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**U.S. ARMY CORPS OF ENGINEERS CIVIL
ENVIRONMENTAL R. & D. BUDGET**

GOVERNMENT

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HEARING
BEFORE THE
SUBCOMMITTEE ON
NATURAL RESOURCES AND ENVIRONMENT
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SIXTH CONGRESS

SECOND SESSION

JANUARY 29, 1980

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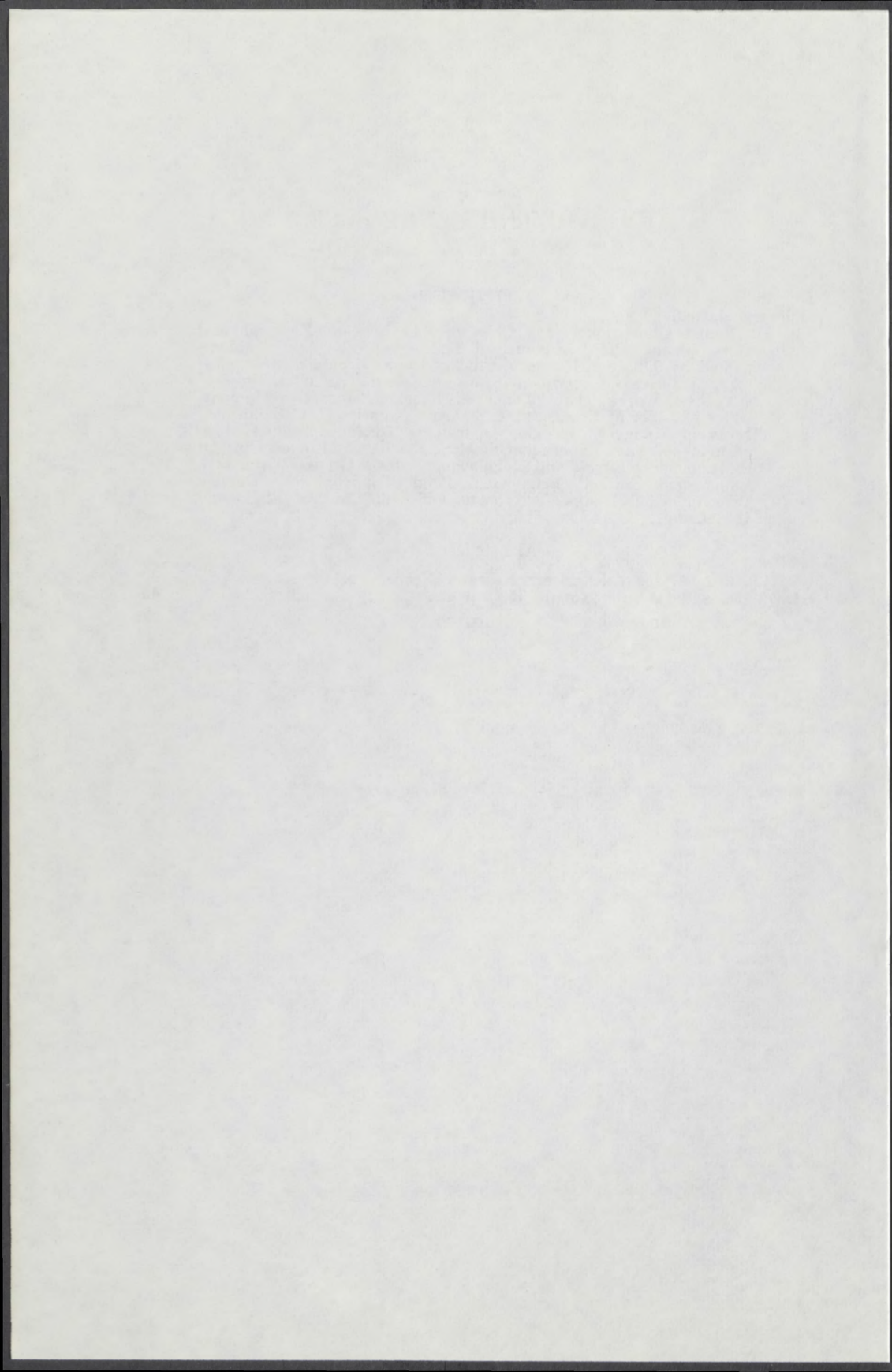
Dr. James Choromokos, Jr., Chief of the Office of Research and Development, Office of Chief of Engineers, U.S. Army; accompanied by Dr. John Harrison, Chief of the Environmental Laboratory, Waterways Experiment Station; Melvin L. Martin, Chief of the Civil Works Team, Office of Research and Development, Office of Chief of Engineers, U.S. Army; Charles C. Calhoun, Jr., Program Manager, Dredging Operations Technical Support Program, Waterways Experiment Station; Dr. Robert Engler, Chief of the Ecological Effects and Regulatory Criteria Group, Waterways Experiment Station; Brig. Gen. Hugh G. Robinson, Deputy Director, Civil Works Directorate, Office of Chief of Engineers, U.S. Army-----

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U.S. ARMY CORPS OF ENGINEERS, CIVIL ENVIRONMENTAL R. & D. BUDGET

TUESDAY, JANUARY 29, 1980

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON NATURAL RESOURCES AND ENVIRONMENT,
Washington, D.C.

