair or replacement of major components.

The Corps operates as a decentralized organization, placing as much responsibility and authority at the district level as possible. Operation and maintenance guidance is developed at the Headquarters level and distributed to the field for implementation. Due to the wide variation in project purpose, age, size, etc., many of the policies and regulations are written to provide the field with as

much flexibility as possible. Divisions/districts/projects then implement the guidance based on interpretation of how the generalized guidance applies to their specific situation(s).

Formal authorities and directives may be contained in Public Laws, Federal Regulations, Department of the Army Regulations, or Corps of Engineers Regulations.

Examples of Public Laws applicable to the Corps' O&M program include Water Resources Development Acts, Water Project Recreation Act (PL 89-72), and the National Dam Safety Act (PL 92-367). For further descriptions of public laws applicable to the Corps' O&M program, see Chapter 26 of the Digest of Water Resources Policies, EP 1165-2-1.

Federal regulations are those which apply to all departments of the Federal Government, including the Department of Defense and the Corps of Engineers, and are established by the Executive departments and agencies of the Federal Government. The Code of Federal Regulations (CFR) Section 33, Navigation and Navigable Waters, is an example of these documents.

Department of Army regulations (AR) govern the activities of Army components, including the Corps of Engineers. Army regulations apply to all functions of the Army, except those which have been modified by engineering regulations. Applicable Army regulations include AR 405-70, Utilization of Real Estate and AR 335-15, Management Information Control System.

Corps of Engineers regulations include engineering circulars (EC), engineering manuals (EM), engineering pamphlets (EP), engineering regulations (ER), official memorandums (OM), and engineering technical letters (TL). Other forms of guidance used by the Corps are directives and policy guidance letters. Engineering regulations present formal guidance for the performance of work. Engineering circulars are temporary documents which explain the policies addressed in the ERs. Engineering pamphlets are permanent documents which provide examples and discussions of the guidance found in the regulations. Engineering manuals are documents which present official design criteria for the Corps. Official memorandums and engineering technical letters are informal documents written to assist in further understanding of a policy or to inform personnel of a change to a document. Applicable examples of these documents include: ER 37-1-24, Operating Budgets; EC 11-2-157, Annual Program and Budget Request for Civil Works Activities; EM 1110-2-2703, Lock Gates and Operating Equipment; and EP 25-1-1, Index of Publications. A list of regulations and policies applicable to the O&M function is included as Appendix 1.

C. PROGRAM INVENTORY

The Corps' project inventory includes approximately 230 locks and dams, 500 reservoirs, 76 hydroelectric power plants, 800 commercial harbors, and 2500 separate recreation areas at over 460 projects. This inventory has an estimated replacement value of more than \$120 billion. The average

STUDY CONDUCT AND FINDINGS

age of structures is 34 years and 23 percent of Corps' facilities are over 50 years old. In addition to the aging of the existing inventory, growth in total project load continues as new projects are completed. The budget for the O&M program has grown over the past decade at less than the rate of inflation, leading to a decline in real dollars available per site. A summary of expenditures for operation and maintenance for fiscal years (FY) 1981 through 1990, in actual dollars, is displayed in Exhibit 3. A similar display, in FY 90 dollars, is provided as Exhibit 4.

Typically, about 800 projects are included in the O&M budget request for any one fiscal year. A "project", for budgeting purposes, is defined using a Civil Works accounting (CWIS) number and may represent more than one individual structure or functional unit, i.e., several contiguous locks and dams on the same waterway may be combined for budgeting purposes into a single "project". Some projects which are included in the budget may not require expenditures in the fiscal year for which the budget is prepared and some projects which are not included in the budget may require expenditures. For example, in FY 89, 1,022 projects were included in the budget and/or required expenditures. Of that total, 789 were budgeted for, and 994 received expenditures.

The relative size of the project inventory can be inferred from the following display of FY 89 budget/expenditure data.

<u>FY 89</u> <u>O&M Requirement</u>	<u>Percent of</u> <u>Total Expenditure</u>	<u>Number of</u> <u>Projects</u>
Less than \$2 million	25	828
\$2 million - \$10 million	49	169
Greater than \$10 million	26	25

Of the projects in the "less than \$2 million" category, 280 required expenditures less than \$100,000.

D. ORGANIZATIONAL STRUCTURE

The U.S. Army Corps of Engineers is one of 12 major Army commands operating within the continental United States. The agency is made up of divisions which report directly to the Headquarters in Washington, D.C. Divisions are further divided into districts. Division and district boundaries usually follow watershed boundaries. There are 11 divisions within the Corps, 10 of which are included in this study. (The Pacific Ocean Division, which has a minimal civil works mission, was specifically excluded from the scope of this study.) Within the 10 divisions, there are 36 districts. Exhibit 5 shows an organization chart for the Corps of Engineers. Exhibit 5A depicts the Corps organization structure as realigned in a recently established reorganization plan.

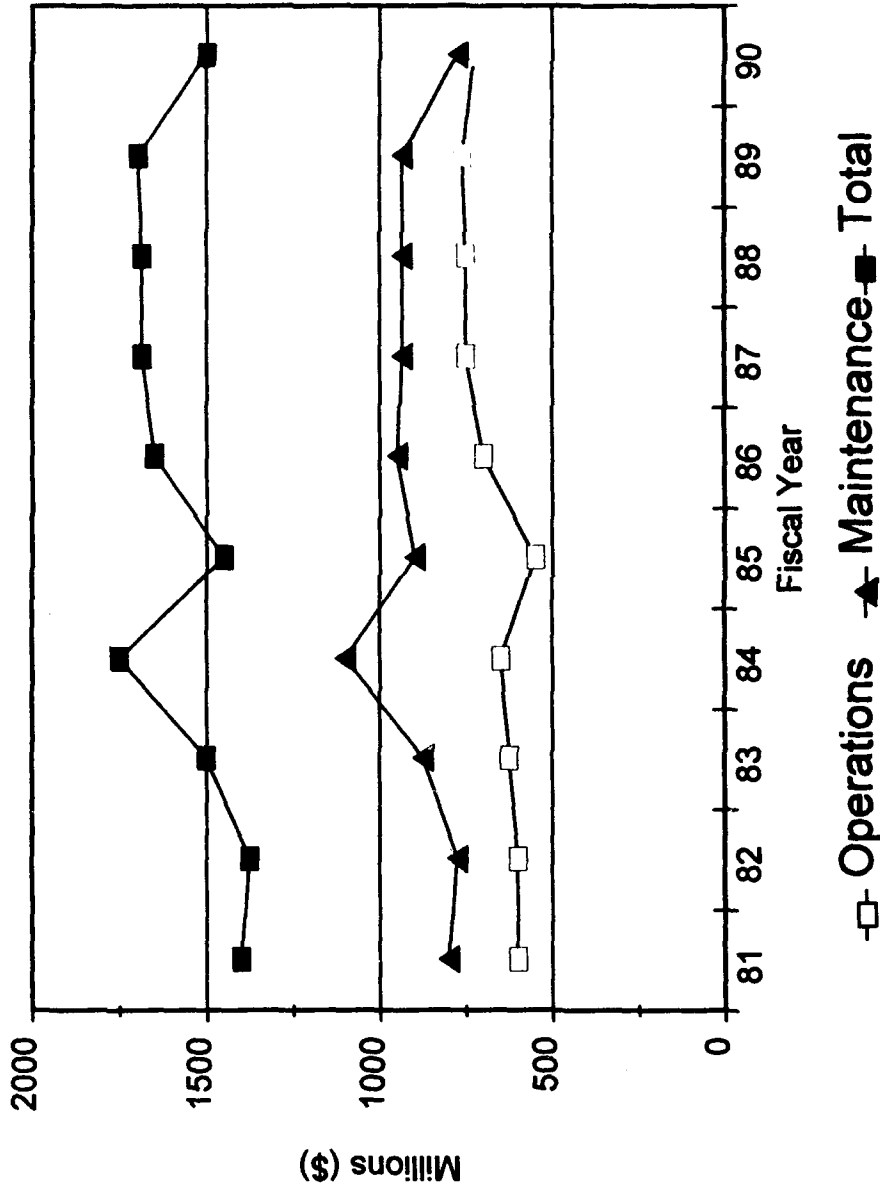


Exhibit 3
**OPERATION AND MAINTENANCE
 EXPENDITURES FY 81-90
 ACTUAL DOLLARS**

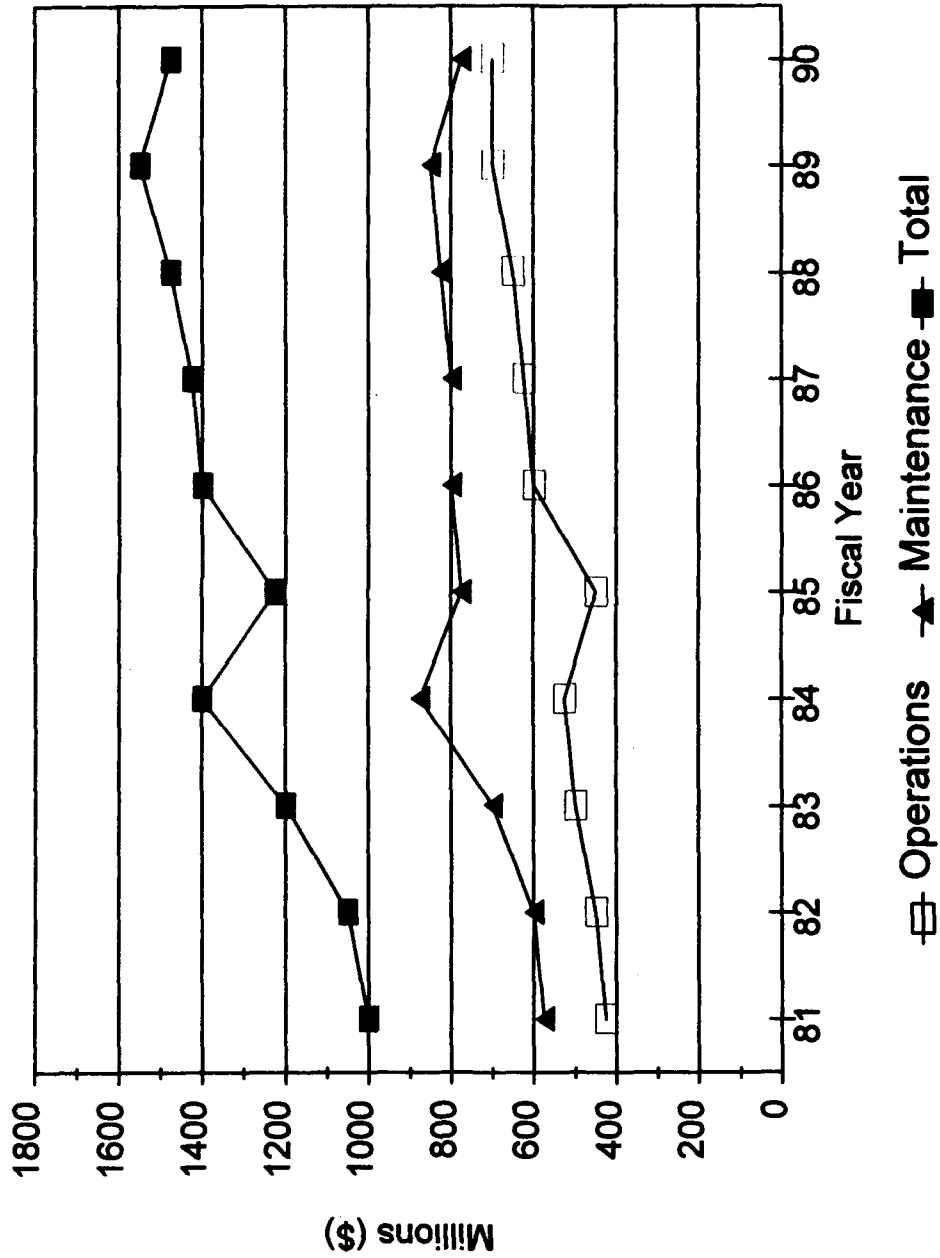
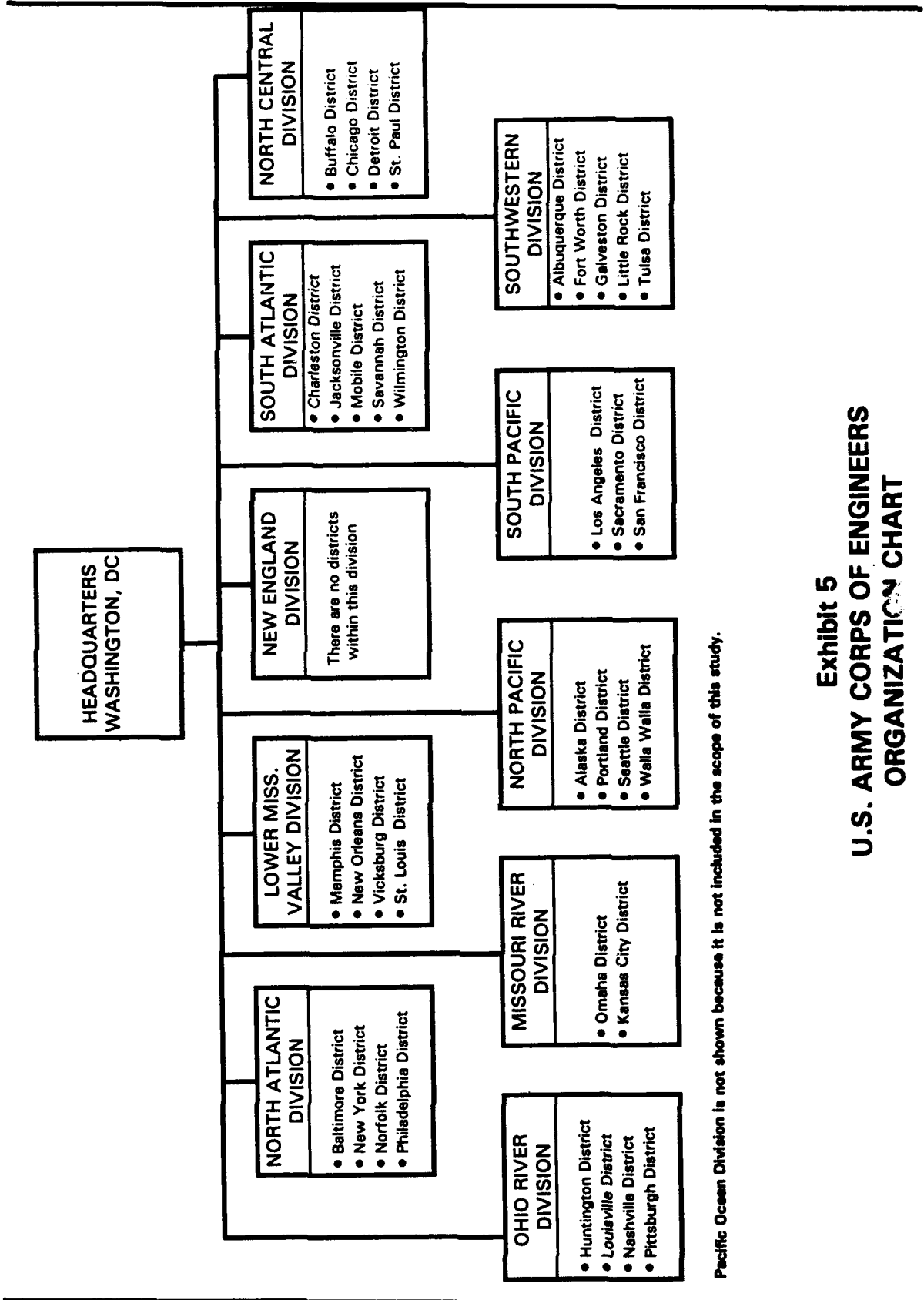


Exhibit 4
**OPERATION AND MAINTENANCE
 EXPENDITURES FY 81-90
 FY 90 DOLLARS**



Pacific Ocean Division is not shown because it is not included in the scope of this study.

Exhibit 5
U.S. ARMY CORPS OF ENGINEERS
ORGANIZATION CHART

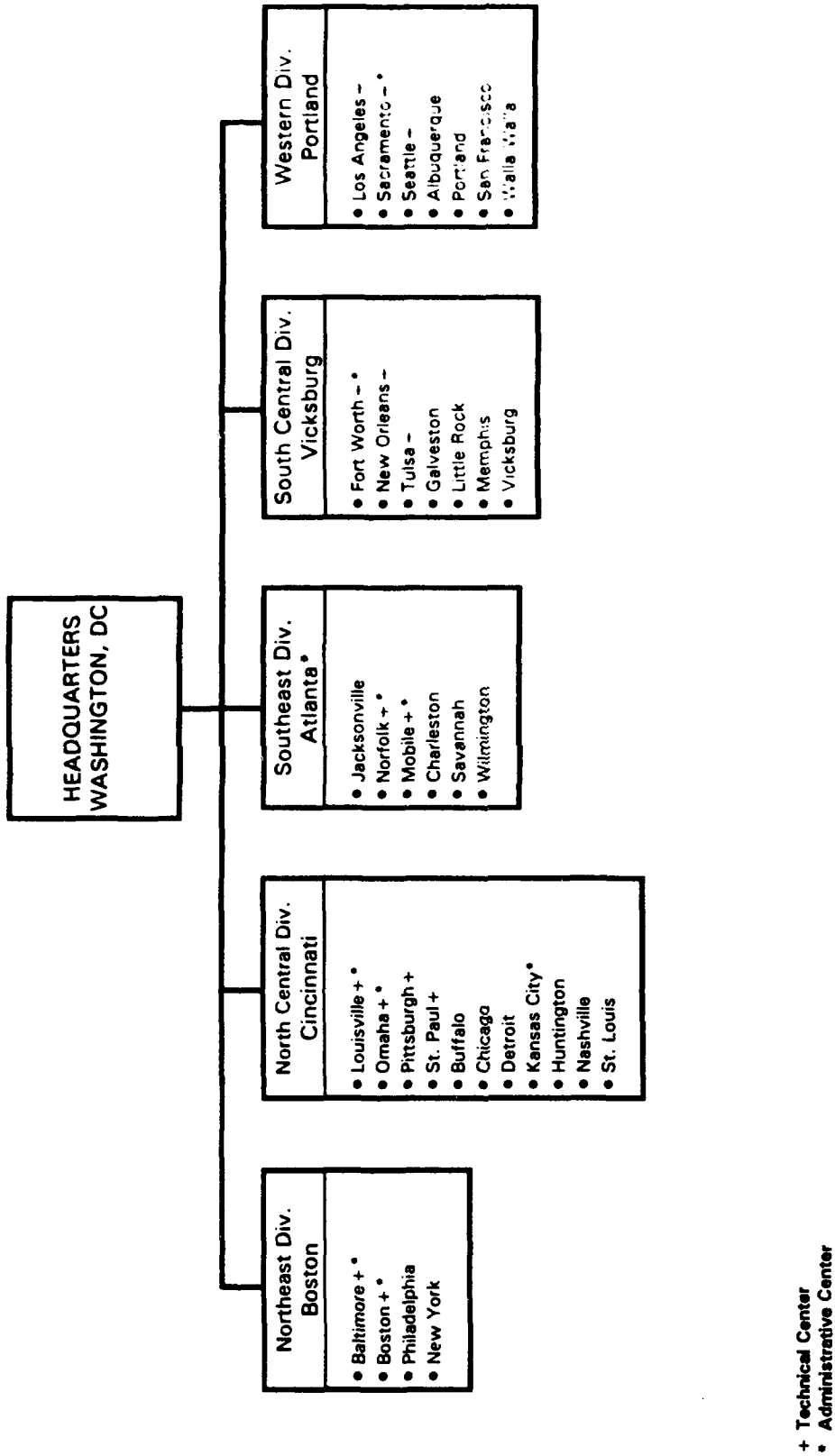


Exhibit 5A
U.S. ARMY CORPS OF ENGINEERS
REORGANIZATION STRUCTURE

There is no standard organizational structure within divisions and districts. Each is organized into functional divisions, for example, Operations Division, Engineering Division, Construction Division, and Planning Division. The Construction and Operations Divisions are combined into a Construction-Operations Division in some districts, but not in others. The same is true for Planning and Engineering Divisions, and other functional divisions as well. The division and district organizational structures are based on factors such as the division or district's mission, the types of projects operated and maintained, the level of workload activity, and the staffing available. Also, depending on the types of projects managed, and the location of the projects, there may be Area Offices or Project Offices within a functional district organization. Exhibit 6 shows the typical interrelationships of these offices.