The subcommittee met, pursuant to notice, at 2 p.m., in Room 2325, Rayburn House Office Building, Hon. Jerome A. Ambro, chairman of the subcommittee, presiding.

Mr. AMBRO. The subcommittee will be in order.

I would like to welcome this large and distinguished contingent from the Corps and observe for the record that today we are debating on the floor the bill on water resources that was developed in the Subcommittee on Water Resources of the Committee on Public Works.

This afternoon, however, here in this room, the Subcommittee on Natural Resources and Environment will receive testimony from the U.S. Army Corps of Engineers regarding their environmental research and development programs. Our interest in these programs stems from the fact that many of them overlap and interact with similar programs in other Federal agencies, such as EPA and NOAA, whose research activities are authorized by this subcommittee. Areas of particular interest to us in this regard include aquatic weeds control, ocean pollution research and monitoring, wastewater research, water quality studies, and dredge-spoil disposal. It is the aim of this subcommittee to insure that Federal environmental research conducted in these various agencies is effectively coordinated so that the most pressing national environmental needs are addressed with adequate resources and with a minimum of program redundancy.

Several members of the Committee on Science and Technology have been, and continue to be, active in areas of environmental concern which are addressed by the research programs of the Corps of Engineers. Chairman Fuqua was instrumental in EPA's decision to institute a much-needed program for control of aquatic weeds, through environmentally sound practices, throughout the United States. During my tenure on the Committee on Science and Technology, I have worked to stem the degradation of our ocean resources. In the past, my concern about pollution of coastal areas has led to disagreements with the operational arms of the Corps, particularly with regard to the controversial disposal of toxic dredge-spoil in Long Island Sound and other coastal waterways.

I am confident that our dialog today will help the environmental research program of the Corps and will help us especially to reach our common goal of preserving environmental quality.

Before we get to the witnesses I would like to turn to my distinguished colleague, the former chairman of this subcommittee from California, and ask him if he would like to make some opening remarks.

Mr. BROWN. I have no remarks at this time, Mr. Chairman.

Mr. AMBRO. Thank you, Mr. Brown.

We are pleased to welcome as our first witness today Dr. James Choromokos, Jr., Chief of the Office of Research and Development, Office of the Chief of Engineers, and Dr. John Harrison, Chief of the Environmental Laboratory, Waterways Experiment Station, Vicksburg, Miss.

If you gentlemen would introduce your colleagues, we would appreciate it.

Dr. Choromokos. Sitting on my left is General Hugh Robinson, the Deputy Director for Civil Works, OCE, Washington, D.C. Next to him is Mr. Mel Martin, Civil Works Team Chief, Research and Development Office, OCE, Washington, D.C. At the far right from me is Mr. Charles Calhoun, the Environmental Lab, Waterways Experiment Station, Vicksburg. Next to him is Dr. Robert Engler, Environmental Lab, Waterways Experiment Station. To my immediate right is Dr. John Harrison, the Chief of the Environmental Lab, Waterways Experiment Station.

Mr. AMBRO. Would you proceed?

Dr. Choromokos. Yes.

STATEMENT OF DR. JAMES CHOROMOKOS, JR., CHIEF OF THE OFFICE OF RESEARCH AND DEVELOPMENT, OFFICE OF CHIEF OF ENGINEERS, U.S. ARMY, ACCOMPANIED BY DR. JOHN HARRISON, CHIEF OF THE ENVIRONMENTAL LABORATORY, WATERWAYS EXPERIMENT STATION; MELVIN L. MARTIN, CHIEF OF THE CIVIL WORKS TEAM, OFFICE OF RESEARCH AND DEVELOPMENT, OFFICE OF CHIEF OF ENGINEERS, U.S. ARMY; CHARLES C. CALHOUN, JR., PROGRAM MANAGER, DREDGING OPERATIONS TECHNICAL SUPPORT PROGRAM, WATERWAYS EXPERIMENT STATION; DR. ROBERT ENGLER, CHIEF OF THE ECOLOGICAL EFFECTS AND REGULATORY CRITERIA GROUP, WATERWAYS EXPERIMENT STATION; AND BRIG. GENERAL HUGH G. ROBINSON, DEPUTY DIRECTOR, CIVIL WORKS DIRECTORATE, OFFICE OF CHIEF OF ENGINEERS, U.S. ARMY

Dr. CHOROMOKOS. The Corps of Engineers is pleased to inform this committee on the environmental research and development in our civil works program.

The complete Corps' R. & D. program is managed by the Research and Development Office, which has two responsibilities. They are to provide staff responsibility to the Chief of Engineers located in Washington, and, second, to manage the five Corps of Engineers' laboratories. The location of the laboratories will be shown to you later.

For management and coordination purposes, the research and development program is divided into 16 functional areas of which the civil works environmental program is one.

The Corps' lab with primary responsibility for the planning and execution of the environmental program is the U.S. Army Waterways Experiment Station, West, at Vicksburg, Miss.

Mr. AMBRO. Let me interrupt you a second.

Dr. CHOROMOKOS. Surely.