Currently, about 27,000 full time equivalent (FTE) civilian positions are employed to carry out the civil works missions. Of that total, approximately 14,500 support the operation and maintenance activities covered by this study.

E. BUDGET AND PROGRAM EXECUTION PROCESS

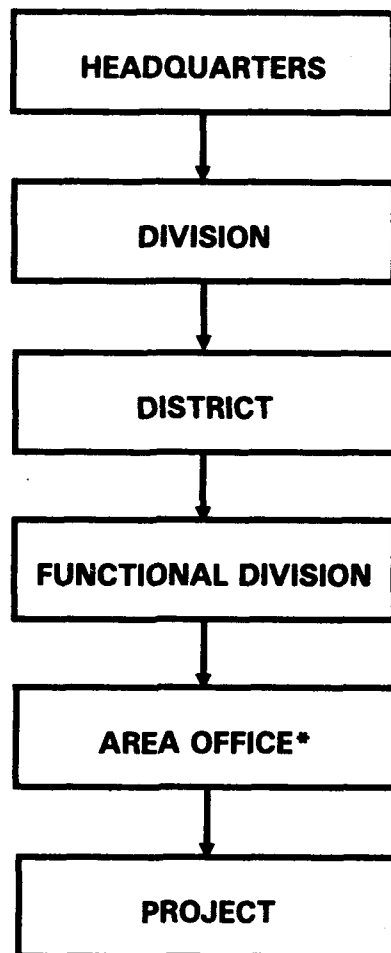
The O&M budget is developed in accordance with guidance contained in the Annual Program and Budget Engineering Circular. A graphical representation of the budget process is presented in Exhibit 7. The budget formulation is a two-year process that begins in January of each year when each district begins developing the O&M funding request and work packages for execution two years beyond the current budget year. (e.g., formulation of the FY 1993 funding request began in January 1991.) The program execution process is displayed in Exhibit 8.

III. STUDY CONDUCT

- The objective of the study was to assure that Federal expenditures for O&M of Corps' projects provide justified levels of service in the least-cost manner.
- The output is practicable measures -- the policies and procedures -- that can be applied to meet the objective.

This study was structured so that the contractor would:

- Examine program-wide policies and procedures.
- Select representative projects and districts.
- Conduct on-site investigations and interviews.
- Identify possible improvements based on the sampling process.



*The Area Office structure is not utilized by all Corps Districts

**Exhibit 6
HIERARCHY OF MANAGEMENT**

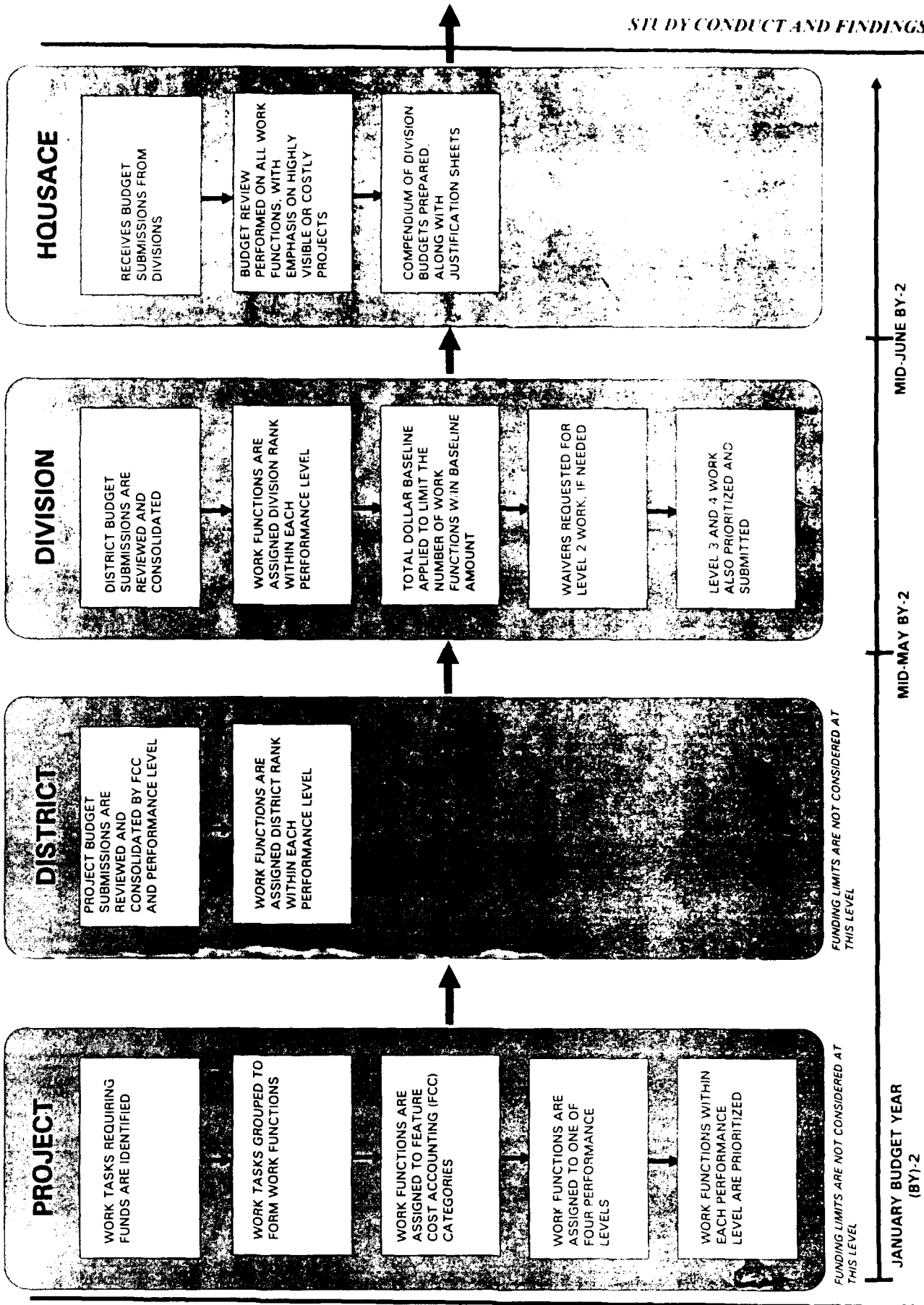


Exhibit 7 - BUDGET FORMULATION

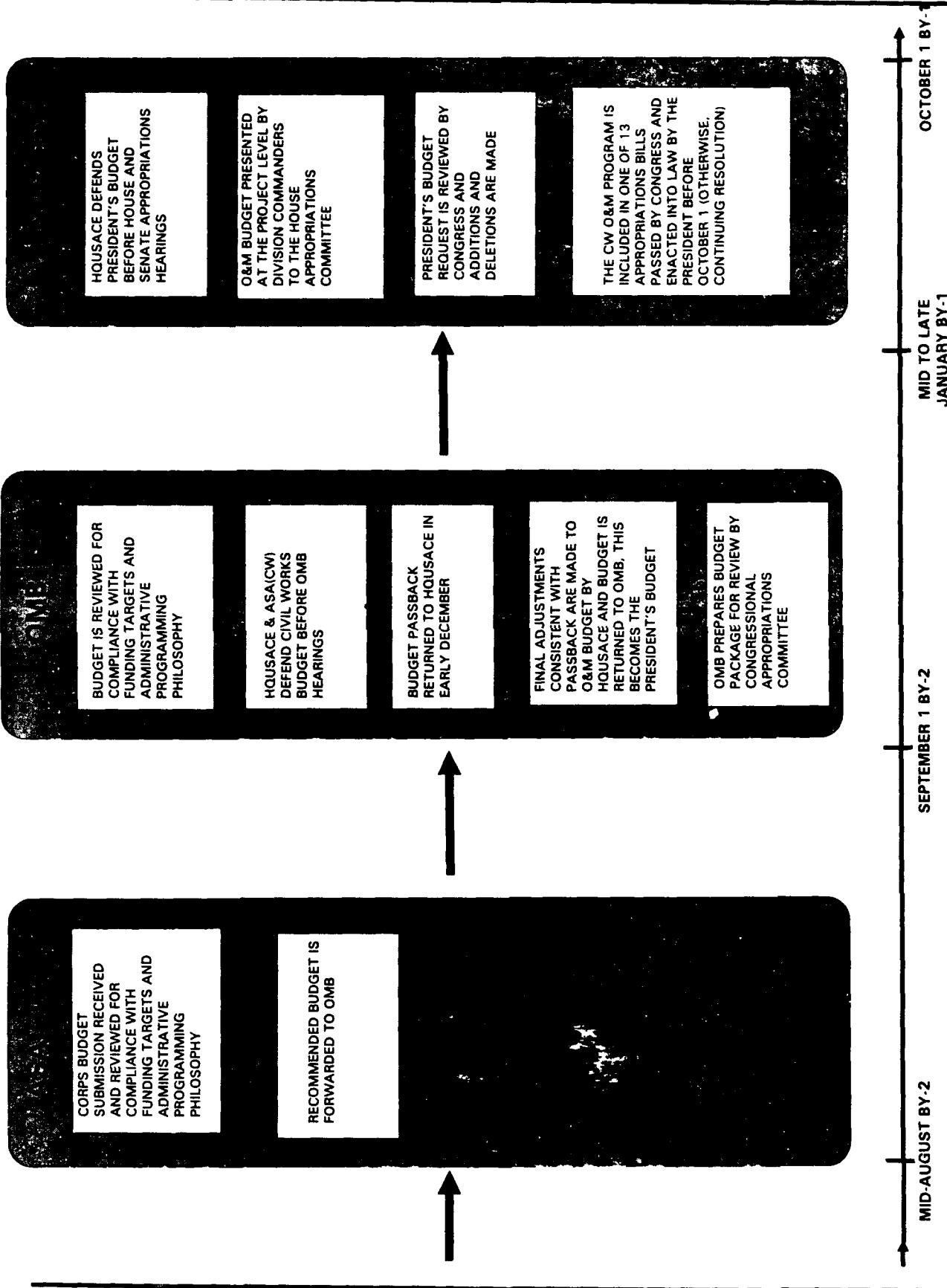
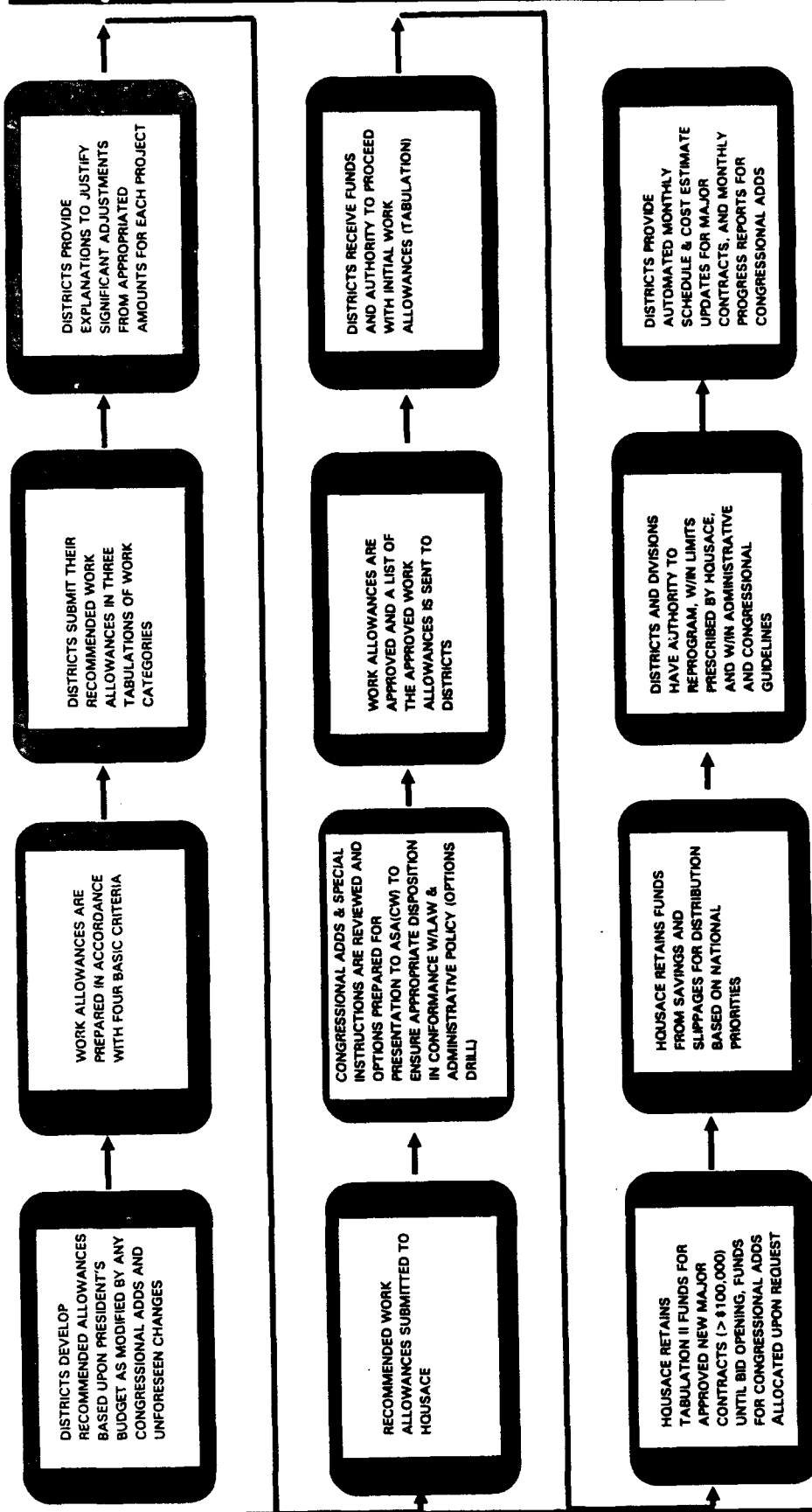


Exhibit 7 - BUDGET FORMULATION (CONTINUED)



○ AUGUST BY-1 - SEPTEMBER 1 BY-2
 ○ OCTOBER 1, BY - SEPTEMBER 30, BY

**Exhibit 8
BUDGET EXECUTION AND MONITORING**

STUDY CONDUCT AND FINDINGS

- Propose improvement options for each theme.
- Combine theme options into program improvement plans.

This process is described in the following narrative.

A. THEMES

The investigations were conducted from four broad perspectives or themes. These themes represent the principal categories of work that must be addressed to attain more cost-effective management and execution of the program. The study was defined by the four themes both to discriminate among those features which should be addressed and to achieve manageability for the study. These themes are defined below.

1. Program Development, Execution, and Monitoring

The objective of this theme is to improve management of the O&M program through changes in budget development, execution, reporting, and monitoring. To accomplish this, the Contractor developed methodologies to identify and evaluate:

- Procedural options for the linkage of budget, Congressional appropriation, and execution; and
- Alternative frameworks for budget formulation and execution in order to provide for the allocation of limited resources to the most productive uses.

All O&M functions representing 100 percent of the O&M budget were investigated for this theme.

2. Intensive Management

The objective of the Intensive Management theme is to determine efficiencies that may accrue from improved allocation of resources (organizational structure, manpower, and funding) and application of new and innovative techniques, and to formulate new policies and procedures to convey these efficiencies to the project level. In the Intensive Management theme, the Contractor analyzed policies and procedures for selected O&M cost features to determine efficiencies that may be realized through:

- More efficient allocation of O&M resources, including the identification of alternative organizational structures and more effective prioritization of manpower and funding;
- Reexamination of existing policies and procedures, and the implementation of alternative policies; and
- Development and application of new and innovative techniques.

Slightly more than one-half of the O&M functions representing 87 percent of the budget were examined in this theme.

3. Productivity of Existing Program

The objective of the Productivity theme is to compare Corps Civil Works districts and divisions to determine where apparent differences in productivity exist, and to analyze these differences. The Contractor used two different approaches to perform this analysis:

- A comparison of the cost categories used by the districts and divisions (e.g., overhead, direct labor, etc.) and their relative levels of expenditure; and
- An analysis of output measures based on individual district or project performance.

Forty percent of the O&M functions representing 77 percent of the budget were considered for this theme.

4. Modernization and Maintenance

The objective of the Modernization and Maintenance theme is to analyze policies and procedures for selected O&M cost features to determine if there are opportunities for reductions in resources through modest (i.e., less than \$500,000) investments in modernization. The Contractor has:

- Evaluated the current condition status of selected Corps projects;
- Identified/developed appropriate, cost-effective strategies for determining when repair, rehabilitation, or modernization is justified; and
- Identified modernization opportunities in current Corps' operating procedures and/or maintenance programs.

About one-third of the functions representing 27 percent of the O&M budget were included in this theme.

B. INTERVIEWS AND SITE SELECTION

1. Interviews

Initial meetings with the Corps' Management Review Team began shortly after the contract was awarded. The Contractor interviewed key personnel at Corps Headquarters to become familiar with current operating policies and procedures, and to identify the areas, or topics, of concern in the Corps today. The Contractor also took this opportunity to become familiar with other activities, such as other on-going studies, that could potentially impact this study. The interviews at Headquarters were crucial to the site selection process and development of the field interview strategies.

STUDY CONDUCT AND FINDINGS

The Study Team began project site visits in November 1991. Separate, but somewhat overlapping, sets of projects and district sites were selected for the four themes, based upon the analytical requirements for each. A total of 41 Corps' sites, including project, district, and division offices, were visited. Twenty public and private non-Corps' sites in three countries were visited in conjunction with the Study. A list of the Corps' and non-Corps' projects and district and division offices visited is provided in Exhibits 9 and 9A. For facilities similar to the Corps', the Contractor attempted to discover efficient and effective procedures which, if implemented by the Corps, would improve project operation and maintenance.

In total, for the Programs theme, the Contractor visited 29 Corps' division and district sites. In addition, program-related interviews were performed in conjunction with the non-Corps visits for the other three themes. Twenty-five Corps' project and district sites and 21 non-Corps' organizations were visited for the Intensive Management theme. For the Productivity theme, 16 Corps' district offices and 20 non-Corps organizations were visited, and for the Modernization and Maintenance theme, 12 Corps' projects and 15 non-Corps' sites were visited. A specific agenda was developed for each interview, but interviewees were encouraged to discuss additional pertinent issues as well. Throughout the study, every attempt was made to coordinate the data collection effort for the themes in order to conduct the study as efficiently as possible and to minimize the impact on the O&M community. For the Corps' sites, the Operations Divisions at the district and division offices served as the primary point of contact during each site visit. However, personnel from other organizations, such as Engineering Division, Construction Division, and Real Estate Division, were also contacted as necessary.

The Contractor received excellent cooperation at every Corps' site visited. Realizing the need for this study, and the study's potential for improving project operation and maintenance, Corps' employees were eager to share their knowledge and experience. The issues and options identified throughout the report are a direct result of this willingness to openly discuss new ideas, and the desire to make the Corps of Engineers a more effective organization. Cooperation from the non-Corps' organizations was also enthusiastic in that these organizations were excited about the opportunity to participate in a study of the Corps' O&M program. Additionally, those interviewed were interested in learning as much as possible about the Corps' program in anticipation of identifying ways to improve their own organizations.

2. Sample Site Selection

a. Initial Project Selection

The Study Team examined 10 years of budgetary and expenditure data, and from this identified a population of 1022 projects. This listing, while as comprehensive as possible within the given

THEMES

ITEM NUM	DIST CODE	CWIS NUM.	CORPS-OPERATED PROJECT NAME	THEMES				
				INTNSV MGMT	MOD & MAINT	PROG	PROD	
1	LMK	20330	YAZOO CITY PUMPING PLANT, MISSISSIPPI		X			
2	LMK		DISTRICT			X		
3	LMM		DISTRICT				X	
4	LMM	77050	MEMPHIS HARBOR			X		
5	LMN		DISTRICT				X	
6	LMN	68	MISS. RIVER BTWN BATON ROUGE, LA AND THE GULF OF MEXICO	X				
7	LMS	15190	REND LAKE, IL			X		
8	MRK		DISTRICT					X
9	MRK	3480	CLINTON LAKE			X		
10	MRO	3020	CHATFIELD LAKE, CO			X		
11	MRO	6230	FT. PECK LAKE, MONTANA	X	X			

Exhibit 9
MATRIX OF SITE VISIT INTER-THEME
RELATIONSHIP

ITEM NUM	DIST CODE	CWIS NUM.	CORPS-OPERATED PROJECT NAME	THEMES			
				INTNSV MGMT	MOD & MAINT	PROG	PROD
12	NAB	870	BALTIMORE HARBOR AND CHANNELS, MARYLAND	X			
13	NAB	14900	RAYSTOWN LAKE, PENNSYLVANIA	X		X	
14	NAP		DISTRICT				X
15	NCB	18280	TOLEDO HARBOR DREDGING PROJECT, OHIO	X		X	
16	NCE	17380	ST. MARY'S RIVER, MI			X	
17	NCR		DISTRICT				X
18	NCR	15070	LAKE RED ROCK, IOWA	X	X	X	
19	NCR	88854	LAGRANGE L + D REHAB/ILL. RIVER, ILLINOIS	X	X	X	
20	NCS	74295	MISS. RIVER BETWEEN THE MISSOURI RIVER AND ST. PAUL, MINNESOTA	X	X	X	
21	NED	391	WOOD ISLAND AT BIDDEFORD, MAINE	X		X	
22	NPP	3630	COLUMBIA AND LOWER WILLAMETTE RIVERS, OREGON	X	X	X	

Exhibit 9 (continued)
MATRIX OF SITE VISIT INTER-THEME
RELATIONSHIP

ITEM NUM.	DIST CODE	CWIS NUM.	CORPS-OPERATED PROJECT NAME	THEMES				
				INTNSV MGMT	MOD & MAINT	PROG	PROD	
23	NPP	80546	BONNEVILLE LOCK AND DAM, OREGON	X	X		X	
24	NPS	200	ALBENI FALLS DAM, IDAHO	X			X	
25	NPW		DISTRICT					X
26	ORH		DISTRICT					X
27	ORH	13140	OHIO RIVER LOCK AND DAM SYSTEM, WVA	X	X		X	
28	ORL		DISTRICT					X
29	ORN		DISTRICT					X
30	ORN	4390	DALE HOLLOW DAM, TENNESSEE	X	X		X	
31	ORP	11740	MONONGAHELA RIVER LOCK AND DAM SYSTEM, PENNSYLVANIA	X	X		X	
32	SAJ		DISTRICT					X
33	SAM	2190	LAKE SIDNEY LANIER, GEORGIA	X				

Exhibit 9 (continued)
**MATRIX OF SITE VISIT INTER-THEME
 RELATIONSHIP**

ITEM NUM	DIST CODE	CWIS NUM.	CORPS-OPERATED PROJECT NAME	THEMES				
				INTNSV MGMT	MOD & MAINT	PROG	PROD	
34	SAM	19190	WALTER F. GEORGE DAM, ALABAMA/GEORGIA	X	X		X	
35	SAS	75085	SAVANNAH HARBOR, GEORGIA	X			X	
36	SAW	30	WILMINGTON DISTRICT INTER-COASTAL WATERWAY, N. CAROLINA	X			X	
37	SAW	10580	MANTEO-SHALLOWBAG BAY, N. CAROLINA	X				
38	SPK		DISTRICT					X
39	SPL		DISTRICT					X
40	SPL	75232	SEPULVEDA				X	
41	SPN	16230	SAN PABLO BAY / MARE ISLAND STRAITS, CALIFORNIA	X			X	
42	SWF		DISTRICT					X
43	SWF	930	BARDWELL LAKE, TX				X	
44	SWG		DISTRICT					X

Exhibit 9 (continued)
**MATRIX OF SITE VISIT INTER-THEME
RELATIONSHIP**

THEMES

ITEM NUM	DIST CODE	CWIS NUM.	CORPS-OPERATED PROJECT NAME	INTNSV MGMT	MOD & MAINT	PROG	PROD
45	SWG	7140	GULF INTRACOASTAL WATERWAY			X	
46	SWL		DISTRICT				X
47	SWL	520	McCLELLAN-KERR VVW (ARKANSAS RIVER - NAVIGATION SYSTEM), ARKANSAS	X		X	
48	SWL	820	BULL SHOALS PROJECT, ARKANSAS	X	X	X	
49	SWT		DISTRICT				X
			SUB TOTALS =	23	12	29*	11
* The Study Team had an opportunity to visit LMK District, although this was not included in the original sample of 28 districts.							
WATER CONTROL SYSTEMS							
50	SWT		TULSA DISTRICT - ARKANSAS RIVER SYSTEM	X			
51	MRD		MISSOURI RIVER DIVISION - MISSOURI RIVER SYSTEM	X			
CORPS OPERATED TOTALS =				25	12	28	11

Exhibit 9 (continued)
**MATRIX OF SITE VISIT INTER-THEME
RELATIONSHIP**

THEMES

ITEM NUM	LOCATION.	CORPS-OPERATED PROJECT NAME	THEMES			
			INTNSV MGMT	MOD & MAINT	PROG	PROD
1	NY/ONTARIO	WELLAND CANAL/ST. LAWRENCE SEAWAY	X	X	X	X
2	CA	BUREAU OF RECLAMATION/CENTRAL VALLEY	X	X	X	X
3	TN	TENN. VALLEY AUTH./FT. LOUDON PROJECT	X	X	X	X
4	NY	NY POWER AUTH/NIAGARA & MOSES PROJECTS	X	X	X	X
5	ONTARIO	ONTARIO PWR AUTHOR/SIR ADAM BECK (NIAGARA)	X	X	X	X
6	CA	DEPT OF WATER RESOURCES/CALIFORNIA	X	X	X	X
7	VA	PRINCE WILLIAM NATL FOREST PARK/NAT PARKSVC	X	X	X	X
8	NY	DEPT OF TRANS/ST. LAWRENCE SEAWAY	X	X	X	X
9	WA	SEATTLE POWER AUTH/BOUNDARY DAM	X	X	X	X
10	BR. COL.	BRITISH COLUMBIA HYDRO/SEVEN MILE DAM	X	X	X	X
11	MO	UNION ELECTRIC/BAGNELL DAM	X	X	X	X
12	MT	BUREAU OF RECLAMATION/HUNGRY HORSE DAM	X	X	X	X

Exhibit 9A
**MATRIX OF NON-CORPS SITE VISIT
 INTER-THEME RELATIONSHIP**

THEMES

ITEM NUM	LOCATION.	CORPS-OPERATED PROJECT NAME	THEMES				
			INTNSV MGMT	MOD & MAINT	PROG	PROD	
13	GERMANY	GERMAN WATERWAYS & SHIPPING ADMIN/TRIER	X	X	X	X	
14	GERMANY	GERMAN WATERWAYS & SHIPPING ADMIN/ OFFENBACH	X	X	X	X	
15	GERMANY	GERMAN WATERWAYS & SHIPPING ADMIN/KOBLENZ	X	X	X	X	
16	MA	MASSACHUSETTS PORT AUTHORITY	X		X	X	
17	MA	U.S. COAST GUARD-MARINE SAFETY POLICE	X		X	X	
18	MA	BOSTON TOWING AND TRANSPORT CO./MASS	X		X	X	
19	CA	PORT OF OAKLAND/CALIFORNIA	X		X	X	
20	CA	OAKLAND NAVAL BASE/CALIFORNIA	X		X	X	
NON-CORPS SITE TOTALS =			20	15	20	20	

Exhibit 9A (continued)
**MATRIX OF NON-CORPS SITE VISIT
 INTER-THEME RELATIONSHIP**

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time constraints, is admittedly still not all-inclusive. Some Corps' dredging projects require maintenance dredging on 20 or even 30-year cycles, and as such will be excluded by virtue of using "only" a 10-year period for analysis.

The next requirement of the selection process was to establish an initial list of 75 projects considered to be representative of the full spectrum of Corps' projects, and which would be used as a sample of the overall population. The site visit sample selection process for each of the four study themes was to make use of this sample population as pragmatically as possible. To ensure objectivity in the project screening process and to ensure that the sample reflected all study considerations and constraints, the Contractor developed a quantitative screening methodology, based upon linear programming, to generate valid, reproducible results.

In developing the methodology to screen to 75 projects for more detailed review, a number of factors, including the following were considered:

- At least 75 projects were selected;
- All 29 Feature Cost Codes presented were included;
- All districts and divisions, excluding the Pacific Ocean Division (POD), were represented, including at least three projects from each division, and at least one project from each district;
- All project purposes were considered;
- A representative sample of changes between budget development and program execution were included; and
- Projects undergoing major rehabilitation were selected.

To satisfy all of the above constraints it was necessary to select a sample of 81 projects for further analysis; the requirement could not be met by a sample size of only 75.

b. Programs Theme Site Selection

The Contractor developed questionnaires to collect program-related information at the division, district, and project level for the 81 selected projects. Input from division-, district- and project-level personnel was required to gain a thorough understanding of the budget preparation process.

c. Intensive Management Theme Site Selection

The 81 projects earlier selected were used as a starting point from which to select the 25 project sites for the Intensive Management theme. Specific selection criteria for key project features were developed to guide the further site selection process for Intensive Management. The Study Team determined that 22 of the 25 sites from the list of 81 projects were appropriate for inclusion in the

Intensive Management Theme, in that they met the identified sample requirements. The remaining 3 sites were selected from the greater population of Corps' projects in order to visit specific projects with the key features, such as technical, age, purpose, regional, and physical characteristics, of overriding interest to the theme.

d. Productivity Theme Site Selection

Unlike the samples required for the other three themes, the productivity sample was district-based rather than project-based. Two separate sets of site visits were conducted. In the first, two districts with high direct labor percentages and two districts with low direct labor percentages, as well as two districts with high overhead costs and two with low overhead costs were analyzed. To choose the four districts based on direct labor percentages, the Contractor considered the following criteria:

- Selection of districts with consistently low direct labor percentages.
- Selection of two districts dissimilar enough to yield unique results from each. For example, the study avoided selection of two districts that have primarily coastal dredging missions.
- Selection of districts large enough so that valid conclusions can be drawn and applied to other districts.

The criteria used for selecting districts based on overhead were the same as above, with one additional consideration: avoiding selection of a district previously selected for analysis based on direct labor percentages. Based upon the characteristics of the cost distributions, once they were developed, the sample size was increased by one to include a mid-level overhead district. For the second portion of the Productivity analysis, various statistical and econometric techniques were employed to specify functional relationships between costs and outputs and to formulate models which would enable district comparisons. Cost to output measures with the greatest statistical rigor were then chosen for each Feature Cost Code. The cost per output data for each district was compared to identify the five districts with the highest overall cost per output across functions and the five districts with the lowest overall cost per output. After examination of the ten selected districts, an eleventh district was added to ensure that both high and low cost to output relationships were captured within each functional area.

e. Modernization and Maintenance Theme Site Selection

The initial pool of 81 sample projects was reviewed for possible use as sample projects for the Modernization and Maintenance theme. All of the relevant FCCs could be effectively reviewed by visiting sites with the following project features: locks, dams, multipurpose power, recreation, water control, and pumping plants. Specific criteria used in selecting the 12 Corps' projects for the

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Modernization and Maintenance Theme are similar to those utilized for the Intensive Management Theme.

C. THEME POLICY AND PROCEDURES OPTIONS

Based on assessment of current policies and procedures, interviews, and site visits to projects and district offices, issues for further consideration were developed. These issues reflected deviations from current policies, inconsistent application of policy, and opportunities to improve the program through development of new policies and procedures. The issues were then evaluated to determine which were project-specific anomalies and which were pervasive enough to reflect program-wide attention.

Policy and procedures options for improvement of the program were developed for each theme. Each option was evaluated to determine its advantages, disadvantages, costs and ultimate contribution toward meeting the objective of this study. The options were ranked for net value in resolving the issue and presented in a theme report.

D. POLICY AND PROCEDURES PLANS

Options for each theme were integrated to eliminate overlap and duplication among themes. Options were then evaluated according to the potential for the greatest impact on improvement of the O&M program and timing of implementation. Options adjudged to have the greatest potential were then grouped into three plans in accordance with the following parameters.

- **High Impact:** These issues show promise of resulting in very large savings and are generally multi-functional. They will have a significant impact on the Corps' O&M program by improving the overall management of the program, decreasing the cost of providing services, or improving the level of service.
- **Short Term:** Short term issues include those actions which Headquarters or other Corps' management can take, in a relatively short amount of time (less than one year), and which can also realize improvements in the Corps' O&M program.
- **Long Term:** Long term issues are those which will take longer than one year to implement and/or to realize significant improvements in the Corps' program.

IV. ASSESSMENT & ANALYSIS OF CURRENT PROGRAM

This chapter presents an assessment and analysis of the Corps' O&M program and the issues which the Contractor feels should be addressed by the Corps in its effort to accomplish the study objective. The summary is the integrated result of the analysis conducted under the four study

themes, i.e., Program Development, Execution and Monitoring (PG); Intensive Management (IM); Productivity (PR) of Existing Program; and Modernization and Maintenance (MM). The analysis is presented in the following format:

- Programmatic,
- General Project Management,
- Functional Area Specific.

A. PROGRAMMATIC

1. General

Management of the Operation and Maintenance program, annually, from budget development to program execution two years hence, is a highly complicated process which must balance a wide array of diverse, and sometimes conflicting, factors. Such factors include providing for the proper balance between the degree of spending flexibility necessary for field offices to adapt their program to the actual conditions encountered, versus the necessary degree of central control; changing program priorities that occur over time; the diversity of project type, age, geographic distribution, and contracting environment within the Corps' inventory of completed projects; the increasing importance of environmental considerations; and, ensuring the efficient allocation of limited resources for the most productive uses within the framework of these other factors. An additional factor complicating O&M management is the long lead time between budget formulation and actual execution. This lengthy period between budget development and program execution increases the possibility of changes to requirements and, therefore, decreases the accuracy of the budget estimate.

2. Operation and Maintenance Program Management Successes

The current O&M budget formulation process has several successful aspects with respect to developing the complex Corps' O&M budget. The budget development process employs a bottom-up approach. The project managers or staff (e.g., Engineering, Planning, Real Estate, etc.) at the various district offices who are responsible for executing the O&M program have direct input into the formulation of the budget. This approach allows budget submittals for individual projects, organizational elements, and districts, within HQ guidelines, that reflect the unique mix of factors and conditions that are applicable to each particular situation.

Another successful aspect of the current process is the funding level matrix concept. The matrix categorizes individual work items and work packages (a group of related work items) by Feature Cost Account Code (FCC). The matrix also defines funding levels corresponding to the priority of operation and maintenance work packages. The purpose of this matrix is to specify in which funding

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level each work package should be placed for a budget submission so that, on a Corps-wide basis, similar work packages are competing for funds at the same level of priority. Also, these work packages are sorted by budget category, which are tied to FCCs, so that functional experts can review budget submittals to determine if the proposed funding levels provide a feasible program from a technical point of view.

A tool which has evolved over several years, and which facilitates the prioritization and consolidation of the budget submittals at the district, division, and HQ levels, is the Automated Budget System (ABS). The ABS greatly simplifies the consolidation and prioritization process of budget submission. Use of the ABS, and such features as machine sorting, reduces the amount of time required to consolidate and prioritize the highly complex O&M budget. The ABS also is the tool which allows for the budget submittal to be divided into functional areas for review by the various functional experts. There was virtually unanimous praise of the ABS at the 28 Corps' districts visited for the Program Theme.

The current management process has several successful features regarding the execution of the O&M program. One such policy is that certain funds are withheld at the HQ level to allow for distribution on a Corps-wide priority basis. For example, Tabulation II (Tab II) items, which include new major contracts greater than \$100,000, are released upon bid opening, as well as all funds related to Corps-owned hopper dredges. If these Tab II items encounter delays or unanticipated savings, HQ reprograms these funds to other projects that experience unanticipated budget overruns, or to other high-priority unfunded items. It is clear that the withholding process has increased the flexibility of the O&M program as a whole. Similarly, districts have the ability to reprogram funds between projects within certain limits to react to actual conditions encountered when executing the program. This ability to react to actual conditions, which were unforeseen when preparing the budget, is key to the successful execution of the Corps O&M mission.

To monitor the O&M program, periodic financial reports, such as the monthly 2101 Schedule of Obligations and Expenditures and the quarterly Command Management Reviews (CMRs), track expenditures and obligations to allocation, thereby providing a means to manage the execution of the O&M program and to ensure that appropriated amounts are not exceeded.

3. Operation and Maintenance Program Management Procedures Issues

The Contractor has identified various issues related to the management of the Corps' O&M program. The remainder of this subsection discusses some of the issues identified regarding budget development, program execution, and program monitoring.

Currently, the Corps manages the O&M appropriation as one large pool of money with one general set of policies and procedures applied across all FCCs. The Contractor has identified certain

major unique components of the program, however, which may be better managed individually, thereby improving the management as a whole. These program components include:

- non-dredging program baseline requirements,
- non-dredging periodic and/or non-recurring (variable) requirements,
- dredging requirements, and
- dredging/emergency reprogramming requirements.

The Contractor developed procedures options for each of these program components that would allow the Corps to: a) take advantage of the unique characteristics of each specific component, such as the stability of the baseline requirements; or, b) develop procedures options to better manage the requirements of individual program components, such as the volatility of dredging requirements.

a. Baseline Requirements

Although the program as a whole is dynamic, certain large portions of the O&M requirement are recurring and predictable. For example, at a Corps-owned lock, the cost of lock operators' salaries and benefits, and the cost of routine and preventive maintenance (as opposed to major, one-time repairs), will change little from year to year. At most non-dredging projects, these recurring costs constitute the bulk of project expenditures; in fact, the largest individual segment of the program, in terms of dollars, are these "baseline requirements". Baseline requirements include only the relatively fixed, non-discretionary costs of operating and maintaining projects.

As defined, these baseline requirements constitute the largest and most stable portion of the O&M program and are estimated to be between 70 and 80 percent of the total non-dredging O&M program. Two overall problems with respect to baseline funding packages currently prevent the Corps from taking full advantage of what should be a highly predictable program component. First, projects and districts have varying interpretations of what constitutes baseline work items. Second, similar projects from different regions have significantly different levels of baseline staffing and other resources that have developed over time.

The Contractor suggests that the baseline requirements for each non-dredging Corps O&M project be reviewed to ensure that only true baseline items, and no discretionary items, are included in these baseline submissions to determine a consistent and equitable baseline for all non-dredging O&M projects. Once established, these baseline requirements can be programmed with a high degree of confidence and require a minimum of review effort for each budget submission.

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b. Periodic and Non-Recurring Work Items

In addition to the baseline requirements, the O&M program consists of requirements for periodic and non-recurring work items. These variable requirements are primarily comprised of a dynamic mix of periodic or non-recurring maintenance work packages, such as major maintenance to tainter gates, cavitation damage repairs at a hydropower plant, and equipment replacement. The current programming practice assumes that the number, dollar amount, and priority of projects' needs for periodic or non-recurring work packages merits constant funding within each district based upon Corps-wide priority from year to year, i.e., each district has a fixed requirement for variable work items. However, on a Corps-wide basis, the priority of need for these variable work items changes from year to year. As priorities change, the amount of funds allocated to each district for variable requirements should also change to maximize the priority of funded variable work items and the efficiency of the allocation of resources on a Corps-wide basis.

c. Dredging Requirements

Dredging requirements represent another unique component of the O&M program. Dredging projects are often subject to acts of nature, such as floods and droughts, which may require expenditure of significantly more or less funds than were budgeted. The dredging function is therefore inherently more volatile than other O&M functions and this volatility becomes even more pronounced on an individual project basis. The size and inherent volatility of the dredging function make it difficult to adequately plan for, monitor, and manage both the dredging and non-dredging portions of the O&M program.