Mr. AMBRO. I read this last night, but I wasn't quite sure that it was your statement, and I don't have the same kind of introduction you have. Are you reading from the same paper that I have in front of me?

Dr. CHOROMOKOS. No, I'm not.

Mr. AMBRO. Do we have a copy of your statement?

Dr. CHOROMOKOS. I have it right here. I'll be more than happy to give it to you. These are just some opening remarks to introduce the speakers, sir.

Mr. AMBRO. Oh, I see. It's easy to confuse me. Go ahead.

Dr. CHOROMOKOS. I don't want to confuse you yet.

The point we're trying to make here is that the execution of the civil works environmental program is delegated to the Waterways Experiment Station, and those were the only remarks that I wanted to make.

At this time I will introduce again Dr. John Harrison, who will present the briefing to you and your staff.

Mr. AMBRO. Thank you.

Dr. HARRISON. Thank you, Dr. Choromokos.

Mr. Chairman, I presume that I will start with the presentation that you read last night. If I don't, stop me very quickly.

The Corps of Engineers' laboratories provide research, development, testing, and evaluation work in support of the Corps' wide range of civil and military missions.

CORPS OF ENGINEERS' LABORATORIES

The first official research organization of the Corps was formed in 1929, and by 1963 it evolved as the Coastal Engineering Research Center. Headquartered at Fort Belvoir, Va., the Center is the focus of national expertise in coastal engineering.

Following one of the Nation's great disasters—the 1927 flood on the Mississippi River—the Waterways Experiment Station was established in 1929 as a hydraulics laboratory to assist the Mississippi River Commission in developing and implementing comprehensive plans for flood control in the lower Mississippi Valley.

The Experiment Station is the largest and most diverse R. & D. organization of the Corps, covering nearly 700 acres at Vicksburg, Miss., and consisting of four major laboratories: hydraulics, geotechnical, structures, and environmental.

The Army has performed topographic mapping since 1776. However, research in mapping dates back only to the early 1900s and was performed by various boards and laboratories. This work was consolidated in 1967 into the Engineer Topographic Laboratories, also located at Fort Belvoir, Va.

The Cold Regions Research and Engineering Laboratory was established in 1961 in Hanover, N.H., to develop a winter combat capability for the Army and to study the natural phenomena of cold regions and devise methods of building, traveling, living, and working in them.

The Construction Engineering Research Laboratory was established in Champaign, Ill., in 1968. Its mission is to explore life-cycle requirements of facilities from design through construction, operation, and maintenance to replacement.

Other Corps' field-operating agencies provide some R. & D. support as part of their mission.

The Corps' Civil Works Environmental Program is managed primarily by the environmental laboratory at the Waterways Experiment Station. However, significant input is provided by most of the other Corps' R. & D. activities, one Corps Division, other Federal agencies, private concerns, and the academic community.

During the next few minutes I will briefly summarize the Corps' Civil Works Environmental Research and Development Program.

WASTEWATER MANAGEMENT

The objectives of the Corps' Wastewater Management Research Program are: To improve methods for collecting, treating, and disposing of wastewater at Corps' facilities; to improve procedures for estimating project costs, both capital and O. & M. costs; and to establish design criteria for management of land treatment systems.

The results of this work are used to manage wastewater from urban and regional areas, military installations, and Corps' recreational areas. The program is coordinated with the EPA, Department of the Interior, Department of Transportation, State agencies, and the A-E community, and is divided into land-based and water-based disposal.

The primary objective of land-based disposal is to provide guidance for planning, designing, and managing cost-effective land treatment systems that will meet quality standards.

The degree of wastewater treatment required before applying it to the land has been controversial. Data from 6 years of tests in the laboratory and on prototype systems have shown that only primary treatment is necessary. When pretreatment is limited to primary, capital costs are reduced and there is a large reduction in the amount of chemicals and energy normally used to achieve secondary treatment.

Another research result that will lead to large dollar savings is being able to accurately determine the rates at which wastewater will enter and move through a particular soil. The greater the accuracy of prediction, the less the needed safety factor. The bottom line reads "more water on less land," which also translates to less cost.

The Corps has supported research by the Department of Agriculture and conducted in-house research to better understand the role of cover crops in land treatment systems. As a result, in many parts of the United States, wastewater is being used as a source of nutrients instead of commercial fertilizers.

Water-based disposal is, in many ways, considered more conventional than land-based disposal.

A three-part wastewater treatment manual was recently completed. A contract was then awarded to assess the design requirements for controlling pollution sources during project construction and operation.

A series of field tests on in-pond alum addition to upgrade lagoon effluents was conducted at Lake Eufaula, Okla. The study determined the feasibility of in-pond chemical addition and the capability of the algal removal operation to meet very stringent effluent limitations.

The methodology for areawide planning studies, what we refer to as MAPS, is a water supply and wastewater management and planning

tool developed by the Corps. MAPS has been successfully used in 10 urban and water supply studies.

CAPDET, that is, the computer-aided procedure for the design and evaluation of treatment systems, is a remarkably successful Corps-developed tool for providing initial wastewater treatment alternatives—including costing. It has been presented to over 300 people in the Corps, other major Army commands, 6 other Federal agencies, various State agencies, and more than 100 private consulting firms.

One of CAPDET's features is the preparation of capital and O. & M. costs for thousands of possible treatment alternatives. Its success spurred EPA to select CAPDET for upgrading and use in the construction grants program. An interagency agreement was started in 1977 and was extended last fiscal year.

In addition to the wastewater management research, management strategies for solid, hazardous, and toxic wastes are being determined by military appropriation.

General technical support is being provided for the Army pollution abatement program that includes reviewing technical designs, investigating landfill sites, developing scopes of work for A/E contracts on environmental monitoring and pollution abatement, participating on an advisory committee for management of contaminant-migration problems, and assisting in training CAPDET model users. One of the most significant field efforts involved site investigations at Fort Belvoir, where both gas and leachate production at landfill sites demanded immediate attention.

As part of the Army's Installation Restoration Program, treatment processes for removing organic and inorganic contaminants from groundwater systems have been evaluated. During 1979 an ultraviolet/ozone treatment unit was installed at Rocky Mountain Arsenal. This unit was tested to determine design guidance for an overall groundwater treatment system.

Field evaluation of the intermittent sand filtration pilot test facility for treating washrack and motorpool runoff waste was recently completed at Fort Carson, Colo. A contract has been initiated to further evaluate specific aspects of the pilot washrack facility with emphasis on operation and maintenance under extremely high solids loadings.

ENVIRONMENTAL IMPACT

The Environmental Impact Research Program (EIRP) is providing methods and guidance to the field for evaluating the environmental effects of the Corps' civil works activities. Its basic purpose is to provide R. & D. support to the Corps' efforts to achieve established national environmental objectives while providing engineering support to the total Army and the Nation.

The accuracy of preproject predictions on fish and wildlife resources continues to be evaluated by contract with the Sport Fishing Institute.

The Corps selected field sites to verify procedures that predict erosion potential and associated environmental impacts in cold regions. Aerial photography is being evaluated to show historical rates of erosion in order to project future trends. Emphasis is on the influence of ice cover and frozen soil on erosion rates.

A national workshop was held to evaluate marsh/estuarine water quality and ecological models to solve identified problems.

A cooperative study to determine the effects of inundation on archaeological resources will be completed this fiscal year. This study includes the Corps, Soil Conservation Service, National Park Service, and the Water and Power Resources Service. Studies were made on the microbiological, chemical, and mechanical impacts of inundation.

We are evaluating the impacts of constructing rubble structures on both the Pacific and Atlantic coasts. A study is underway at Murrells Inlet, S.C., to document the effects of constructing a rubble-mound weir jetty. Results indicate that rubble-mound structures provide reef habitat for large populations of fish and attaching organisms in barren coastal areas.

We have successfully created and stabilized coastal dunes with native beach grasses. Studies were conducted on Cape Cod; Core Banks, N.C.; Padre Island, Tex.; and Clatsop Spit, Oreg.

We recently started a new area of work on determining the effects of widening and deepening inlet channels and building jetties on fish and shellfish migration.

We are also making pre- and post-beach-nourishment studies of benthic animals on the beach and in the surf-zone and near-shore areas in Florida and California. Results to date have shown there is little or no permanent adverse effect from beach nourishment.

We recently completed two field demonstrations on the Chena Lake Project in Alaska. Also, observations were made to develop environmental guidelines for construction and operation in cold regions.

The Corps is carrying on work in western salt marshes in Oregon to determine their biological productivity and overall contribution to the estuarine food chain. This will provide a basis for impact assessment.

We are also providing ways to relate physical changes to aquatic habitats to their value as habitat for important fish and shellfish. A national workshop will be held in a few months.

Work is underway in several high-priority areas to provide methods to reduce adverse environmental impacts. We have successfully stabilized eroding banks with marsh plants in a number of intertidal environments. Studies in North Carolina, Chesapeake Bay, Galveston Bay, and San Francisco Bay provided efficient techniques for planting several marsh species.

We assembled information from a variety of Federal and State agencies for field guidance on cost-effective methods for difficult construction site restoration problems. Guidance is required to reduce erosion, contaminant runoff, and other long-term impacts.

Existing information was assembled, and a workshop was conducted to determine the feasibility of managing existing wildlife habitats more intensely instead of buying additional land for mitigation.

We began evaluation of engineering use of submerged plants, such as for trapping and stabilizing sediments.

FISHERIES RESEARCH AND PROTECTION

The Fisheries Research and Protection Program is being carried out by the Corps' North Pacific Division office because the program is focused on the anadromous fisheries of the Northwest. As a result of early work, Corps' projects on the lower Snake and Columbia Rivers

and in the Willamette system have relatively efficient adult fish passage facilities.

Later work focused on protecting juvenile fish from turbines and gas supersaturation. Spillway deflectors and additional power units have virtually eliminated gas supersaturation. However, a greater proportion of the juvenile fish now pass through the turbines and are exposed to other adverse impacts from more severe river regulation. Although significant progress has been made, return rates of anadromous fish are not sufficient to reverse drastically declining runs and reestablish healthy populations capable of sustaining reasonable harvests. Because fish runs are in such perilous condition, they are being considered for threatened or endangered status by fisheries agencies. Accordingly, continuing research is necessary to provide improved methods of insuring healthy fish populations along with full use of the multipurpose projects.