Each Corps' district budgets for a different mix of dredging and non-dredging projects under the O&M appropriation. This mix provides for varying levels of flexibility to reprogram funds to cover excess dredging needs. For example, one district visited was predominantly a dredging district with few other minor functions performed. This district was often unable to fund all of its basic dredging requirements in a given year and had very few non-dredging O&M projects from which to reprogram funds to cover the shortfall. Another district visited had a large non-dredging program that could be used to fund unanticipated dredging requirements. In fact, this district had enough excess non-dredging funds to reprogram over \$1M dollars to build additional campsites during a recent fiscal year. Thus, the ability of districts to reprogram funds to cover excess dredging requirements, due to project mix, varies widely.

Managing the dredging funds separately would offer two distinct advantages. First, when dredging requirements exceed budgeted amounts such overages will be managed centrally within the overall dredging fund, rather than reprogramming funds from other non-dredging projects. By walling off the volatility of the dredging projects, the Corps will be able to take advantage of the

relative stability of the funding requirements for non-dredging projects in planning and executing the program for these projects. Secondly, as indicated by investigation of FY 1989 and FY 1990 data, the reprogramming of dredging funds appears to have become a routine source of funding for other O&M needs. Centralizing the reprogramming requirements for the dredging function will decrease this secondary source of funds for non-dredging projects, thus requiring improved planning and management of both dredging and non-dredging projects. Based upon the FY 1989 and FY 1990 data, it would appear that a reduced level of funding could be budgeted for dredging. This would allow for more funds to be available to plan and budget for other O&M projects rather than reprogramming excess dredging funds during the course of executing the program.

d. Funding Level Matrix Definitions

The funding level matrix provided in the Annual Budget EC often includes guidance which is not consistent with current practice or that does not provide enough detail for consistent interpretation. The Contractor suggests that the definitions in the funding level matrix be clarified in those areas of the greatest range of interpretations, by providing supplemental, expanded definitions to augment the one- or two-sentence descriptions contained in the actual matrix. Also, the Corps should revise the funding level descriptions to bring them in line with current funding practices. These revisions will increase conformance to Corps' guidance, lessen inequities in budget submittals due to varying interpretations of funding level matrix definitions, and improve the efficiency of resource allocation.

e. Mid-Range Planning

Although a ten-year budget projection is prepared each year as a part of the annual budget preparation, no formalized process exists to perform detailed mid-range planning with respect to specific periodic and non-recurring work items. The Contractor suggests that a detailed five-year budget projection be prepared, and any projected periodic and non-recurring work items above a specified cost threshold be categorized and listed as separate line items in the projected year of the requirement. These projected requirements would be adjusted at the HQ level and then distributed to the project level for use as a planning tool. This would allow the Corps to plan in advance for specific upcoming periodic and non-recurring work items to increase the priority of the variable work items funded above the baseline requirements and to better manage the unaccomplished maintenance backlog.

f. New Program Requirements

When a new program is developed and policies promulgated, there is an associated resource impact; current procedures for funding such new requirements make it difficult to isolate and identify that impact. Although the Annual Budget EC has been updated in recent years to isolate

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the costs of some major new program initiatives, such as Environmental Compliance and Wildlife Mitigation, other new program requirements have been added without new categories to separately identify increased costs, e.g., the Condition Indices and the Corps Sign Manual programs. The Contractor suggests that line items be displayed at the project level for all funding demands over \$25,000 that result from new programs or policies.

g. Interim Funding Requests

The interim BY budget submittal, and the subsequent work allowance request, are not subject to the same level of review as the original BY budget submittal. The original budget submission, or President's Budget, is subject to detailed scrutiny and justification requirements, especially for variations from the BY-1 budget submittal. The adjusted BY budget, in contrast, is subject to a much less stringent review than the original BY submittal, since the adjusted budget is prepared under reprogramming guidelines. Although the review guidelines have recently been tightened to manage change in a more disciplined manner, they are still significantly less rigorous than the BY budget review. For the sample of 81 projects as a whole, the total allocated work allowance request differed from the total approved original BY appropriation by twelve percent. The Contractor suggests that an audit process be established to ensure compliance with guidance.

h. Presentation and Justification of O&M Program

Personnel within the Corps, ASA(CW), and OMB variously expressed concern with regard to the perception of the Corps' O&M, General, appropriation. In particular, outside reviewers experienced far greater difficulty in understanding the composition of the O&M, General, program than other appropriations such as Construction, General. Current detail for the Corps' O&M, General, Program, as presented to the Subcommittee on Energy and Water Development, provides for a listing of estimated operation and maintenance requirements for each Civil Works project. This information is presented by Corps' division, and is further subdivided into four project types (navigation, flood control, multiple-purpose power projects, and protection of navigation), and by State.

The Contractor suggests that additional summary exhibits be provided for each division and Corps-wide O&M presentation. The presentation should highlight various components of the O&M, General, requirements to provide the reviewer with a better understanding of funding requirements.

B. GENERAL PROJECT MANAGEMENT

This section addresses general project management issues with significant, multi-functional impact. Issues related to the following areas are discussed: administrative, operations, and maintenance.

1. Administrative Issues

The following section will address the Contractor's findings about the general topics of organizational structure, contracting, property and supply, automated data collection and reports control, and work management.

a. Organizational Structure

Every district office visited utilized a different Operations or Construction/Operations Division organizational structure to manage its civil works mission. The majority of projects visited also had unique organizational structures and reporting hierarchies. There is little consistency in the names of organizational elements, or in the organizational responsibilities of these branches, sections, or units. District organizations have developed over the years along district-unique lines, not all of which are equally cost-effective. Policies related to management layering, number of district versus project staff, and cross-functional use of staff were particularly varied.

b. Contracting

(1) Service Contracts for Routine O&M. Most projects now use some contract staff to supplement, or in lieu of, an in-house, hired labor staff of maintenance workers. Depending on the district, and on the funds available, some projects have contractors perform specific one-time or annually cyclic tasks only, such as building painting, major repairs, or vault toilet pumping. Some projects use contractors only occasionally and for smaller items, such as winterizing plumbing systems, degreasing generators during overhauls, or cleaning drainage ditches where the bulk of the maintenance is performed by Corps' in-house staff. At other projects, contract staff may be responsible for the operation and maintenance of entire parks. In these situations, the contractor deals exclusively with a Facilities Manager or a designated Ranger acting as the day-to-day representative for the Park Manager.

Some Corps' projects, however, also utilize contract staff to assist in the accomplishment of routine, one-time, or major maintenance tasks. Repairs and general maintenance, i.e., seasonal start-up and shut-down of facilities, minor electrical and plumbing problems, and restroom painting, are items typically performed by contract. Many of the Corps' projects utilize both hired labor and contract staff. While most projects strive not to mix the in-house and contractor staff on the same

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tasks, at least one project interviewed contracted for the use of laborers to supplement its hired labor crew of craftsmen because Government FTE were not available.

Of those who utilize both contract and hired labor staff, several projects continue to employ an in-house "renovations" crew whose primary responsibility is to make large-scale improvements, enhancements, and enlargements of campgrounds, swimming beaches, boat ramps, and picnic areas. Renovations of campgrounds, picnic areas, and visitor centers are almost exclusively the purview of hired labor crews, regardless of whether or not other maintenance requirements are performed by contract staff. Hired labor is often responsible for building and installing new restrooms, fee collection booths, campground entrance gates, and playgrounds, and for project office remodeling requirements. The Contractor suggests that guidance be developed, at the national level, to standardize use of service contracts.

(2) Types of Contracts Used. A variety of contract instruments are used to obtain services at Corps' projects. Generally, the most cost-effective contract instrument for repetitive requirements is the Firm-Fixed-Price contract which establishes a set fee for each work item, or a fixed total price for all anticipated work requirements. This type of contract is used by many Corps' districts, and is recommended by the General Accounting Office and the Office of Federal Procurement Policy in OMB because there is a strong incentive for the contractor to be efficient and to perform quality work in a timely manner. Many rural projects obtain contract services from local vendors using Blanket Purchase Agreements or Standard Form 44s. These procurement instruments are more often used for small, one-time services than for repetitive requirements.

In at least one division, the most common contracting instrument for O&M services was the Cost-Plus-Award-Fee contract. Normally, cost-plus type contracts are used when the quantity or scope of required services are difficult to determine in advance. Once the known characteristics of the work to be performed are established, a contractual rate for the incremental accomplishment of the work and the allowable mark-up on the cost of supplies and materials purchased by the contractor is set. In general, cost-plus type contracts do not carry as strong an incentive to be cost-effective, since the contractor is generally reimbursed for all contract-related expenses. The Corps of Engineers has recognized the element of risk associated with cost-plus contracts, and therefore requires that all cost-reimbursable maintenance contracts be sent to Headquarters for review and approval prior to advertisement. This costly and time-consuming review process, although warranted, is a further drawback to the use of this contract type. The General Accounting Office has previously encouraged agencies to use more cost-effective contract instruments wherever possible, though it recognizes Cost-Plus-Award-Fee contracts as a slightly more incentive-driven model than the basic cost-plus contract.

c. Property and Supply

At a majority of the sites visited, the number of Operations Division approvals required for procurement of small items (those greater than the projects' local authority and less than \$25,000) varied greatly. At most sites, between one and five approvals are required within Operations Division alone before a request is forwarded to the next organization. Each additional review/approval conducted within Operations Division extends the time required to complete the procurement and meet the project's small purchase needs. This results in inefficient utilization of manpower, increased downtime, increased overtime, lost revenue, and potential danger to the staff and public.

The degree of management oversight at the district level should be balanced against the overall timeliness and cost of the procurement process. The Contractor suggests that direct procurement request authority limits be established based upon project size (as determined by the O&M budget level, number of procurement requests, or FTEs) and scope.

d. Automated Data Collection and Reports Control

(1) Lack of Standardized Method for Exchange of Management Information. Limited mechanisms exist for the exchange of information between projects. The absence of a standard vehicle for informing others about managerial techniques results in a large amount of duplicated effort throughout the Corps. For example, every project, district, and division visited had its own internal data management systems. The systems ranged from simple spreadsheets to elaborate systems with graphic capabilities. Even districts within the same division had unique internal data management systems. A great deal of similarity exists between many Corps' projects, and the sharing of successful -- as well as unsuccessful -- management techniques and experiences could reduce costs throughout the Corps.

(2) Corps-wide Project Database. The Corps maintains a number of functional data management systems to record, track, and analyze information in its vast inventory of projects. Current data management practices are not conducive to Corps-wide analysis, as databases containing project information are developed in an isolated fashion, by different organizations, and as a result are often redundant or incompatible. Information about project structures, facilities, or activities in one database does not always agree with another database, and many are either out of date or incomplete. Furthermore, there is no single Corps-wide system which provides access to all project information. In addition to restricting analytic efforts, these problems have led many districts to develop their own "home grown" data systems. Redundant efforts to develop data management systems at the district level are costly and inefficient.

One solution to this problem is to develop a centralized system for recording and maintaining core project data. Basic data elements, such as authorization history, CWIS number, geographic

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and district data, as well as summary historical expenditure data, would be developed and maintained by Corps Headquarters, with points of contact established for each functional area. Users would be able to access the system, in a read-only mode from a remote terminal, and submit additions/modifications to a central data manager.

(3) Software Incompatibility. An increasingly large portion of the Corps' operation and maintenance workload is accomplished through automated means, and the Information Management Office (IMO) at each district is responsible for approving software purchases. However, there are no Corps-wide regulations which specify the type of software Corps' districts must use. Each district has developed its own policies for software procurement, and, as a result, data cannot easily be shared between field activities due to software incompatibility. For example, specialized software, such as hydropower plant operating software, varies from district to district, as do the more traditional types of software, such as word processing, spreadsheet, database, and graphics packages. The wide variety of software leads to redundant data entry, a more limited use for some data, and increased requirements for data conversions.

e. Work Management

(1) Inconsistent Work Definition, Tracking and Management. The lack of current guidance in the area of maintenance management has resulted in wide variations in the scope and intensity of project efforts. Maintenance Management systems at some projects are virtually non-existent, in that work ordering, tracking, and reporting are conducted on a purely verbal basis. At other projects, every hour of every day for every person is tracked and every task performed is recorded for over 400 different categories of work. The lack of Headquarters' guidance has resulted in redundant and inconsistent district and project efforts to establish maintenance management requirements and, at several of the project sites visited, a complete lack of records regarding work performed at the project. The Contractor suggests that new work management guidelines be developed and that projects be required to develop new project O&M manuals based on the new guidelines.

(2) Construction and Expansion Conducted with O&M Funds. Project staff gave a variety of reasons for using O&M funds to construct additional camping sites, maintenance offices, warehouses, and equipment sheds. In many cases, these were replacements for facilities that had deteriorated over the years. In other cases, staff stated that they needed more facilities to house the contract O&M staff and the Government-furnished equipment; campgrounds were too crowded; or a place was needed to keep the in-house crew's campground renovation materials, supplies, and equipment separate from the contractor's supplies. The primary reasons given for adding utilities, such as electric and water hook-ups, to campsites was to allow the Corps to charge more for the sites, or to keep up with other local campgrounds, rather than to reduce O&M costs. While upgrades

which allow for higher campsite fees are a permissible use of Special Recreation User Fee (SRUF) funds, there is no Corps' guidance on the limit to which an existing Class A facility should be improved each year in order to continually justify higher fees. First priority for expenditure of O&M funds, including SRUF funds, should be placed on project operation and maintenance, and more justification, including FTE impacts and long term maintenance costs, should be required for project improvements and enhancements.

(3) Determining Heavy Equipment Requirements. Many projects retain ownership and maintenance responsible for large fleets of heavy construction and engineering equipment long after construction of the project has been completed. In some cases, while the equipment may only be used several times a year, a staff position for a Heavy Mobile Equipment Repairer is required in order to keep equipment in operating condition. There is limited guidance on how many heavy equipment items different types of projects ought to maintain on-site.

(4) Unclear Understanding of Corps' Regulations in the Field. There is a significant variation in understanding or interpretation of many Corps' rules and regulations between districts, between divisions, and between district/division level organizations and Headquarters. This leads to inconsistent management of Corps' resources, including manpower and funding. Districts and divisions currently maintain hard copies of rules and regulations, and revisions are distributed by Headquarters as necessary. Maintenance and distribution of hard copy documents is difficult and time consuming, and the documents are not always easily accessible. The Contractor suggests that electronic copies (computer diskettes or CD ROM) of updated rules and regulations be distributed to division and district offices.

2. Maintenance

a. Identification of Maintenance Requirements at Projects

Each Corps' project typically identifies maintenance requirements according to its own project practices, although a district-specific inspection program for certain types of projects had been implemented at one district visited. Informal inspections are conducted at regular intervals and the information is subsequently used to develop work requests or for inclusion in the operation and maintenance line item budget request. However, there is no consistent methodology for identification of short-term maintenance requirements. The latest guidance (1967) on identifying maintenance requirements does not reflect the needs of the current projects for maintenance planning and budget preparation. A Corps-wide standard inspection program would provide district-to-district consistency, and allow comparisons to be made not only between projects, but also across districts.

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b. Interchangeability of Parts/Equipment

Procurement costs and inventory levels could be lowered, and maintenance times reduced, with increased interchangeability between equipment and facility items at the project. In addition, district-wide interchangeability, particularly with respect to major components, would significantly decrease maintenance times and costs. However, most districts do not have formal methods of promoting interchangeability between projects. An interchangeability review should be established at the project and district levels. This would increase spare parts availability, thus reducing repair time and costs. Several non-Corps' sites visited have already initiated such programs.

c. Identification and Recording of Unaccomplished Maintenance and Repair (UMAR)

No formal reporting procedures currently exist for the identification and tracking of unaccomplished maintenance and repair (UMAR). Some projects maintain their own informal listings of unaccomplished work, yet the information is generally not reviewed above the project level. As a result, accurate comparison of UMAR listings between projects is not possible. The majority of Corps' projects visited did not maintain up-to-date listings of UMAR items. Many project managers will not include an item in the budget submittal unless they believe that a reasonable chance exists that the item will be funded. Therefore, while a backlog of maintenance and repair work exists at a number of projects, in many cases no formal documentation of such is available. This lack of regular identification and reporting of UMAR inhibits district-level managers in long-term planning and funds allocation decision-making. An annual reporting procedure for project UMAR should be established with accompanying audit procedures. This would ensure that: the condition of each project is thoroughly evaluated on an annual basis; valuable information is provided for making monetary and personnel resource allocation decisions; and better documentation of Corps' funding requests is available.

d. Centralized Maintenance Expertise

There is no Corps-wide policy on establishing centralized organizations of maintenance expertise in districts or divisions. Only some of the Corps' lock systems and none of the hydropower plants visited were supported by centralized maintenance organizations. The lack of central maintenance units to support hydropower projects has resulted in several redundancies among projects within a given district, such as duplication of major equipment and specialized skills. Establishing at least one central organization responsible for major maintenance within each district with significant hydropower facilities would reduce the duplication of equipment and personnel skills which currently exists between similar projects. Additionally, the creation of specialized, centralized work teams, e.g., generator rewind teams, cavitation repair teams, etc., should be investigated.

e. Automated Maintenance Management Systems

There are no policies or procedures which require the use of automated systems to collect, track, or report maintenance data, or provide standard guidance for development of such a system. As a result, many divisions/districts are independently developing automated maintenance work order generating, tracking, and management report systems, while others continue to track and report data manually. Data required for each system are often inconsistent. The Contractor suggests a policy be issued which encourages the use of standardized automated systems for maintenance management.

f. Preventive Maintenance vs. Reliability-Based Maintenance

The Corps currently operates using a preventive maintenance-based strategy. With this strategy, preventive maintenance is performed at regular intervals in accordance with established guidelines. Under a reliability-based maintenance program, maintenance (or replacement) should be performed just prior to the point at which the item fails, or suffers "significant" damage or performance degradation. The most difficult aspect of this methodology is the determination of the point where the risk and projected costs are higher than the cost of the repair, rehabilitation, or modernization. This strategy was not fully implemented in any of the organizations visited, but two of the non-Corps' organizations are vigorously pursuing proactive and predictive evaluation techniques to identify when to perform major maintenance, rehabilitation, or modernization.

The Corps' preventive maintenance program is beginning to be enhanced with some insightful work in the reliability-based strategy with the application of the condition indicator concept. The Contractor suggests continued investigation into this predictive technique. After a history of condition indicators and maintenance activities is established, the Corps can begin to realize the benefits and savings available when using a reliability-based strategy to determine when to repair, rehabilitate, or modernize equipment and facilities.

C. FUNCTIONAL AREA SPECIFIC

1. Flood Control

a. Operations

(1) Operational tasks associated with dams are quite few and are generally limited to routine inspections and equipment readings. In most cases, the operational duties are performed by a member of the resource maintenance or powerhouse maintenance crews. The Contractor investigated the possibility of installing remote operating devices on dam gates, remote sensing, installation of video cameras, and installation of automatic trash rack cleaning systems. In every case, the cost of automation was significantly higher than continued manual operation.

(2) Operational tasks associated with pumping plants are generally limited to monitoring the equipment while it is pumping during flood events, but include routine inspections and equipment readings. The possibility of automating and remotely controlling the operation of the pumping plant visited was investigated. As with the dam gates, due to the limited operating requirements, the potential automation of project operation does not appear cost effective.

(3) Water control data is acquired from data collection platforms, stream gauges, and private individuals. Most of the equipment is now automated so that data on stream elevation and precipitation is transmitted to satellites every four hours under normal circumstances, or every two minutes during flood events. Some of the platforms still have telephone connections whereby raw data can be obtained by dialing into a transmitter on the platform and downloading the data into a computer. Other than Corps' projects, there are few places left where a person is responsible for manually collecting data daily and calling it into the Corps or the NWS directly. The Corps shares the cost for many of the data collection platforms with agencies such as the NWS, its parent organization, the National Oceanographic and Atmospheric Administration (NOAA), and the United States Geological Survey (USGS). There is no national buying program in effect for data collection platform equipment, so the type of equipment used varies from district to district.

The raw data transmitted from the data collection platforms routinely goes to NWS satellites and then is transmitted back to NWS or Corps-operated ground receiver units, depending on the district, where it is manipulated into a format usable by the forecasters. The staff of the H&H Branch input the information into prediction models developed by the Corps Hydrologic Engineering Center (HEC) which have been fine-tuned to meet the requirements of the local water basin. These models produce run-off predictions which are used to develop water release schedules. These predictions take into account all the various water demands, actual and estimated rainfall/snowmelt, and the need to seasonally adjust reservoirs during the calculation of the suggested releases.

The Corps is part of a tri-agency effort to develop uses for, and to integrate into existing programs, the new NEXRAD (Next Generation Radar) technology. This is a new weather radar system which greatly enhances the measurement of precipitation, which increases the accuracy of run-off predictions. The Corps' Tulsa and St. Louis Districts are the two assigned to review this technology and its applicability to the Corps-wide water control program. The Contractor commends the Corps on centralizing research of this type at specific locations, as it would not be cost-effective for each district to attempt these NEXRAD developments on their own. Consideration should be given to consolidating other water control-related research on such topics as low dissolved oxygen and HEC-model modifications to specific districts or divisions within the Corps.

b. Maintenance

The paragraphs which follow provide a summary of the Contractor's findings in the area of flood control structure maintenance. In general, maintenance of the structures was sufficient in that few, significant flood control structure-related maintenance emergencies were noted by the Corps' staffs interviewed.

(1) Maintenance associated with the dams is usually limited to mowing of grass areas and routine and minor structures maintenance. Typical preventive maintenance tasks include greasing of gates, cleaning the dam equipment and decks, and checking for leaks. The most frequently observed maintenance problems at Corps-maintained dams involved unaccomplished painting requirements, primarily for gallery walls, and equipment items. No structural problems were noted at the sites visited.

(2) Maintenance of pumping plants is in many ways quite similar to maintenance at hydropower plants, except that pumping plants are used much less frequently. The pumping plant staff visited as part of this effort was in the process of preparing for a major overhaul of the pump turbine and associated motor. While no significant lapses of service had occurred, routine maintenance inspections showed signs of significant deterioration of the turbine blades.

(3) Water control maintenance consists of maintenance to the data collection platform equipment, the transmitters/receivers, satellite links, and the H&H Branch computers used to run the modified HEC models. Most Corps' districts have entered into contracts with the USGS to install and remove data collection platforms, rain gauges, and stream gauges. Any malfunctioning platforms are exchanges for spares and the bad units are normally returned to the local Corps' district office for examination by electronics technicians who attempt to diagnose and, if possible, fix the problem. If they cannot, the units are sent back to the manufacturers' authorized service center for repair.

2. Hydropower

The Corps is the largest operator of hydroelectric facilities in the United States. The Corps operates and maintains 76 hydroelectric powerplants housing 356 generating units. These powerplants have a combined capacity of nearly 21,000 megawatts, and represent a \$13 billion investment.

a. Staffing

The Corps power plants visited by the Study Team are generally manned 24 hours per day, 365 days per year, and use a five shift operation to cover the 168 operating hours per week. Power plant operator staffing in the Corps sample ranged from a low of 0.65 operators per unit operated to a

high of 1.40 operators per unit, with an average of 1.03 operators per unit directly operated (i.e., non-remotely operated units). Staffing levels in the non-Corps' plants varied from a low of zero operators per generating unit to a high of 2.38 operators per unit; the average number of operators per main unit was 1.82. Maintenance staffing at the Corps' power plants visited varied from a low of 0.88 maintenance workers per unit to a high of 3.15 maintenance workers per unit; the average number of maintenance staff per main unit was 2.55 FTE/unit. For non-Corps' sites visited, maintenance staffing ranged from a low of 2.17 FTE/unit to a high of 8.44 FTE/unit; the average number of maintenance staff per main unit was 5.89 maintenance workers per unit. While the small sample size makes definitive statements somewhat difficult, it is quite clear that non-Corps' power plants are staffed at significantly higher levels than are the Corps' plants. There was no apparent standard method for establishing staffing levels at any of the organizations visited; the primary factor most often cited as the basis for staffing decisions was "experience".

b. In-house Capability

The Study Team observed a high level of consistency with respect to maintenance capabilities, procedures, and philosophy at the Corps' hydropower projects. Maintenance shops at each of the visited projects possessed a significant level of capability, with adequate personnel and equipment resources to accomplish most preventive maintenance and breakdown repair jobs in-house. Exceptionally large jobs, and those requiring highly specialized skills, were generally the only types of work contracted at the projects. Large, recurring work requirements, such as cavitation repair and mechanical maintenance to turbine equipment, typically are accomplished using in-house labor at each of the sites, although major electrical work, such as generator rewinding, is performed by contract.

In every non-Corps' organization visited, contracts were utilized to provide support to the in-house maintenance labor to at least a minor extent. New construction work is almost universally contracted and the level of maintenance-related contracting is organization specific. Some organizations, such as Ontario Hydro and BC Hydro, restrict contracts to only the very specialized, one-time requirements. Other organizations use contracts extensively. In those organizations which have engineering capability on-site, the contract specifications are generally developed locally and, depending on the cost of the job, awarded locally as well. Project sites which do not have engineering staffs are supported by a maintenance facility or engineering office with geographic (area) responsibilities.

Maintenance shops throughout the non-Corps' sample sites varied from modest facilities to extensive repair organizations. Certain non-Corps' organizations maintain minimal capabilities necessary to perform preventive and routine maintenance, while others attain as much self-suffi-

ciency as possible. When queried about the basis for the organization's philosophy, non-Corps' managers stated that the organizations had evolved into their present structures over time rather than occurring in a single event. Consistency from plant to plant within the given non-Corps' organization, however, was quite evident.

Organizations which are structured to provide extensive on-site maintenance include British Columbia Hydro, Ontario Hydro, St. Lawrence Seaway Corporation (U.S.), New York Power Authority, and Union Electric Company. These organizations generally accomplish both routine maintenance as well as the heavy work with resources available at the project site. Non-Corps' organizations which prescribe to the minimal on-site capabilities philosophy include TVA and Seattle City Light. In each of these organizations, the on-site maintenance effort is limited to routine maintenance and repair. Maintenance expertise for these organizations is centralized into specialty repair groups who provide heavy maintenance support for all projects within a geographic area. These central shops may be co-located with one of the plants or may be remotely located. Advantages of the centralized maintenance facilities include the effective use of limited personnel and financial resources, cost-effectiveness and high utilization of expensive maintenance equipment, ability to retain a high level of expertise, and centralized maintenance planning.

c. Preventive Maintenance

Every Corps' project visited maintains its facilities and equipment under the philosophy that preventive maintenance, performed regularly, results in lower total operation and maintenance costs as compared with a breakdown mode of operation. While increases in repair requirements occasionally cause preventive maintenance tasks to be slipped, each of the projects believes planned, scheduled maintenance is a more effective and efficient use of personnel and financial resources than a breakdown maintenance policy. Methods of improving the preventive maintenance/breakdown maintenance ratio which are being pursued include modification of manufacturer-recommended preventive maintenance frequencies and tasks, and automated scheduling of the maintenance ordering process. One area which has received little attention to date at the projects visited, however, is proactive maintenance evaluation techniques. Each of the projects generally performs maintenance at regular intervals of time; however, it is widely believed in the non-Corps' O&M community that predictive techniques could be applied in many instances which would optimize the frequency of maintenance tasks, thus reducing overall maintenance costs and demands upon personnel.

Philosophies on preventive maintenance were fairly consistent throughout the non-Corps' organizations. It was generally considered that a good preventive maintenance system can significantly reduce long-term costs. The single exception was a public utility which is experimenting

with a pure "breakdown maintenance" approach at two of its sites; this experiment has yet to be evaluated. Preventive maintenance tasks are usually based on manufacturer's recommendations and experience of plant personnel. The more complex hydropower plants generally have more extensive programs. Documentation on performance of preventive maintenance was generally very good whether it was manually recorded or computerized.

Proactive maintenance evaluation techniques are being explored by a few of the non-Corps' organizations visited. Ontario Hydro (OH) is a particularly active organization in this field and has been working with the Electric Power Research Institute (EPRI) in San Francisco, California. In a joint program with EPRI, OH has installed sophisticated sensing devices on one of its large turbine-generator units at the Robert H. Saunders plant in Cornwall, Ontario. The on-line monitoring system is controlled by a personal computer and includes readouts on 84 separate operating characteristics. The effort is expected to provide recommendations on the optimum level of main unit monitoring for turbine-generator units.

d. Engineering Support

Engineers are stationed on-site at three of the Corps' hydropower projects visited. Their duties included, but were not limited to, maintenance engineering and management of the crews performing the maintenance work. Engineering work consisted of planning and coordinating maintenance work for the shops, trouble shooting maintenance problems, coordinating conduct of on-site turbine-generator testing, reviewing plans and specifications developed by the district for work on project, and providing contract administration for technical maintenance work.

All of the non-Corps' hydropower organizations visited agreed that significant engineering design work should be conducted out of a central office which supports multiple plants. There are two different opinions on the topic of maintenance engineering, i.e., providing on-site engineering expertise for the repair or replacement-in-kind of components and systems required to keep the plants operating. One is that maintenance engineering should be done at the project site, and the other is that all engineering work should be conducted at the district or area office. Most of the non-Corps' sites had engineering staffs of some size at the project sites, with the exception of Seattle City Light and Tennessee Valley Authority plants.

Associated with the amount of maintenance engineering capabilities on-site is the issue of centralized engineering and design support. Except for one district, project staff receive their engineering and technical support from their district's Engineering Division. Several districts visited had civil engineers responsible for construction contract administration or inspections operating out of project or areas offices. Only one district has established several project level technical support units, staffed with electrical/mechanical engineers, specifically to serve the needs

of the project itself. (This district operates a series of large, older hydropower facilities along a politically and environmentally sensitive waterway. The district does not staff small projects with technical support units.) The Corps should develop standardized guidelines for determining the level of on-site engineering expertise versus concentrating this expertise at the district/division level.

The Corps currently operates several centers of engineering expertise within the United States. The Hydroelectric Design Center is located in NPD, and there are also two "sub-design centers", located in MRO and SAM. There is no center of engineering expertise for recreation-related design requirements, though the Corps has made an effort to standardize in this area by recently issuing new architectural design standards for project recreation area restrooms and showerhouses.

In every case, the non-Corps' organizations contacted had one centralized group responsible for all engineering and design (E&D) effort for that organization. The interviewees stated that these E&D groups provided a level of expertise that was not available at the project and was only necessary in one location. Additionally, every organization stated that the level of service received from their E&D organization was satisfactory and, in some cases, excellent.

e. Standard Operating Procedures

Overall power plant operations at the Corps and non-Corps plants were quite consistent and uniform. The power plant operators' primary duties are to start and stop the turbine-generator units and monitor their continued operation. Each plant had a Standard Operating Plan which was on file in the control room. These plans are generally based on the original operating plans provided with the plant by the construction contractor. The plans address operational procedures for normal operating conditions as well as contingencies for emergency conditions. Each plant also has sets of control diagrams and blueprints which are used by the operators and maintenance personnel to troubleshoot alarm conditions and problems as they occur.

f. Maintenance Management

One area where differences existed among the hydropower facilities visited is maintenance management. Three of the five hydropower projects visited utilize computer-based systems to various extents for managing preventive maintenance and repair work requirements. One of these projects utilizes a computer system to list preventive maintenance tasks as each is due, and records labor hours expended on preventive and breakdown maintenance. The system does not, however, record information regarding what maintenance tasks have actually been performed, nor is it used in the work ordering process beyond preventive maintenance. Trouble reports are completed manually, and large maintenance jobs are recorded in a maintenance log book. At one large hydropower project, a computerized system is on-site, but the project staff is experiencing difficulty in implementation. Another project maintains a very elaborate computer system for management

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of preventive maintenance, unscheduled repair, and other maintenance labor requirements. The other two projects operate without a computer-based system for maintenance management.

The level of maintenance management varied significantly among the non-Corps' organizations visited, with the larger hydropower plants being the most sophisticated. The New York Power Authority, Ontario Hydro, British Columbia (BC) Hydro, and the Bureau of Reclamation plants each had very modern and comprehensive systems for analyzing, planning, scheduling, and tracking maintenance effort. Each of these non-Corps' organizations utilizing formal maintenance management techniques tracks every hour spent by all maintenance personnel and records what type of work is done, as well as the equipment which is being repaired. Seattle City Light's Boundary project, which is currently operating in a breakdown-maintenance mode, is considering the development of an automated maintenance management system which will include management of a preventive management program.

g. Facility Assessment

The power plant control systems at the Corps' hydropower projects visited generally have the original components which were installed when the plants were constructed. Obtaining replacement parts is a continuing problem because the systems are no longer being used in industry and often the original equipment manufacturer is either no longer in business or cannot make replacements. Finding manufacturers willing to make parts for these old designs is becoming more difficult and expensive.

In many cases, the facilities and equipment at non-Corps' projects were also essentially unchanged from the original construction. Control rooms in power plants were more often than not unchanged from the days of initial construction. At some sites, manual and analog operating equipment had been replaced with automatic control panels accompanied by CRT (cathode ray tube) screens. Plants which were constructed in the 1970s or later, or had undergone modernization, usually had digital recorders rather than the strip chart recorders installed in earlier facilities. In every case, the control rooms were air conditioned, climate-controlled spaces, which were clean and comfortable.

An impressive aspect of every Corps' and non-Corps' hydropower plant visited by the Study Team was the fact that the main generator rooms were always very clean and organized. In only a few cases were there noticeable maintenance deficiencies and these were limited to water spots caused by roof leaks. The sheer size of the facilities makes roof leaks a recurring maintenance item.

h. Remote Operation

A trend followed by all non-Corps' sites, with the exception of the New York Power Authority, was that of increasing automation to reduce staffing. The interviewees often had mixed feelings over full automation; several expressed reservations over the automation and remote controlling of plants. While financial pressures were encouraging such automated operations, several managers felt that the added insurance that comes with a manned station should be considered in the economic analysis to evaluate future automation projects.

Costs associated with maintaining full operations staffing at most Corps' hydropower projects are considerable, as Corps' power plants are, on average, staffed with seven operators. These operators are highly skilled, highly paid tradesmen, whose wages are determined based on special power plant wage scales rather than the Federal Wage Grade schedules used for most Federal trades positions. Corps' projects which are remotely operated have demonstrably lower operations costs than would be incurred with full, on-site operations staffing. However, no standard guidance exists which identifies conditions under which remote operation of power plants will be pursued. Several of the Corps' districts visited stated that they believed there were significant savings to be obtained through additional remoting of power plants under their jurisdiction. One Corps' district visited stated that it could save more than \$500,000 per year if permitted to remote to the extent it desired; this figure was based on preliminary feasibility studies already completed. Due, however, to the adverse impact on morale, union opposition, and Congressional actions to prevent the associated staffing reductions, there is a widespread reluctance to actively pursue these savings.

In many cases, remote operation of hydropower plants can result in significant operations cost savings, without compromising safety or project integrity. The Study Team believes the Corps should establish standard guidelines for remote operations, and plants should be converted to remote operation where practical and cost effective.

3. Recreation

a. Operations Activities

(1) Organizational Structure. Across the country, there is little consistency in the structure of the recreation management function. Regardless of the size of the facility, the organizational chain begins with the Park Ranger who reports to a Park Manager or to a Supervisory Park Ranger, who may also be the Park Manager or the NRM Branch Chief. The Park Manager/NRM Branch Chief/Supervisory Ranger typically reports to a Project Manager, an Area Engineer/Park Manager, the Chief of the district's Natural Resources Management Branch, or to the Chief of the district's Operations Division.

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The Area Park Manager concept was only observed directly in two districts during the course of this study. In both cases, the Park Managers of small reservoir projects reported to an Area Park Manager located physically, as well as organizationally, between the project and the district office. The role of the Area Park Manager was to provide technical, administrative, and managerial support to the staff of the individual projects, and to assist them to implement recreation policies issued at the district, division, and HQUSACE levels. In some cases, this is a cost-effective alternative to the staffing of redundant support positions at small projects located near one another. In other areas, the Area Park Manager concept functions as an additional layer of communications and paperwork between the field staff and district staff trying to assist them.

Above the Area Park Manager/Engineer, or the Park/Project Manager in most districts, the next organizational level of recreation management is either the district's Natural Resources Management Branch Chief or the Operations Division Chief. Problems with the use of the stove-pipe structure into the Natural Resources Management Branch included reduced communications and planning between functional groups, difficulty in determining long-range allocations of resources between functions, and the need for redundant support positions where power plant and recreation/resource groups are completely separated organizationally at the project level.

Project recreation staff also frequently interact with other technical elements at the district level. At most districts, Planning Divisions are responsible for developing Master Plans, visitor center/interpretive services prospectus reviews, and the conduct of some Environmental Impact Statements which would be required for development of recreation facilities. As discussed in a later section, project staff are required to perform a variety of the compliance, utilization, and general outgrant inspections, as well as manage the lakeshore use permit program. Many of the inspection duties must be accomplished during the conduct of routine patrols and tours.

By comparison, the National Park Service (NPS) has a flatter organizational structure than the Corps. They have nine multi-state regional offices, similar to the Corps' division offices, and an Alaska region, which report to the NPS Headquarters in Washington, D.C. The National Park Service does not have another organizational layer between the individual parks and the regional offices. They have combined at the regional level those functions which the Corps separates between its division and district offices. The Park Superintendents, who report to their respective Regional Superintendents, manage all visitor center, recreation, interpretive, historic preservation, and O&M functions at a given park.

(2) Visitor Centers. It is the policy of the Corps to plan, develop, manage, and operate visitor centers at water resource development projects. According to ER 1130-2-401, visitor centers are intended to educate and inform the public with regard to the history and mission of the Corps, its

role in water resources development, the project, its purpose, benefits, and costs. Visitor center facilities are classified as Type A Regional Visitor Centers, which are the largest and can only be authorized by Congress; Type B Project Visitor Centers, which can be authorized by legislation, cost-sharing, or the division commander; or Type C Visitor Information Centers, which are the most common and are designed as part of a new or existing project administration office. From a design standpoint, some inconsistencies were noted. ER 1130-2-401 states that the excessive use of windows in visitor centers unnecessarily restricts interior development of the building. Most of the Corps' visitor centers at lock or flood control/hydropower projects have been designed, or at least remodeled, with large amounts of window space to provide visitors with a view of ships going through the lock, water passing through the dam gates, or fish leaping up the fishladders.

Most visitor centers are fairly new or have been renovated over the last 10 to 20 years. The Contractor found no evidence that visitor centers are seen by visitors as old or run-down; those visited all seemed well maintained, regardless of the age of the project. In fact, several were assessed by the Study Team to be larger and better equipped than one would expect for the visitor center classification.

(3) Levels of Service. Overall, the Corps has an excellent reputation for the recreational services and programs it provides. Many visitors, young and old, were observed listening intently as rangers told the Corps' story and its relationship to the environment and to their lives. Even during the middle of the winter, one or two recreational vehicles could be found in most of the recreational areas visited by the Study Team.

Operating season calendars for Corps' recreation projects are typically set by project management in consultation with the district's Natural Resources Management Branch. The number of days recreation areas are open annually is directly affected by the funding available to operate and maintain the facilities. This is manifested in the number of O&M staff positions that can be funded during the months of lowest visitation, given the need to conserve FTE's for the busy summer months. Project staff attempt to provide the highest level of services possible throughout the year, within funding limitations.

Many projects do not provide campground staff during the October through March period, but leave all or some of their campgrounds available for primitive camping at no charge. This is especially popular in those regions where winter hunting, fishing, and cross-country skiing are popular sports, and in those areas where winter temperatures occasionally rise to a moderate level. While no fees are generally charged during the winter months to campers using self-contained recreational vehicles or to those utilizing pit toilets, rangers or O&M staff must still pick up trash and make inspections of the facilities on a regular basis. Operating hours are also influenced by the

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funding available to staff visitor centers, offer tours, and conduct evening campfire programs and security patrols. The length of coverage each day must be balanced within the total number of FTE allocated to the project for the entire year. Corps' projects typically extend visitor and information center hours, as well as increase patrols and routine tours, during the summer months.

Interpretive staff at projects provide excellent programs using a variety of methodologies. Rangers and Park Technicians were observed giving lectures, conducting audio-visual programs, leading tours, providing demonstrations, answering questions, and doing research. Overall, the Corps' staff of rangers exhibit a high degree of professionalism and pride in their work. As a group, they spend a great deal of time and effort developing and refining programs for the enjoyment and enrichment of visitors.