For several years fish have been transported by truck and barge from upstream dams to below Bonneville Dam. Several efforts are underway to improve the ability to detect, attract, collect, and pass juveniles through or around the existing structures.

Evaluations of fixed scoop deflection produced negative results and indicated the continued need for traveling fish screens in the intake bulkheads. Forebay surface skimming is being evaluated for projects not currently scheduled for turbine screens.

A scanning sonar unit is being developed to detect large concentrations of migrating fish. When large numbers are detected, selective spills can be made to increase fish passage and survival rates. Also, deflector nets are being tested to move fish away from the spillway and encourage them to migrate directly upstream.

Colored tags are placed on some adult Chinook salmon. Tag recoveries provide data on fallback and the effectiveness of the deflector nets.

RECREATION RESEARCH

The purpose of the Corps' Recreation Research Program is to provide methods and solutions to problems encountered in order to improve the Corps' effectiveness in providing recreation opportunities at its water resources development projects. The program is closely coordinated with the National Park Service, Forest Service, Heritage Conservation and Recreation Service, TVA, Fish and Wildlife Service, Bureau of Land Management, and Water and Power Resources Service.

A system of 24 research and demonstration areas has been developed to support the program. These areas are representative of Corps' projects and provide cumulative data for the program.

Visitor safety is of prime importance. Improved recreational planning and management criteria will enhance the resource manager's ability to provide this safety.

We have an increasing need to contract operation and maintenance functions at recreational areas. Work is underway that addresses the efficiency of contracting these functions and the advantages and disadvantages as they relate to quality control, flexibility, and efficiency.

In fiscal year 1979, research was begun to improve the Corps' ability to attract private investment for needed facilities and services while maintaining desired levels of resource quality.

The high cost of construction, operation, and maintenance for roads and rest areas has necessitated the need to determine the minimum facility development required by user groups and the impact of facility designs.

Energy shortages have had dramatic effects on visitation patterns. A study is underway to determine changes in visitation patterns and to make recommendations for related changes in planning and management.

I would like to submit Attachment 1 for the record.¹ It is a technical report entitled "A Handbook for Conducting Recreation Surveys and Calculating Attendance at Corps of Engineers' Projects." It is now being used by numerous Federal agencies.

Mr. AMBRO. If you wouldn't mind, I would like to have it for the committee files, but I wouldn't like to include it in the record. It's just a bit too cumbersome and too expensive to reproduce.

Dr. HARRISON. All right, sir.

Mr. AMBRO. Thank you.

DREDGING AND DREDGED MATERIAL DISPOSAL

Dr. HARRISON. In the early 1970s, the need for a nationwide research program on the environmental effects of dredging and dredged material disposal was recognized. Such a program was authorized by the River and Harbor Act of 1970, Public Law 91-611. Responding to this legislation, the Corps developed and carried out the Dredged Material Research Program. We refer to it as the DMRP. By March 1978, all program objectives had been accomplished in the planned 5-year time frame at a cost of \$32.5 million. The Dredging Operations Technical Support, that is, the DOTS, program was initiated at the end of the DMRP to insure as complete technology transfer as practical.

The DMRP was a highly interdisciplinary effort encompassing 269 individual studies. Presented for the record, Attachment 2 shows how this research was accomplished. Mr. Chairman, this is a single sheet. Sixty-two percent of the studies were conducted outside the Corps. Eleven percent of these studies were done by other Federal agencies, including the EPA, Fish and Wildlife Service, and NOAA.

The DMRP was extensively coordinated with pertinent individuals, groups, and agencies. Presented for the record, Attachment 3 is a list of the major coordination and technology transfer efforts. Again, Mr. Chairman, it's a single page attachment. A full-time high-level scientist from the Fish and Wildlife Service was assigned to the Waterways Experiment Station to coordinate DMRP activities. That scientist's role has since been enlarged to include all environmental research, and the agreement has remained after program completion. Studies were also closely coordinated with the needs of the Corps' regulatory program and integrated with EPA research. Coordination was also maintained with European and Japanese researchers.

The DMRP produced numerous reports and other publications. For the record, Attachment 4 shows the most significant. Attachment

¹ All attachments to Dr. Harrison's testimony are available in the committee files.

4 is a single page document. To disseminate information rapidly, information exchange bulletins were distributed to almost 4,000 requesting recipients each month. The basic technical findings of the DMRP were summarized into 21 reports that were also published as Corps' Engineer Manuals.

I would like to include for the record the June 1979 Information Exchange Bulletin as Attachment 5 that is the final summary of the DMRP. This is a short information exchange bulletin. Also, I would like to include Attachment 6 for the record. It is the summary report entitled "Executive Overview and Detailed Summary," which gives a more indepth treatment. Mr. Chairman, this is a rather lengthy document. However, it is a summary document and perhaps would be of interest in the record. I defer to your judgment.

Mr. AMBRO. Why don't we make a judgment later? But we'll accept all of this for either the committee files or the record.

Dr. HARRISON. All right, sir. Fine.

This document, this executive summary, has been forwarded to Congress, Federal regulatory agencies, and all State governments.