(4) Degree of Contract Utilization. Most, but not all, Corps' projects utilize contract staff to supplement hired labor in the performance of project operations requirements. More and more, as available FTE must be shifted to other project priorities such as O&M of flood, hydropower, and navigation structures, project managers are contracting for recreation area operations services. Typical contracted services at Corps-operated parks include fee collection, custodial, grounds maintenance, law enforcement assistance, and trash removal.

(5) Special Recreation User Fee Program. The SRUF funds projects can receive are a portion of those funds that are collected from recreation sites which are designated as fee areas. SRUF funds are allocated, on an annual basis (not necessarily proportionately), back to the projects from which the funds have been collected. These revenues must be expended during the fiscal year that they were distributed to the project, and may be used at one or all of the fee areas from which the funds were collected. Expenditures of SRUF funds are authorized for facilities operation and maintenance, improvements, renovations (including repair or replacement), additions, and consolidations at existing recreation areas. Corrections of sanitary deficiencies are funded separately. Typical uses of the SRUF funds are the erection and staffing of fee collection stations at fee campgrounds, upgrading campgrounds to higher use fee classifications, installation of electrical and water hook-ups when improvement and O&M costs are recoverable, separation of day use and camping areas to reduce utilization conflicts or to increase fee collections, improve existing restroom and shower facilities, paving roads, building group use facilities, renovating sewer systems, providing barrier-free access, and installing water fountains and fire hydrants. Project managers with recreation area responsibilities utilize SRUF funds to the fullest extent possible. Most of the funds, however, are used for maintenance activities rather than operations. Typically, SRUF funded operations are limited to fee collection activities.

(6) Real Estate Activities. One of the routine duties of Corps' ranger staff is the accomplishment of real estate-related permit actions and property inspections. Project lands are required to be zoned according to the Master Plan for different purposes. One of the most critical and sensitive areas on a water resource project is its shoreline. In accordance with ER 1130-2-406, "Shoreline Management at Civil Works Projects," October 1990, project staff are responsible for the implementation of a shoreline management plan. This ER provides policy and guidance on management of shorelines of Civil Works projects, including discussions of preparation and approval of the plan, shoreline allocation, public participation, and the periodic review of the management plan. Other topics discussed include the use of permits and user fees, facility maintenance, and the density of private development. The shoreline management plan is designed to maximize the potential value, both Federal and commercial, and the public use of the area. Operation and Maintenance is responsible for the daily operation and upkeep of the shoreline areas and is thus affected by any changes to this regulation or to the management plan.

(7) Boundary Surveying and Monumentation. Routine inspection, and cyclical surveying and monumentation, of project boundaries are Corps land management responsibilities which are often delegated to project ranger staff. The protection of Corps' boundaries is important to the security and sovereignty of the Corps' land holdings. The Corps' goal is to survey and monument 100% of project boundaries, unless a specific exemption to this goal has been approved by the District Engineer. The Contractor has identified a cost-saving opportunity in this area. Project staff, in conjunction with the district Real Estate Division, could rate sections of their project's boundary as to the likelihood of encroachments by non-Corps' entities, i.e., other Federal, state, or local agencies or private/commercial parties. Those segments which are contiguous with other governmental agencies, or which have had historically low encroachment problems, could be placed on a less frequent re-surveying and re-monumentation schedule. (The Corps could also attempt to cost-share these tasks with neighboring government agencies with whom they share boundaries.) The project's resources could then be concentrated on those segments with the highest frequency of encroachments.

b. Maintenance Activities

(1) Organizational Structure. As previously described, there is little consistency in the manner in which maintenance activities at Corps' recreation areas are organized or managed. Maintenance staff at Corps' facilities are either hired labor, contract staff, or a mix of both. Recreation area maintenance requirements are established annually at most facilities through annual inspections, responses to visitor or staff comments, according to project O&M manuals or Operational Management Plans, and by virtue of what didn't get done the previous year. Only a few projects were found to use routine preventive maintenance plans for the recreation facilities, and those utilizing

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contractors for park O&M were much more likely to conduct routine annual maintenance requirements inspections. There is no consistency in the manner in which maintenance items are identified, ordered, dispatched, tracked, recorded, or evaluated.

(2) Visitor Centers. The condition of visitor centers at Corps' projects ranges from fair to excellent, and those that are only fair are the exception. Project staff at all levels tend to take very good care of their visitor centers, even to the extreme in several cases. While enthusiasm and initiative is commendable, the project's O&M program can be impacted by incremental changes to the visitor center's structure or scope. Resources available at projects must be weighed and monitored very judiciously by Corps' management.

(3) Levels of Service. Corps-operated campgrounds are typically well managed, safe, comfortable, and clean. The cost of providing this level of service can be significantly impacted by the length of the operating season. Projects which provide year-round camping must provide year-round trash removal and other maintenance services. Those which close their campgrounds for several months each year are often able to furlough some staff occupying seasonal positions or curtail contracts.

The current and desired levels of service at Corps' recreation facilities, i.e., in terms of the services, amenities, facilities, and maintenance provided, are open to interpretation. Across the divisions, there are projects which have campgrounds that resemble small state parks, small "mom and pop" commercial campgrounds, or small National Park Service or Forest Service campgrounds. These recreation areas have the minimum amenities that would be required for safe and healthy camping facilities: a concrete or gravel car pad, picnic table, fire ring, grill, lantern post, restrooms, water supply, nearby trash dumpsters, some provisions for night-time security, and access to the river or reservoir. These sites bring in the minimum amount of revenue, but are the least costly to maintain over the years. There is not much equipment which can break, and repairs or replacements are not expensive.

At the other end of the spectrum, there are Corps-operated parks that have been developed to meet the needs of a higher-level camper, i.e., the operator of the large 20- to-40 foot motorhome. The enhanced level of services at some of these facilities includes: concrete car and recreational vehicle pull-through sites with water, electrical, and sewer hook-ups; and shower facilities. Other facilities encountered at Corps' recreation sites included: tennis courts, baseball fields with tower lights; soccer fields; basketball courts; canopied picnic tables; and campsite curb-side trash removal. As discussed below, the rationale given to the Study Team for many of these improvements was the need to keep up with commercial facilities nearby. The effect of these improvements has been an increase in potential maintenance requirements. Repairs and replacements of individual site

water, sewer, and electrical hook-ups and other features will be more expensive than repairs to the simpler communal water and sewer outlets. As with visitor centers, varying FTE and funding levels will ultimately have an affect on the level of maintenance services that can be provided to these upgraded facilities.

(4) Special Recreation User Fee (SRUF) Program. In an effort to make recreation as cost-effective, or cost-neutral, as possible, the SRUF program was developed to help balance income and O&M expenditures across all Corps' districts. The SRUF funds provided to projects as a portion of their revenue are intended to supplement the costs of operating, maintaining, and, when practical, improving campground facilities. The SRUF program is widely publicized so that campground users can see tangible evidence of the use of their camping fees at the projects. Those projects which produce very little revenue due to the primitive conditions of their campgrounds often receive more SRUF funds than they collect in revenue. Those projects having high revenue-producing campgrounds often supplement the "poorer" projects by receiving less SRUF funds than they would expect given the revenue produced.

Project and district staff interviewed stated that revenue enhancement potential was the driving force behind SRUF fund usage priorities, rather than using the funds for general maintenance. Several of those interviewed stated that they felt responsible to maintain the Corps' reputation as, in their words, "the provider of the best campgrounds for large recreational vehicles (RV) in the country." Renovations of campgrounds, as well as the addition of utilities and recreation fields, using SRUF fees, have been justified in the past on the basis of obtaining \$1 to \$2 a night more per site or providing improved or additional campsites to attract those who might otherwise go to commercial campgrounds. As one project manager stated in a memo outlining the project's FY 1989 SRUF work plan to the district office, "We feel that we have the greatest demand on our facilities and as such should spend every legal dime we can generate improving our facilities."

c. Physical Assessment

(1) Campgrounds. Corps-operated campgrounds are in good to excellent condition. Some provide more services than others, but the physical conditions of the tables, restrooms, and facilities are good. Road repair requirements within recreational areas were the most common problems observed. Changes in environmental and sanitary requirements by states continues to be a problem for some projects. As quickly as possible, project staff are attempting to reprogram the necessary funds from other activities to upgrade existing sanitary facilities. Erosion damage to campgrounds due to changing pool elevations and, in some cases, poor design decisions was the next most potentially expensive problem discussed.

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(2) **Picnic Areas**. The Corps has excellent picnic facilities. They have made attempts to blend these sites into the natural landscape and to place them in areas which have a combination of shade or shelter, playing fields, water and restroom facilities, and a good view of the river or reservoir. Many of the projects visited had new, well designed, easy to maintain group picnic shelters.

(3) **Boat Ramps**. The condition of Corps boat ramps depends on several key factors: climate, usage, and pool elevation fluctuations. Those which were subject to frequent freeze/thaw cycles were not in as good a condition as those in warmer climates. Those in the moderate or warmer climates, however, tended to show more wear due to the longer boating seasons in those areas. Changing pool elevations have had a negative affect on boat ramps at many projects. Heavier maintenance and more frequent replacement is necessary at those projects where boat ramps and parking lots are flooded on a regular basis.

(4) **Restrooms/Bathhouses**. There is currently a wide variety of restroom and bathhouse designs in use at Corps' facilities. The Corps issued a set of Standard Designs for Recreation Structures in March 1991, which are to be used in conjunction with EM 1110-1-400, Recreation Planning and Design Criteria, July 1987. These designs have been established in order to reduce design, construction, installation, and maintenance costs. Many of the projects have been routinely remodeling their existing restroom facilities to improve lighting and ventilation, and tiling the cinder block walls to reduce routine cleaning time.

4. Navigation

a. The Corps Navigation Program

The Corps operates and maintains 230 locks and dams on the nation's waterways. The dredging function performed by the Corps also facilitates navigation, as does the maintenance of breakwaters, seawalls, and jetties at coastal harbors. Due to the extensive expenditures associated with the dredging program and its unique nature, a separate discussion of the dredging program is presented.

b. Maintenance

Major maintenance, major rehabilitation, and modernization tasks are performed at Corps' locks by crews from centralized maintenance facilities and/or by contractor personnel. Four of the five river systems visited utilize off-site Corps' support for these large work efforts. Each one of the centralized maintenance support organizations provides a trained staff and a floating maintenance facility. These crews are each equipped to pull and replace lock or dam gates, construct emergency dewatering dams, repair minor concrete and timber damage, add rip-rap for erosion or scour protection, and repair lock control equipment. For large maintenance items, such as constructing

new facilities, installing new controls or gate actuating systems, or major concrete wall replacement, contractor support is procured through the district office.

Those Corps' projects where the navigation system is closed periodically during the winter utilize these periods for major maintenance of their locks. Corps' locks are dewatered on varying rotational schedules, depending on the district, of every five to 15 years or more. Work crews comprised of mechanics from the project and from the district's centralized maintenance group, where available, and the projects' operations staff can typically complete the major overhaul of one to three locks during a two-to five-week shut-down period. (Typically, during winter closures, some of the seasonal position Lock Operators at each site are furloughed for several weeks, some assist with maintenance on the lock where they are normally stationed, and some join the major maintenance crew(s) at the lock(s) being overhauled during that period.) In areas where climatic conditions, i.e., severe icing, do not force the closure of the navigation system naturally, the district Navigation Branch and the local waterway users group together develop a schedule for lock maintenance outages based on when and for how long the waterway shipping industry can suspend operations.

The St. Lawrence Seaway, a major international waterway, is maintained by two separate entities, the St. Lawrence Seaway Authority (SLSA), which operates the Canadian portion of the system, and the St. Lawrence Seaway Development Corporation (SLSDC), which operates the U.S. portion under the aegis of the Department of Transportation. Most major maintenance of the SLSA locks, as well as that of the SLSDC, is performed when the chambers are dewatered each year during the annual late December through March winter closure period. In addition to maintenance personnel, lock operators are also utilized in the seasonal repair work, rather than being furloughed during the winter. Examples of typical maintenance work accomplished when the locks are dewatered during the seasonal closure period include concrete repair, painting of miter gates and valves, and electrical/mechanical work on gates, valves, and appurtenances. Major rehabilitation work is also accomplished during the closure period, as are inspections and measurements. Due to considerable heavy equipment capabilities and an extensive level of spare parts, the SLSA and the SLSDC are able to accomplish most maintenance and repair tasks in-house. The current informal policy of both organizations is to perform work with in-house labor whenever possible; however, if the size of the job is exceptionally large, or if specialized skills are involved, the work is contracted out.

c. Automation

While lock control systems are being rehabilitated or replaced at several Corps' sites, automation of the lockage process in order to reduce costs and decrease cycle times is not currently being

aggressively pursued at the Corps' locks visited. The potential may exist, however, to improve lockage efficiency and reduce costs at certain Corps' locks. For example, the lock nearing completion at the Bonneville Project may be a good candidate for remote operation from the powerhouse, and hand-held lock controls may have application at several of the other Corps' locks visited.

During the early and mid 1980s, the St. Lawrence Seaway Authority of Canada reduced staffing on several of the Welland Canal locks by increasing the level of automation in the lock operating process. Where each lock gate had an adjacent control system in the original design of the lock, the SLISA centralized control of the two gates into one lock house, thereby reducing the staffing by one operator at each site. The SLISA also improved radio communications and ship locating systems in order to reduce transit time through the locks. During the late 1980s and early 1990s, the traffic through the St. Lawrence Seaway has been significantly reduced and cost cutting measures are now considered to be most important, even those which may increase the transit time through the locks.

d. Vessel Securing

Procedures for securing vessels to mooring bitts during the lockage process are not consistent from district to district. In fact, procedures are not always consistent between lock projects within the same district. There is no consistent, Corps-wide policy which dictates whether vessel securing is the Corps' responsibility or that of the shipper. One district visited does not provide securing assistance to vessel operators at any of its lock projects. Verbal instructions are given to vessel operators, but no physical assistance is provided. Other districts visited provide securing assistance at one or more lock facilities. At projects where Corps' personnel maintain responsibility for vessel securing, lock operators often handle lines, although line handler positions exist at some locks specifically to fasten and unfasten lines to/from mooring bitts. Some projects have as many as two line handler positions per lock, per shift, dedicated to the vessel securing process. One non-Corps' navigation organization visited had recently provided securing assistance to vessel operators, but no longer does so in an effort to reduce operations costs. Primary securing responsibility now resides with vessel operators, and, as a result, the organization has been able to reduce staffing by two positions per lock.

The Contractor suggests that significant cost savings would result from a Corps-wide policy which places securing responsibility upon vessel operators except where the physical characteristics of the lock or unique safety concerns necessitate Corps' personnel provide assistance. Under such a policy, most lock projects could reasonably require securing procedures be performed by vessel operators, thus resulting in significant personnel savings throughout the Corps.

e. Dewatering Frequency

Lock chamber dewatering frequencies were found to vary considerably between districts. The frequency at which locks were dewatered was inconsistent between all four navigation systems visited, and there is minimal justification for such variance. Since lock dewaterings and associated maintenance/inspection actions are extremely labor-intensive, and entail delays to commerce if performed during the navigation season, it is critical that the minimum frequency effective dewatering schedule be employed. ER 1130-2-303 Project Operation - Maintenance Guide, Dec 1967, indicates that dewatering should take place every 10 to 15 years, but that salt water conditions may require more frequent dewaterings. In practice, however, the length of time between dewaterings of individual locks often varies due to many factors. In some cases, district maintenance staff have had to meet demands which are perceived as more pressing than routine dewaterings, which have resulted in delayed lock dewaterings. In some cases, lock chambers over 20 years old have never been dewatered. By contrast, locks of the St. Lawrence Seaway Authority (Canada) and the St. Lawrence Seaway Development Authority are dewatered for maintenance annually during the three-month seasonal closure period, and locks of the German Federal Waterways System are dewatered at five-year frequencies along critical-designated waterways, and at eight-year intervals along non-critical navigation routes.

The Contractor suggests that all locks be dewatered on a regular multi-year schedule. An example would be to have critical locks dewatered every 10 years and non-critical locks dewatered every 15 years or, where special circumstances exist, on approval of HQUSACE. Dewatering all locks on a regular schedule would provide consistency between Corps' projects, and would lead to standardization of what maintenance tasks are performed during each dewatering. In addition, advanced planning would facilitate the scheduling of manpower and acquisition of parts and materials. The shipping industry would also be able to better plan their tow schedules if they knew in advance when particular locks are scheduled for closure.

f. Bank Stabilization

The purpose of the Corps' bank stabilization program is to protect shore lines and river banks through prevention/reduction of erosion. This is accomplished in several different ways, depending on the physical characteristics of the body of water. Construction of jetties, groins, and breakwaters are common ways to protect shore lines. Riprap is often used to stabilize stream and river banks. The primary method of bank stabilization used on the Mississippi River is to sink, or lay, revetment mats. Revetment mats are made of concrete, and are placed along the river banks by revetment units. Two districts, within the same division, each own and operate one revetment unit. Operation of revetment units is labor-intensive. There are approximately 420 crew members per revetment

unit crew, and there are three crews (one at one district, and two at the other). In each crew, approximately 65 positions are considered critical-skill positions and are filled year round with full-time and 50-week seasonal employees. The remaining positions are filled with temporary employees who work only during the sinking season.

The Corps' revetment program is moving from a construction phase to a maintenance phase, as revetment mats have been placed along the majority of the river's banks where needed. The division plans to consolidate revetment operations in 1995, as the construction phase of the revetment program is completed. At this time, the division plans to go to one revetment unit only, which will be used to maintain the existing revetment mats. The Contractor has identified several opportunities which can be taken to reduce operational costs of revetment units, both now and after 1995.

5. Dredging

a. The Corps Dredging Program

Dredging is the single largest O&M program in the Corps. Annual dredging expenditures averaged \$291,000,000 during the five-year period from FY 86 through FY 90. In FY 89, over 290 projects were dredged around the country, including harbors, large rivers, and other inland waterways.

The Corps' dredging program is managed at the district level, using guidance provided by the Dredging Section at Headquarters. ER 1130-2-307, Dredging Policies and Practices, revised June 1991, provides the principal guidance for maintenance of dredging projects. At the district level, the Navigation Branch/Office/Section of the Operations Division is usually responsible for management of the dredging function. At many districts, the Engineering Division also has a role in dredging management. For example, at one district which uses dredging contracts, Operations Division staff prepare the contract plans and specifications, and perform the hydrographic surveys for payment purposes, while Engineering Division prepares the Government cost estimate.

When procuring dredging services, a unit price contract is used by a majority of the districts. In a unit price contract, payment is based on the volume of material dredged or the amount of time it takes to complete the job. The volume of material removed can be calculated in two ways; the results of pre- and post-dredge surveys can be compared, or the volume can be determined from the number of scows or bins the contractor fills and disposes. Under this type of contract, a price is charged by the contractor for mobilization and demobilization of the dredge, and a separate unit price is charged for each cubic yard of material removed or each hour worked. Districts, as well as the dredging industry, favor this type of contract because the amount of payment closely reflects the amount of work accomplished.

Dredging is accomplished by Corps-owned dredges as well as contract dredges. Public Law 95-269 states that the Secretary of the Army "may retain so much of the federally owned fleet as he determines necessary, for so long as he determines necessary, to insure the capability of the Federal Government and private industry together to carry out projects for improvements of rivers and harbors." The Corps' minimum dredge fleet includes four hopper dredges, one pipeline dredge, three dustpan dredges, three sidecaster dredges, and one special purpose dredge. These dredges are operated and maintained by the Operations Divisions of eight districts.

b. The In-house Hopper Dredges

A Corps study, entitled "Analyzing the Corps of Engineers Dredge Fleet", was completed in July 1991 by the Engineer Studies Center. This study addressed, in detail, industry and Corps' capability with respect to workload, and the cost-effectiveness of Corps' dredges compared with industry. The study also addressed the need for a "federally owned fleet ... to perform emergency and national defense work." A decision was made to revise the study after numerous questions and comments were received from Corps' districts. As of the date of this analysis, the study was still under revision.