One of the most significant findings of the DMRP is that there is no inherent adverse environmental impact of a disposal alternative that technically rules out its consideration without onsite evaluation. This was shown to be true for open-water disposal, confined disposal, habitat development, and all other alternatives. Each case should be considered on its own merits and decisions made on the basis of the soundest technology.

With few exceptions, the physical effects of open-water disposal are much more important than the chemical or biological effects. Physical effects occur infrequently and can be avoided by carefully applying current guidelines from section 103 of the Ocean Dumping Act or section 404 of the Clean Water Act.

DMRP results showed definitely that widely held fears over the short-term release of contaminants to disposal site waters are unfounded. As long as the geochemical environment is not basically changed, most contaminants are not released from the sediment to the water. In contrast, however, upland disposal often changes the geochemical environment and may lead to contaminant release.

Except in unusually environmentally sensitive areas such as coral reefs, turbidity was found to provide an esthetic impact, but not biological, chemical, or physical impacts. Consequently, the turbidity standards used by some State and Federal agencies cannot be technically justified.

The resiliency of bottom-dwelling, that is, benthic, organisms, once beyond the larval stage, was demonstrated. Disposal sites are rapidly recolonized. When the dredged material disposed at a site is basically the same as the bottom sediment, that is, sand deposited on sand or silt on silt, survival of existing organisms is maximized.

The mere presence of a chemical contaminant in a sediment does not necessarily indicate that biological harm will occur. Many contaminants are tightly bound to the sediment particles and simply are not available to the surrounding environment. DMRP results conclusively showed that there is no predictable correlation between the total amount of contaminants in the sediment and the resulting environmental impact. This statement is based on the results of many DMRP studies, 26 of which addressed the release and bioavailability of organic

contaminants. I would like to submit Attachment 7 for the record. It is a list of these 26 reports.

Even when contaminants are available, different types of organisms will, in most cases, uptake different quantities. For these reasons, bioassays must be an integral part of the evaluative criteria used in implementing both the Ocean Dumping and Clean Water Acts. No effective alternative currently exists for determining how organisms will be affected by contaminated dredged material. Major unknowns exist in interpreting the significance of the more subtle chronic or sublethal effects from the organism's bioaccumulating the contaminants. As a first step to addressing this most important area, selected field sites are continuing to be monitored.

Controlling or mitigating adverse effects was not overlooked in the DMRP. Guidelines are now available for predicting and controlling turbidity through such techniques as basic equipment maintenance, efficient operation, and silt curtains. A diffuser for submerged discharge showed excellent potential for reducing turbidity, as well as for reducing the extent of the potentially harmful fluid and mud layer that sometimes develops.

It was generally not within the scope of the DMRP to evaluate the dredge itself, although a limited review of domestic and foreign specialized dredges was conducted. Congress directed that a study of agitation dredging be conducted by the Corps. We started this last month and expect it to be a 1-year program which will identify past, current, and potential practices in agitation dredging.

A confined disposal area must be designed, built, and operated so as to achieve maximum effective capacity and satisfactory effluent quality. Specific guidelines were prepared to meet these objectives. In cases where sites are simply incapable of providing adequate detention, flocculents and filtration are effective effluent treatments.

Drying confined dredged material can lead to an oxidizing acidic environment that is conducive to leaching contaminants, particularly heavy metals. When saline dredged material is placed in a freshwater upland environment, salt may leach from the dredged material. Potential groundwater contamination must be carefully evaluated on a case-by-case basis.

The most expensive aspect of confined dredged material disposal can be land acquisition. Also, minimizing land area requirements obviously minimizes impacts associated with new areas. The DMRP developed methods to increase the storage capacity of existing sites through proper management and dewatering and developed concepts for making existing sites reusable by moving the material to other locations.

Dredged material can be used to create or improve wildlife habitats. Considerable attention was given to the uptake of chemical contaminants by marsh plants. Uptake, although generally not large, was found to occur in most plant species but in different ways and at different rates. How to predict uptake and its significance will require further research.

Marsh creation using dredged material is now a proven viable alternative. In many respects, developing terrestrial habitats with dredged material is a more advanced and more tested technology than marsh development.

Small islands created by dredged material disposal in inland waterways and in coastal bays and estuaries have become extremely valuable wildlife habitat. Maintaining the U.S. population of several colonial nesting and wading birds including certain gulls, terns, and herons depends on these islands.

Limited studies indicated aquatic, that is, submerged, habitat development is a promising but unproven disposal alternative. Much additional information is needed before the basic requirements for establishing such habitat are understood.

The DMRP developed tested concepts for non-wildlife-oriented productive uses of dredged material and the disposal site itself. Many products such as aggregate and bricks have been made using dredged material; however, success is extremely limited. The use of conventional disposal sites for mariculturing shrimp was tested and showed potential. In this and similar concepts, the advantage is that a landowner is more likely to favor using his land as a disposal site if he can derive some benefit from it.

A demonstration proved strip mine reclamation can be accomplished using dredged material.

It was recognized by the Corps that maximum benefits would be derived from the DMRP only if aggressive technology transfer was carried out. For this reason, the DOTS program was established. Through DOTS, an advisory team provides rapid responsive assistance in solving environmental problems associated with dredging and dredged material disposal.