Since 1978, the dredging industry has grown in size and capability, particularly in the field of hopper dredging. There is currently an agreement between the dredging industry and the Corps of Engineers that the Corps will limit the use of its own hopper dredge fleet to 920 days per year, or an average of approximately 230 days per hopper dredge. This allows industry an opportunity to do a significant portion of the Nation's dredging work, which helps sustain the dredging industry's base.

The National Association of Dredging Contractors' (NADC) report, "Analysis of the Army Corps of Engineers Minimum Dredge Fleet Requirement", June 1991, shows that the cost per cubic yard is higher for Corps' hopper dredges than for industry dredges; sometimes by as much as two-thirds. Corps' personnel stated that the data in the report is skewed because of the different types of dredging jobs performed by Corps and industry dredges. However, while there is some validity to this statement, data collected by the Study Team support the NADC's basic conclusion.

The 230-day ceiling does not allow for optimal utilization of Corps-owned equipment or generation of competitive Government dredging rates. It is unlikely that industry would agree to a renegotiation of the 230-day ceiling for Government hopper dredges. In fact, the dredging industry would like to see this ceiling lowered. One alternative which would increase equipment utilization and decrease costs is to eliminate one Corps' hopper dredge from the minimum fleet and redistribute the 230 days worked each year by this dredge to the three remaining Corps' hopper dredges. Nationwide, there would be no change in total working days for Corps' hopper dredges. In those

districts where the number of working days would be increased, the daily rental rate for the dredge(s) would decrease, resulting in estimated annual savings between \$7.5 and \$10 million Corps-wide. This action would leave the Corps without in-house hopper dredging capability in one area of the country, and there is concern among districts that a situation like this would allow industry prices to escalate. However, the potential savings are too great to let these concerns negate further investigation of this option.

If one dredge were eliminated, the most cost-effective course would be to cease operating a dredge from a district which only operates one hopper dredge. This would make it possible to eliminate all costs associated directly with the dredge, including labor and operation and maintenance costs, as well as costs associated with the support staff at the district office. At each of the two districts that own one hopper dredge, over 60 FTE are associated with operation and maintenance of the dredge.

c. Hydrographic Surveying

Hydrographic surveying is a major element of the dredging function. The surveys are used to monitor channel conditions, to determine the extent of shoaling, and to determine the amount of material removed during dredging operations. The quality and timeliness of surveys is crucial to effective channel maintenance. Project condition surveys and reconnaissance surveys are employed for the purpose of monitoring channel conditions. ER 1130-2-307 requires that project condition surveys be performed annually on all projects dredged annually, and that reconnaissance surveys be performed annually on those projects dredged less than annually. However, it may be possible to perform reconnaissance surveys in place of many project condition surveys. Reconnaissance surveys are quicker than project condition surveys and, therefore, less expensive. The Contractor suggests that, rather than requiring districts to survey all projects annually, using either reconnaissance or project condition surveys, the level of survey detail and frequency of survey performance at a project be based on the frequency of project dredging, the level of project utilization, and project traffic type.

Reconnaissance surveys are not as accurate or detailed as project condition surveys, and may not detect all shoals. However, as technology advances and the use of "sweep" type surveys becomes more prevalent, the quality of reconnaissance surveys should improve. Under current operating procedures, the Corps is incurring costs for performance of hydrographic surveys that may not be essential and for detail that is not always necessary. The suggested guidance provides a method for districts to decrease the cost of hydrographic surveys, while continuing to maintain knowledge of current channel conditions and changes in these conditions.

d. Impacts of Increasing Environmental Restrictions on the Dredging Program

Federal, state, and local environmental restrictions, or "windows", are playing an increasingly larger role in the management of the dredging function. Environmental windows are usually enforced to protect species which may be migrating through an area, or nesting/mating in the area during dredging operations. For example, in one district dredging is not allowed between November and March because of white whales, manatees, and turtles in the area. In this same district, dredging is not allowed between March 15 and May 31 because of striped bass in the area. At another district, dredging is not allowed within 500 feet of an oyster bar between April and September, and between December and February. At a third district, disposal of dredged material on beaches is restricted from November 1 to May 14 because of turtle nesting. Many districts sponsor an annual meeting with local resource agencies to discuss the environmental windows and their impact on upcoming dredging requirements and the anticipated dredging schedule. These meetings have been very successful in improving communication and enhancing the working relationship between the Corps and other agencies.

The Corps, in accordance with Section 401 of the Water Pollution Act and Section 307(c) of the Coastal Zone Management Act of 1972, must seek water quality certification, and in some cases coastal zone consistency, from a state before dredging and disposal operations may begin. In order to obtain these documents, the Corps must test the dredged material and the material at the proposed disposal site, in accordance with the Federal standard, defined in 33 CFR Section 335.7. However, because the Federal standard is not interpreted and applied consistently throughout the Corps, a problem arises when the material testing requirements imposed by the state agency(s) exceed those required by the Federal standard.

33 CFR Section 337.2 states that, "if the state agency imposes conditions or requirements which exceed those needed to meet the Federal standard, ... the district engineer will accommodate the state's concerns to the extent practicable." However, the Section also states that additional testing requirements requested by the state, which exceed those requirements specified by the Federal standard, shall be funded by the state agency. Section 337.2 further states that if the state will not fund the additional testing, and "denies or notifies the Corps of its intent to deny water quality certification or coastal zone consistency, the project dredging may be deferred." Some districts have chosen to defer dredging in these situations until additional funding is provided or the additional testing requirements are withdrawn. However, the Study Team is aware of at least one district that has agreed to perform tests which exceed the Federal standard. The annual costs for this testing, which is requested by the local government, are in excess of \$50,000, and the number and costs of tests requested is increasing. The local government has refused to issue water quality certification unless the Corps meets the requirements, but has not agreed to pay for the additional

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testing. The district has determined that funding the additional tests is working to "accommodate the state's concerns to the extent practicable."

Districts must interact with the local community daily. Currently, each district sets its own policy regarding performance and funding of testing/tasks beyond what is required by the Federal standard. This policy allows each district the flexibility to respond to the situation in the local community and to the varying degrees of environmental concern. Every district stated that rising public concerns about the environment are increasing the amount of material testing required. Because environmental regulations are more strict in some areas of the country than others, the degree to which this impacts each district's operations varies throughout the country. Regardless of these variations, however, a decision must be made as to what the Corps of Engineers' position will be with respect to application of the Federal standard.

It is difficult for one district to justify deferral of dredging when another has agreed to incur additional expense to meet requirements imposed by the state for water quality certification and coastal zone consistency. The first district may then appear to the public to be unconcerned about the environment, and unwilling to compromise. Alternatively, there is the problem of a district trying to justify incurring additional expenses, when other districts are deferring dredging. Lack of a Corps-wide policy also encourages non-standardized funds expenditure.

The Contractor suggests the following guidance be provided: "Districts shall not exceed the Federal standard for testing of dredged disposal material, unless the state agrees to fund additional requirements".

D. PEER COMPARISON

Two key areas of comparison between the Corps and other non-Corps' organizations are worth noting. They are: (1) the great extent of centralized O&M program management in non-Corps' organizations and (2) centralized allocation of extensive resources, authority, and responsibility to operating (field) personnel, both of which run contrary to current trends within the Corps. The Corps is evolving in a direction contrary to current management theory and diametrically opposed to the trend in other Federal and non-Federal entities with similar missions. In today's world of increasingly expensive technologies, increasing reliance on information systems, and greater interdependence, an organization which consists of 36 related entities, each of which sets its own standards on information systems, workload tracking, and organizational structure -- while building ever-increasing levels of internal review -- will find it very difficult to become, or remain, cost-effective.

V. OPPORTUNITIES FOR PROGRAM IMPROVEMENT

This chapter presents the Contractor's preferred options for improving the program in those areas previously discussed. The options will be grouped into High impact, Short-Term and Long-Term plans. Additionally, the options are separated into Programmatic, General Project Management and Functional Area categories. The options presented will have a significant impact on the Corps O&M program by improving the overall management of the program, decreasing the cost of providing services or improving the level of service.

A. HIGH IMPACT PLAN

The following is a selection of the most significant issues and options. These issues show the highest potential for large savings or program improvements, and are generally multifunctional. The Contractor estimates the cost of implementing the High Impact Plan to be about \$8.5 million.

1. Programmatic

- Corps' projects and districts have varying interpretations of baseline work items. Similar projects between districts have significantly different levels of baseline staffing and resources. Examining the baseline requirements for each non-dredging Corps' O&M project would provide the basis for guidance of a consistent and equitable baseline requirement for all non-dredging O&M projects.
- The current programming practice includes allocation of a fixed amount of funds to each district each year for variable work items. Allocating funds for periodic and non-recurring work items on the basis of Corps-wide priority would maximize the efficiency of the allocation of resources for variable requirements.
- Funding for dredging projects out of the same fund as other projects allows the funding volatility of dredging projects to impact upon the remainder of the program. Separating the funding for dredging projects would allow the Corps to take advantage of the relative stability of the funding requirements for non-dredging projects in planning and executing the program.
- The funding level matrix includes guidance which is inconsistent with current practice and does not provide sufficient clarity for consistent interpretation. Providing clarification, including expanded definitions to augment the one- or two-sentence matrix descriptions to bring them in line with current funding practices, will enhance conformance to Corps' guidance and improve the consistency of budget submittals.

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- There is no detailed mid-range planning performed with respect to specific periodic and non-recurring work items. Preparing an annually updated, detailed five-year projection of these requirements would improve funding allocation decisions.
- The impact of new programs and policies may not be well understood since it is often difficult to isolate and identify costs. Requiring identification of all new funding demands over \$25,000 that result from new program requirements would allow such requirements to be revisited to ensure that the cost of new requirements does not outweigh the beneficial effects, and that resource conflicts with existing programs are identified.
- The interim BY budget submittal, and subsequent work allowance request, are not held to the same level of review as the original BY budget submittal (President's Budget). Applying a parallel level of review to these interim submittals (or performing random audits) would ensure that all changes to the O&M program during the period between Congressional approval and the start of the Budget Year are justified and in accordance with Corps' guidance.
- Monitoring expenditure and obligation goals may influence Corps' managers to make inefficient expenditure decisions to meet these goals. Eliminating these goals could allow managers more flexibility to make sound expenditure decisions.
- Current expenditure recording practices may not achieve the desired level of accuracy. Providing additional sub-FCCs and accounting element definitions and/or clarifying existing definitions so that all activities are accounted for; clarifying timekeeping regulations; and performing random periodic audits of recorded expenditures, would provide for improved accuracy in the recording of O&M expenditures.
- The current presentation of the O&M budget request may not provide the most effective format for justification of the program. Providing additional summary detail of the division and Corps-wide requirements for baseline (fixed), variable, and dredging requirements would provide the reviewer with a better understanding of the Corps' funding requirements, and would allow the Corps the opportunity to highlight successful management and cost containment practices related to each program component.
- The condition of many Corps' structures has deteriorated due to the inability of these projects to fund for major maintenance and rehabilitation out of the annual O&M appropriation. Implementing a recapitalization program for those projects with significant structural features, possibly with funding partially provided by external users, would eliminate much of the unaccomplished major maintenance and rehabilitation requirements.

2. General Project Management

- Labor is being charged inconsistently to technical indirect accounts, impacting technical indirect overhead rates and making cross-district comparisons difficult. Reducing the emphasis on overhead rates as a measure of productivity and, instead, concentrating upon an analysis of overhead functions, overhead organizations, and total cost per output would provide a more meaningful assessment of overhead costs and facilitate more accurate cost comparisons between districts.
- To improve current performance indicators and cost prediction models, cost-to-output performance models should be developed. Such performance models have potential as predictive and monitoring tools for costs associated with O&M functions.
- No formal Corps-wide system exists for the regular identification and tracking of unaccomplished maintenance and repair (UMAR). Establishing an annual reporting procedure for project UMAR would reduce the possibility of critical maintenance requirements being overlooked, provide valuable information for monetary and personnel resource allocation decision-making, and provide better documentation of funding requests.
- Corps guidance on organizational structure for O&M field organizations should be updated and enforced to reduce management layering and staffing. The guidance would describe the ideal project, area, and district office organizations, based upon the critical factors (size, mission, etc.) affecting Corps' districts.
- New guidance on defining, ordering, tracking, dispatching, and managing work orders, to reflect modern public and private management practices, should be developed. This would reduce O&M costs over time, improve work flow, and ensure consistency between project policies.

3. Functional Area Specific

- Some visitor center facilities exceed the size, scope, and staffing criteria for the type of center authorized. Down-sizing facilities where expansion was not or cannot be justified could potentially reduce resource requirements. Further, projects could be required to submit plans and justifications to HQUSACE prior to enlargement of visitor center size or scope, to ensure effective utilization of resources.
- Special Recreation User Fee (SRUF) funds are being used to enlarge, as well as improve, existing facilities. A policy should be issued that SRUF money be used first to offset O&M costs, and only secondly to enhance the level of service. SRUF funds should be withheld until districts provide written justification showing maintenance impacts as well as level of service benefits.

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- Hydrographic surveys are required annually at all Corps' dredging projects. The level of survey detail, frequency and performance should be related to the frequency of project dredging, the level of project utilization, and project traffic type. This would focus funding and resources on those projects of economic importance to the region and Nation, and projects requiring the most maintenance. This would also reduce annual hydrographic survey costs.
- Operation of revetment units is labor and equipment intensive. Modification of current operating and scheduling procedures would significantly reduce crew sizes and equipment requirements.
- The number of potential operating days for Government-owned hopper dredges is currently restricted, thus limiting the cost-effectiveness of this equipment. One hopper dredge could be eliminated from the Corps' fleet, allowing the remaining dredges to increase annual operating days. Further, a reduction of one dredge would allow for elimination of all operation and maintenance costs associated with the dredge, including equipment and hired labor.
- The Federal standard for testing of dredged material for disposal is not interpreted and applied consistently. The Corps should adopt a standard policy that testing of dredged material, in excess of the Federal standard, will not be performed unless additional funds are provided by non-Federal sources. A standardized policy will ensure Federal funds are spent consistently from project to project.
- In certain cases, remote operation of hydropower plants can result in significant operations cost savings, without compromising safety or project integrity. No standard Corps-wide policy exists, however, for determining when remote control operation of power plants is justified. Standard guidelines should be established, and plants converted to remote operation where practical and cost effective.

B. SHORT-TERM PLAN

Following are the Contractor's preferred options for short-term improvement of the program. These options would create significant advantages for improvement but would have less programmatic impact, as a group, than the High Impact Plan. The Contractor estimates the cost of implementing the Short-Term Plan at about \$7 million.

1. Programmatic

- Decrease the amount of detail required in the baseline budget submittals, to reduce the amount of resources required to prepare, process and review the submittals.

- Develop separate programming policies for dredging projects to better manage the volatility of the dredging program and to increase the efficiency of programming.
- Issue guidance on how to estimate the budget amount for individual dredging projects, which would decrease the variance between budget and expenditures for the dredging program.
- Implement a contingency fund for dredging projects at the HQ level to provide for a greater diversification of the risk of funding shortfalls, and to reduce the risk of funding shortfalls due to cost overruns.
- Implement a contingency fund for emergency requirements at the HQ level to provide for a greater diversification and reduction of the risk of funding shortfalls.
- Maintain the current minimum cost threshold for major rehabilitation funding.
- Adjust the transfer limit for the O&M, General, account to increase the flexibility to reprogram funds for relatively small projects.
- Use the current work allowance schedule as the base for monitoring expenditure and obligation goals for the Command Management Review. This would encourage field personnel to yield excess funds and decrease pressure to make inefficient funding decisions to meet stringent obligation and expenditure goals.

2. General Project Management

- To improve the timeliness, cost-effectiveness, and control of the small item procurement process, establish new procurement request authority limits for Area/Resident/Project Engineers/Managers. The individual limits could be based on the size and scope of the project(s) managed and the process for determining the limits would be consistent across districts. The funding verification process could be accomplished by project staff, which could eliminate an entire step in the district-level request approval process.
- Logistics Management (LMO) and Information Management (IMO) offices are imposing additional control mechanisms on Corps' project staff. The increased controls, coupled with limited communication between projects and the LMO/IMO offices, detracts from the operational effectiveness of the project. Concentrate performance of LMO and IMO interface/liason duties into an existing Operations Division position. This will provide Operations with a single point of contact for all LMO/IMO issues.
- Implement a quarterly or semi-annual O&M newsletter to increase the exchange of useful O&M information relevant to Corps-operated structures and facilities. Practical tips and

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techniques could be shared, as well as information on innovative technologies and new methods for the allocation of scarce resources.

- Data cannot be easily shared between field activities due to software incompatibility. Set file/data compatibility standards for all types of software, and allow divisions to set individual purchasing policies. This will increase data compatibility within divisions, ensure consistent support within divisions, allow for simultaneous upgrades to software, and possibly allow for limited volume discounts on software purchases.
- Establish new Feature Cost Code sub-features to improve the tracking of facility maintenance and repair vs. additions/enhancement activities Corps-wide and between districts. For example, there could be separate sub-features which would allow for tracking maintenance and repair at non-SRUF recreation facilities (629.11) and SRUF recreation facilities (629.91), and another set for tracking additions or improvements at non-SRUF facilities (629.12) and SRUF facilities (629.92). In both cases, the decisions to fund routine O&M activities would be made separately from those to fund recreation facility additions and improvements.
- To increase Corps' maintenance staff productivity, change the current Compressed Work Week policy to allow the Project Manager to restrict the use of compressed work week schedules for maintenance staff to those months when there is daylight available for all or most of the extended work day. This would reduce the need for maintenance staff to work during the morning or afternoon dark hours, which is a safety hazard.
- Provide all division and district offices with electronic versions of the most up-to-date regulations to increase field staff understanding of current Corps' policies, rules, and regulations. The district staff could provide hard or electronic copies of these policies, rules, and regulations to project staff with information on how the division/district interprets them operationally.
- Enforce HQ policies regarding distribution of rent and ADP to technical indirect and G&A costs. Districts currently use varying methods of distributing these costs.
- HQ centralized expenses that are charged to every district should be distributed based on direct labor before the effective rate is applied. Currently, differences in district effective rates unduly affect those districts with higher effective rates.
- Limit the digitization and updating of project structural drawings to new or frequently used drawings, to cost-effectively use Computer-Aided Design and Drafting (CADD) equipment by districts and some projects. The process of digitizing and updating drawings is expensive and labor intensive; the Corps' resources in this matter should be directed to those drawings

which have the highest value in terms of frequency of use. All new project "as built" drawings should be developed and updated using the CADD equipment.

- Develop and implement a Corps-wide project maintenance inspection program to establish a comprehensive maintenance planning and funding program. The ability to compare the maintenance funding requirements from district to district, and the status of project conditions, would be greatly enhanced by issuing inspection checklists, or standards to be used in district/project-developed checklists, to be completed and submitted by all Corps' projects annually. The summaries of the inspection reports would provide HQUSACE with the information necessary to make cost-effective funding allocations, as well as provide detailed background information for use when developing requests for maintenance funding.

3. Functional Area

- Establish guidelines for developing vessel-securing procedures for Corps-operated locks to reduce vessel operator confusion and, potentially, lock staffing requirements. Standardized procedures would increase the operational consistency between locks, which should be helpful to both the shipping industry and recreational boaters. At some locks, a policy to require vessel crews to secure their own vessels in the lock chamber could reduce staffing.
- To reduce seasonal staffing costs, install alarms and fences around cold climate locks rather than staffing them with full-time Corps' personnel 24-hours a day during seasonal lock closure periods. The potential savings, for example, of over \$390,000 per year in staffing costs in one district would quickly repay the one-time cost to install alarms and fences at locks in that district.
- For projects that are dredged intermittently, (i.e., less than annually) and lack commercial or military traffic, require surveys every two to three years, rather than annually. Districts are currently required to perform hydrographic surveys of all projects annually, regardless of project utilization. The suggested guidance will provide a consistent method for prioritizing surveys, and will reduce survey costs at selected projects.
- Current policy places priority on who (in-house or contract staff) performs hydrographic surveys for payment purposes, rather than on performance of quality surveys at the lowest cost. The Corps should develop a policy which specifies the level of quality or standard that each hydrographic survey must meet, to encourage the use of the most cost-effective method.
- To ensure that the most cost-effective inspection method for hydrographic surveys is used, revise current guidance to state that a Government inspector will be placed on board the

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contractor's vessel during survey performance, unless a resurvey of 5% of the area by an in-house crew is more cost effective.