Presented for the record, Attachment 8 is a list of the types of activities the DOTS program encompassed last fiscal year. During fiscal year 1979 DOTS responded to 94 major requests assisting 31 Corps' elements. Numerous other times, assistance was provided over the telephone, in meetings, or by correspondence.

DOTS also has the responsibility for technical management of the joint Corps-EPA Environmental Impact Statement Program necessary for ocean disposal site designation under the Ocean Dumping Act.

Assistance through the DOTS program has not been limited only to the Corps. DOTS responded to requests for assistance from the Fish and Wildlife Service, EPA, NOAA, DOE, DOT, DOI, and TVA. Also, on several occasions, the Canadian Government requested and received assistance.

The large number of DOTS activities indicates that the results of the DMRP are being implemented both within and outside the Corps.

There are three other efforts being managed under DOTS: monitoring selected openwater disposal sites, selected habitat development sites, and selected productive use sites; field verification and refinement of DMRP-developed engineering and operational methods; and research in support of the Corps' regulatory program.

The objectives of the regulatory efforts are to provide the Corps' field-operating elements with methods for complying with the requirements of the Clean Water, Ocean Dumping, and the Resource Conservation and Recovery Acts and to provide technical support for developing future guidelines to implement legislative requirements.

The continued upgrading of the technical criteria and guidelines is mandated by legislation. Consequently, a technical committee of scientists and engineers from research elements of the Corps and EPA

was formed in late 1975 to act as the focal point for coordinating research. A major objective of this group is to develop joint field guidance manuals. Preliminary manuals are presented as Attachments 9 and 10. Other objectives of the committee are to recommend research priorities, establish joint projects, and conduct joint program reviews. The technical committee also reviews and evaluates interim testing procedures promulgated by Corps and EPA headquarters. Presented for the record as Attachment 11 is the most recent activity report of this particular committee.

From a wetland perspective, four preliminary wetland guides covering various regions of the United States have been published; four others are in review and will be published shortly. Presented for the record as Attachment 12 is the preliminary guide to the wetlands of the west coast.

There have been two other major accomplishments in meeting the requirements of the Ocean Dumping Act: the development of an interim ocean disposal site designation manual and, although not R. & D., the initiation and technical management of the joint Corps-EPA ocean site designation monitoring and survey program. Both agencies are jointly investigating 26 interim ocean disposal sites. These sites account for approximately 90 percent of the annual volume of ocean-disposed dredged material. This survey and monitoring program is one of the most intensive and significant ocean monitoring efforts ever undertaken.

Interaction also continues with the American Society for Testing Materials and Standard Methods to insure establishment of scientifically sound and widely acceptable procedures. In the wetlands area, joint Corps-EPA research continues to develop methods for delineating wetland transition zones.

Even though the DMRP left unaddressed and unanswered questions, it and the subsequent regulatory efforts have provided much information to assist Corps' districts and EPA's regions conduct thorough dredging and disposal evaluations on a case-by-case basis. This research has helped us to determine when, where, and how to carry out the evaluation required to insure environmentally compatible disposal.

Dredged material is not in all cases a highly contaminated waste but consists generally of 95-percent mineral soil material that has virtually no contamination potential. The research has shown that even moderately contaminated material can, in most cases, be safely disposed in aquatic, wetland, and upland environments without applying any treatment procedures.

ENVIRONMENTAL AND WATER QUALITY OPERATIONAL STUDIES

The Environmental and Water Quality Operational Studies Program just started its third year. Its primary objective is to improve the Corps' ability to plan, design, construct, and operate riverine and reservoir projects to meet both environmental quality objectives and authorized project purposes.

Understanding the results of modifying Corps' projects is the main reason for developing good predictive techniques. Both mathematical and physical models provide useful predictions. A multidimensional reservoir model will soon be selected from existing models, and improvements will be started. A review of existing one-dimensional models will be conducted by the Geological Survey.

Work on an improved description of reservoir hydrodynamics was started in fiscal year 1978 and continued through fiscal year 1979 with emphasis on the effects of pumped storage hydropower projects, inflow, and internal mixing techniques.

Simplified techniques can predict some environmental impacts with little or no cost. Work in this area started by compiling a data base for verifying existing nutrient loading models. The second phase was a preliminary analysis of data identification for potential models. The models will be tested and modified if necessary.

Many water quality problems facing the Nation are affected by the way reservoirs are operated. Work in the area of reservoir operations is solving many of these problems. We have evaluated current algal management techniques. An algal management workshop will be held this year to solidify objectives for providing new or improved technology.

One of the most noticeable effects of reservoir operations is created by fluctuating pool levels. Certain authorized project purposes can cause esthetic, ecological, and economic problems. A literature review on using vegetation to minimize these effects was recently completed and field experiments were started last year.

Field studies are underway on minimum release flows and the effects of fluctuating releases from hydropower projects. Additional demonstration sites are planned and a workshop is scheduled for April.

We have begun work to improve guidance on reservoir site preparation compatible with water quality objectives, affected project purposes, and recreation interests. This work is scheduled to continue into fiscal year 1983.

The impacts of contaminants on reservoir project purposes are becoming increasingly important. We have completed a literature survey on the contaminant problem. Important contaminants and their effects are now being identified.