- Manage hydrographic survey equipment, in-house survey crews, and hydrographic survey contracts from Operations Division. The organizational location of these functions is currently not standardized throughout the Corps. Centralization of management in Operations Division will improve efficiency, increase scheduling flexibility, and allow for more efficient utilization of resources.
- To increase survey equipment utilization and provide more incentive to reduce operating and maintenance costs, mandate the use of the Revolving Fund for hydrographic survey equipment procurement, thereby eliminating project-owned equipment. Establish a standard stock level for hydrographic surveying equipment to reduce stores of excess equipment at districts, and decrease equipment tracking and maintenance.
- Require that costs for all hydrographic surveys be charged to multiple sub-features within Feature Cost Code (FCC) 607, Survey, Study and Inspections, to ensure hydrographic survey costs are consistently charged to the same FCC, and to allow for more accurate accounting of survey costs. All costs will be captured under one FCC, yet it will still be possible to separate costs for different types of hydrographic surveys.
- Develop a standard hydrographic surveying software package for all districts, to reduce duplication of effort at the district level and reduce software maintenance costs.
- Improved management and scheduling of in-house resources will decrease the operating costs of in-house dredges. Make labor from private temporary agencies and local labor halls available to dredge crews on a short-term basis, and on short notice. This will increase equipment utilization and crew productivity. Additionally, to ensure cost-effective scheduling, perform a cost analysis for each dredging job which is outside of a crew's normal duty area, to determine if it is more cost-effective to transport the crew home for each leave period, or to pay the crew per diem to stay at the job site during the leave period.
- Districts maintain specialized dredge equipment, which in some cases is rarely used. Furthermore, maintenance practices are not standardized, which may lead to over- or under-maintenance of dredge equipment. To reduce equipment maintenance costs, discontinue maintenance of dredge equipment which is rarely or no longer used. When practical, remove equipment which is no longer used, or replace it with equipment which will improve operating efficiency. Additionally, reduce cycles of "cosmetic maintenance" and eliminate the requirement to maintain Corps' dredges in accordance with military specifications.

- To improve lock monitoring and increase vessel and personnel security, install closed circuit television (CCTV) units at selected locks. The use of CCTV cameras can improve the lock operators' ability to observe vessel positioning in the lock, prevent or respond to accidents or attempted theft of Corps' equipment, and monitor the functioning of lock filling/emptying mechanisms. Installation of these camera systems also carries the potential for a future decrease in staffing requirements.
- Procure multiple sets of large, installed equipment items separately from installation when it is more cost-effective to ensure equipment standardization between several similar projects. This practice can increase parts and equipment interchangeability from site to site, and, therefore, the sharing of resources, which reduces the number of different items which must be purchased and stored at each location.
- To decrease training and repair time, and spare parts inventory levels after major maintenance or rehabilitation efforts, procure multiple sets of large, installed equipment items separately from installation when it is more cost-effective or to ensure equipment standardization between similar projects.
- To increase the consistency and cost-effectiveness of major maintenance activities between districts, dewater all locks on a regular multi-year schedule. Competition for major maintenance funding cannot be eliminated; by establishing guidelines for a specific dewatering cycle and then scheduling each district accordingly, the distribution would be equitable over the course of each multi-year cycle.
- Convert unskilled laborers and personnel in non-power trades, who work in power plants, from the local Power Trades wage classification to the local Department of Labor Wage Grade scale classification. Since these individuals are not performing the operation and maintenance of power plant equipment, they should be placed on the same pay scale as other non-power trades personnel.
- To more effectively measure power plant performance, compare the amount of power produced vs. the amount requested as well as the other current performance measures. Assessing performance based on availability of the plant causes Project Managers to ineffectively use overtime to quickly accomplish repairs, regardless of the immediate need for the unit.
- Conversion of spillway gates may be cost effective for remote locations or where climatic conditions hamper manual gate changes. The current practice of evaluating this type of decision on a case-by-case basis should continue.

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- Develop a new “project brochure” format. Rather than expend resources at each district to develop a new brochure format, all districts could develop individual project brochures based on a single, professionally developed format. Allow marketing efforts beyond the “approved” brochure format, community involvement, and other traditional forms of public awareness activities only at significantly underutilized projects.
- Clarify the current regulation concerning district policies on rewards for volunteers. To ensure safety and effective utilization of volunteers, projects should submit lists of potential volunteer duties to the district Safety Officer for review and approval.
- To simplify the reservation process, consolidate all campground reservation requests through a single phone number - similar to that of the National Park Service. A centralized reservation service is seen as a public service, can enhance revenue, and would take some of the burden off individual project clerks or fee collectors.
- Change ER 1130-2-400 to require 100% re-surveying/re-monumentation only of boundary lines contiguous with private, commercial, or local government owned/leased land. Boundary lines between Corps and other Federal lands should only be re-monumented every four years, and efforts should be made to cost-share the work with the adjacent agencies.
- To reduce the cost of boundary inspections Corps-wide, change ER 1130-2-400 to require boundary inspections bi-annually for projects built after 1971 and tri-annually for projects built before 1971. Due to changes in Corps fee land acquisition policies over the years, some projects have fee lands extending much farther out from the reservoir pool than do others.

C. LONG-TERM PLAN

The Contractor’s preferred options for Long-Term improvement of the program are presented in the following paragraphs. These options would have less programmatic impact than the High Impact Plan and would require a longer implementation time than the Short-Term Plan. The Contractor estimates the cost of implementing the Long-Term Plan at about \$20.5 million.

1. Programmatic

- Implement a non-appropriated trust fund to provide an additional source of funding for recreation-related and natural resource work items.
- Standardize budget development formats and practices by developing a PC format for project/organization budget development to allow for automated budget entry into ABS at the district level.

2. General Project Management

- Combine like services at nearby projects and recreation areas under multi-project or multi-site support contracts. Some project personnel manage over 25 different custodial or ground-keeping contracts for the same project. Custodial, grounds keeping, fee collection, or minor maintenance contracts currently managed separately at projects within close proximity could be combined and managed as single contracts by fewer staff and at lower cost.
- To reduce project O&M costs, improve the level of service, and increase interdistrict comparability, develop specific Corps-wide Service Contract Guidelines for use at all projects. These guidelines could help districts choose the most cost-effective contract instrument for use with each type of service for which a contract is desired.
- Develop indefinite-quantity repair contracts for maintenance services to reduce the time to procure services. Once established for a variety of equipment systems at each project, these contracts can be utilized on a short-notice basis at previously established rates.
- Develop project-specific minimum and maximum stock levels as part of the ERGO inspection process. The level of containment materials to be kept on hand should be related to the types and risk level of the hazardous materials currently stored at the project.
- Develop a centralized system for recording and maintaining data on Corps' projects. Databases containing project information are developed by different organizations at Headquarters, and, as a result, are inconsistent. Furthermore, there is no single Corps-wide system which provides access to all project information.
- There are over 300 forms and reports which must be submitted by projects to various Corps, Army, and non-DoD Federal agencies. Few of these are automated, and require a great deal of manual effort to complete. Require that district, division, and Headquarters elements requesting recurring reports provide an electronic format for the project's response and provide projects with electronic copies of all appropriate Corps and Army forms.
- Develop a formula for determining the equipment requirements for a project based on project size, needs, and purpose to determine the amount of heavy (i.e., engineering or construction) equipment that should be owned by individual projects. In addition, explore the cost-effectiveness of leasing the required equipment from the revolving fund equipment pool rather than continuing project ownership and maintenance.
- Revise ER 1130-2-304/303 in a manner similar to ER 25-345-1, and require all projects to begin development of updated project O&M manuals. Revisions to current manuals should

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include specific O&M procedures and policies, equipment inventories, operating instructions, technical specifications, and information on staffing requirements.

- To improve the cost effectiveness of O&M support from technical divisions, Operations Divisions and technical divisions should agree, in advance, on what level of O&M support is needed. The agreement should resemble a Fixed-price contract wherein a specific cost of support is agreed upon in advance. If O&M support can be obtained from outside contractors more cost effectively than from technical divisions, then Operations Divisions should have the option to do so.
- The Corps should require a division-by-division analysis of centralized non-management functions performed for the entire division. If support could be provided more cost effectively from other sources, then districts should have the option to utilize alternative sources.
- Implement guidance requiring all field units to use a set of standard data, file, and report specifications in the development of automated maintenance management systems. Most locally developed automated maintenance management systems in use or under development by Corps' districts and projects are not compatible with regard to data collected, reports generated, hardware, or software. Standardization would allow HQUSACE to compare maintenance workload and outputs between projects or districts.
- Establish centralized maintenance organizations, where practical and cost-effective, within each district or to serve more than one district, which could reduce maintenance staffing and costs at each project. A set of single function (lock, power plant, or recreation) crews or one multi-functional crew could be staffed, and would be responsible for major maintenance throughout the district. The remaining maintenance staff at each project could be reduced, since they would only be responsible for preventive and routine minor maintenance.
- Establish a district level review process that encourages the consideration of equipment interchangeability in routine procurement decisions. Increased interchangeability of parts will allow projects to share resources, such as spares and trained repair personnel, and increase operational consistency between similarly constructed projects.

3. Functional Area

- Use longitudinal hydrographic surveying, rather than cross-section surveying, on projects dredged by Corps' dredges which would reduce survey costs and increase surveying efficiency by 25% at select projects.
- Encourage development of better communication links between the survey vessel and the district office to reduce the amount of time dredging contractors must wait for hydrographic

survey results. Additionally, revise current guidance to state that "after dredging" surveys must be complete and distributed within five days.

- Adjust work schedules throughout the year to compensate for fluctuations in workload to improve the productivity of in-house hydrographic survey crews.
- Revise the current OPM hydrographic surveying series and increase the peak grade for hydrographic surveyors from a GS-08 to a GS-12. At the GS-12 level, the Hydrographic Survey Engineer could expedite the acceptance of contractor work.
- Develop and field an automated system for collecting, analyzing, managing, and reporting hydrographic surveying information, to increase the ability of managers at every level to evaluate data for potential cost savings or efficiency improvements.
- Standardize procurement of new survey vessels and transportation equipment to eliminate excessive capability and allow for standardized survey equipment and crews. Additionally, develop guidelines for a standard communication system aboard Corps' survey vessels and surplus excess communication equipment currently in storage.
- To reduce the cost of inspections, establish Five-year Periodic Inspection Team staffing guidelines. Where practical, reduce the number of personnel from other districts or projects participating on the teams, and, if necessary, have a smaller team stay at a project for a longer period.
- The use of automated dredge monitoring equipment, such as the silent inspector should not be encouraged until the procurement of such equipment is economically feasible.
- Administration of contracts for annual maintenance dredging is labor-intensive and therefore costly. To reduce contract administration effort and possibly decrease contract unit prices, combine small dredging jobs within a project into one contract, where practical. Additionally, for annual maintenance dredging jobs, advertise a one-year firm fixed-price contract with multiple option years. This will also reduce contract administration effort, while providing the Government the flexibility to evaluate the contractor's performance on an annual basis.
- Assign responsibility for routine maintenance dredging contract preparation to Operations Division. There is the potential for reduced contract preparation costs and centralization of the entire dredging contract process.
- Because Corps' dredges do not have to compete with other entities for work, there is no strong incentive to lower operating costs. To ensure that the most cost-effective service is provided, require Corps' dredges to submit a cost estimate for each job (except emergencies) and to compete with industry on a job-by-job basis. An alternative is to require Corps' dredges

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to submit an itemized cost estimate to the Project manager before each job and to account for all costs charged after completing the job. This will allow for more detailed cost accounting, and will also provide data for analyzing the effectiveness of a particular dredge at a particular project or project type.

- Current guidance requires that justification for advance maintenance dredging include a cost analysis. This is difficult at some projects, and the current guidance is not always followed. Revise the current guidance and require that for those projects where it is difficult to estimate costs and savings, advance maintenance dredging can be justified based on historical shoaling rates and dredging frequencies alone. However, also require that the advance maintenance at these projects be further justified by a cost analysis within two to three years.
- Develop a standardized maintenance management system for Corps-owned dredges. A standard, automated system will reduce manual data collection, tracking, and reporting efforts at districts, will allow for standardized report formats, and will reduce duplication of effort at the district level.
- Develop material testing procedures for upland disposal, particularly biological-effects testing. This will provide standard guidance to districts and help to reduce effort and funds expenditures, as well as eliminate redundant efforts.
- Install gate protecting systems in chambers of high volume/high risk lock projects. This will protect critical navigation systems from being shut down due to gate damage inflicted by vessels.
- Engineers who are assigned on-site at Corps' projects should design and prepare specifications for in-house or contract work items, within certain cost and functional area parameters. Each district would establish an internal policy on the parameters, based on the experience level of the engineers assigned to the project sites. This change would reduce the workload on Engineering Divisions in some districts, facilitate work scheduling, and simplify the procurement process.
- Update all Corps' project and water basin water control manuals on a 10-year cycle. The manuals need periodic revision so that each one reflects the latest relevant water control, environmental, climatic, and economic background data, as well as current Corps' philosophy and flood/drought contingency plans.
- Develop a rating system for the condition of Corps-built, locally operated dams, dikes, and levees to reduce the frequency of inspections of completed works. Flood protection projects with excellent maintenance histories should only be inspected by Corps' staff bi-annually.

Those with only fair to poor records of local sponsor maintenance would receive a lower rating and would continue to receive annual inspections. To further reduce costs, rely more often on Engineers at nearby Corps projects to perform annual or bi-annual inspections of completed works which are not located near the district office.

- Develop a decision model to be used by districts for the setting of Corps-operated campground seasons. Based on the monthly visitation (i.e., revenue potential) and the monthly O&M costs to remain open, the model could help to determine the most cost-effective number of days each campground should be open to the public each year.
- Develop generic lecture, campfire program, and water/hunting safety class materials through HQUSACE and make them available to projects for off-the-shelf use. This would provide project staff with more time for other duties, increase consistency in the level of program quality, and take advantage of economies of scale.
- To reduce project encroachment resolution expenses, encourage the use of non-litigative strategies - such as selling small parcels of land up to \$1,000 in value to cure minor encroachments. While this process should be used only as a last resort before entering litigation with a boundary line violator, it can be considered as a way of allowing the reallocation of Ranger resources to other project priorities.
- Issue guidance that accessibility related renovations at Corps-operated recreational facilities are planned and executed in an organized and cost-effective manner, and should be accomplished on a limited basis. The centralization of funding decisions for accessibility related renovations at a higher level will allow the Corps to apply its limited resources to the widest number of projects possible.

APPENDIX A - REGULATIONS AND POLICIES

33 CFR	Code of Federal Regulations, Navigation and Navigable Waters
36 CFR	Code of Federal Regulations, Parks, Forests, and Public Property
AR 1-1	Planning, Programming, Budgeting, and Execution System
AR 5-4	Department of the Army Productivity Improvement System
AR 27-40	Litigation
AR 36-2	Audit Reports and Followup
AR 335-15	Management Information Control System
AR 340-18	The Army Functional Files System
AR 405-70	Utilization of Real Estate
AR 672-20	Incentive Awards
AR 690-500	Position Classification, Pay, and Allowances
EC 11-2-155	USACE Manpower-Civil Program Civilian Force Configuration and Management
EC 11-2-157	Civil Works Budget Request for the U.S. Army Corps of Engineers - Fiscal Year 1992
EC 11-2-159	Annual Program and Budget Request for Civil Works Activities , Fiscal Year 1994
EC 11-8-2	Annual Program and Budget Request for Civil Works Activities, Fiscal Year 1993
EC 37-8-1	Fiscal Year 1991 Plant Increment Rates
EM 385-1-1	Safety and Health Requirements Manual
EM-1110-1-400	Recreation Planning and Design Criteria
EM 1110-2-410	Design of Recreation Areas and Facilities - Access and Circulation
EM 1110-2-1003	Hydrographic Surveying
EM 1110-2-1201	Reservoir Water Quality Analysis
EM 1110-2-1301	Cost Estimate Planning and Design Stages
EM 1110-2-2703	Lock Gates and Operating Equipment
EM 1110-2-3600	Management of Water Control Systems
EM 1110-2-4000	Sedimentation Investigations of Rivers and Reservoirs
EM 1165-2-102	Power in the Navigation and Flood Control Programs
EM 1165-2-106	Control of Releases from Power Plants
EM 1165-2-5025	Dredging and Dredged Material Disposal
EM 1165-2-5026	Beneficial Uses of Dredged Material
EM 1165-2-5027	Confined Disposal of Dredged Material
EP 25-1-1	Index of Publications
EP 1130-2-418	The Performance Monitoring System
EP 1165-2-1	Digest of Water Resources Policies
EP 1165-2-312	Navigation: The Role of The Corps
EP 1165-2-317	Hydropower: The Role of the Corps

ER 1-1-6	Transfer of Missions and Functions - Providing and Obtaining Support Services
EP 1-1-8	Influencing Legislation
EP 1-1-90	Management Analysis Activities of Management Branches
ER 10-1-1	Mission and Command Organization of the Chief of Engineers
ER 10-1-2	General Policies
ER 10-1-5	Mississippi River Commission
ER 10-1-8	US Army Engineer Waterways Experiment Station
ER 10-1-16	US Army Coastal Engineering Search Board
ER 10-1-23	US Army Corps of Engineers Water Resources Support Center
ER 10-1-26	U.S. Army Construction Engineering Research Laboratories
ER 10-1-29	US Army Engineer Studies Center
ER 10-1-40	Directory Charts, Position Charts & Statements of Function
ER 10-1-42	Organization and Support of Low Workload Districts
ER 10-1-46	U.S. Army Engineer Marine Design Center
ER 10-1-48	Engineer Reporting Organization Codes
ER 11-1-27	Command Goals and Objectives Program
ER 11-1-29	US Army Corps of Engineers Peer Review Program
ER 11-2-201	Civil Works Activities Funding Work Allowances & Transfer
ER 11-2-290	Civil Works Activities - General Expenses
ER 15-1-20	Corps of Engineers Performance Review Board
ER 15-2-13	Mississippi River Water Control Management Board
ER 25-345-1	Systems Operation and Maintenance Documentation
ER 37-1-24	Operating Budgets
ER 37-2-10	Accounting and Reporting Civil Works Activities
ER 37-2-11	Financial Reporting for Multiple Purpose Projects Including Power
ER 37-2-13	Automation of Revolving Fund and Military Construction S&A Account Reports
ER 37-2-15	Civil Budget Supporting Data - Civil Works Appropriations
ER 37-2-16	Financial Administration Civil Funds Apportionment
ER 37-2-17	Report on Status of Appropriations and Work Allowances - Civil Works
ER 37-2-18	Collection of Project Funds for Operation of Hydrologic Programs
ER 37-2-19	Civil Works Financial Management Systems Integration
ER 70-1-11	Planning, Programming & Documentation Requirements for the COE Research & Development Program
ER 70-2-6	Identification of Civil Works Needs
ER 70-2-7	Recreation and Research Demonstration System
ER 200-202	Procedures for Implementing the National Environment Protection Act
ER 335-2-1	Waterborne Commerce Statistics
ER 335-2-5	Annual Report to the Chief of Engineers on Civil Works Activities
ER 350-2-400	Training and Development Program for Hydroelectric Power Plant Personnel
ER 360-1-1	Public Affairs
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13. ABSTRACT (Maximum 200 words) This report, prepared by the Institute for Water Resources staff, is a summary of the Contractor's (Management Analysis, Inc.) study and findings and preliminary review by the Corps. The report is presented in two parts. Part I, Plan of Improvement, presents and describes actions which will be undertaken to improve the program. Part II, Study Conduct and Findings, documents the reasons for undertaking the study, how the study was conducted, and presents the study findings and conclusions for those readers who are interested in following the process that supports the need for the improvement actions. The objective of the study is to assure that Federal expenditures for operation and maintenance of Corps projects provide justified levels of service in the least cost manner. The output of the study is to be policies and procedures (practicable measures) to achieve that objective.				
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