Reservoir regulation can often provide a way to meet release water quality objectives. Work has been completed on regulating for a single water quality parameter. This has been expanded to include the feasibility of regulating a system of reservoirs. During fiscal year 1980 and 1981 this will again be expended to include additional water quality parameters in a system of reservoirs.

Reservoir engineering technology will provide methods to meet water quality objectives in reservoirs and in their releases. Fiscal year 1978 work concentrated on improving design guidance for selective withdrawal and reaeration at nonhydropower projects. Fiscal year 1979 efforts emphasized localized mixing and reaeration at hydropower projects and continued work on the hydrodynamics of selective withdrawal. In fiscal year 1980, efforts will expand to include the environmental effects of reservoir destratification with completion scheduled next year.

Environmental assessment efforts were recently redirected to better implement the planning series Engineer Regulations. Also a compilation of biological indicators for riverine systems is being made to reduce data requirements for environmental assessments.

The environmental effects of waterway projects are being determined through literature reviews, short-term laboratory and field studies, and evaluations of current design and operational procedures. Short-term field studies are being conducted to provide the necessary answers to meet environmental quality objectives.

Long-term field studies, both in reservoirs and in waterways, are active. Data collection will continue through fiscal year 1982. These will provide much information on the environmental effects of projects while demonstrating technology developed in other parts of the program.

AQUATIC PLANT CONTROL

The Aquatic Plant Control Research Program is providing demonstrated techniques to control aquatic plants that adversely affect navigation, recreation, water supply, and/or fisheries.

Biological control methods are being developed through an inter-agency agreement with the U.S. Department of Agriculture and university contracts, including searches overseas. These methods include using the white amur fish, insects, plant pathogens, and combinations of certain insects and pathogens. Scientists are releasing the insect, *Sameodes*, in south Louisiana where a large-scale test is evaluating the effects of using plant pathogens and insects against waterhyacinth on an operational level. Work is in progress to evaluate the fungal plant pathogen, *Cercospora*, for controlling waterhyacinth and to evaluate other pathogens to control other plants.

Chemical control methods are being developed through contracts with universities and private companies and cooperative efforts with industry. These involve a screening program for developing new chemicals and conducting tests necessary to obtain Experimental Use Permits and eventual compound labeling by EPA. We are field evaluating two herbicides in Gatun Lake, Panama. Herbicides in four controlled-release forms are ready for field testing; a field evaluation will be started soon.

Mechanical control is being pursued through contracts with private industry to evaluate available machines and methods and through in-house development of design criteria. We have a prototype mechanical system that was evaluated in Florida last summer.

Technology transfer is accelerated through operational-scale demonstration projects and cooperative efforts conducted jointly by the Waterways Experiment Station, 10 Corps' Districts, and the Panama Canal Commission. Aquatic plant control operations are underway in each of those areas using techniques and plans developed in this program.

Techniques for rapidly identifying and assessing aquatic plant problems are being developed; field tests are scheduled for this fiscal year.

Poststocking monitoring of a white amur demonstration project near Orlando, Fla., is proceeding on schedule. The data collection phase will be completed in a few months, and final analysis will be completed in 1982.

Technology transfer is also emphasized through an effective public information program. Two movies and two information exchange bulletins were completed last fiscal year. Twelve technical reports were published. A third movie and several information bulletins were drafted and are in publication.

The 5-year plan for fiscal years 1977-82, Attachment 13, will be revised and submitted for approval in fiscal year 1981.

CONCLUSION

In summary, each of these major-thrust areas is progressing very well, and each is producing answers to very difficult, but important, questions. Technology transfer of the fiscal year 1979 research products was made in the various modes shown in Attachment 14.

Each program could be accelerated by providing additional funding in fiscal year 1981 and years beyond. Such accelerated funding is subject to budgetary constraints in the President's budget for the Corps' civil works program.

That concludes my prepared remarks. I will be pleased to answer any questions.

Mr. AMBRO. I would like to thank you very much, Dr. Harrison, for the comprehensive review of your activities, and tell you, while I'm rifling through this testimony, that I think we all understand and recognize the illustrious kind of contribution the Corps has made with respect to a variety of things in this Nation, in peacetime and other times.

Maybe we can start by going through that which you've just read and running through quick answers to a couple of questions.

On page 4, for example, you say: "To improve methods for collecting, treating, and disposing of waste water at Corps' facilities." What are Corps' facilities?

Dr. HARRISON. In this case, usually recreation areas, sir, or, in some cases, purely Army facilities.

Mr. AMBRO. I see.

"The A-E community," what does that mean in English?

Dr. HARRISON. Architect-engineer firms, private consulting firms usually.

Mr. AMBRO. I'll scratch atomic energy then.

Dr. HARRISON. Yes, sir.

Mr. AMBRO. On page 5: "Data from 6 years of tests in the laboratory and prototype systems . . ." What prototype systems with respect to that?

Dr. HARRISON. The prototype systems were in Utica, Miss.; in Hanover, N.H. at the Cold Regions Laboratory; and I cannot think of the third one, in Minnesota or Wisconsin. I want to say Apple Valley, but that's not correct. There were three that I can think of. There is another prototype system, which is a very specialized industrial application. The Campbell Soup Co. in Paris, Tex. has done this for years. I can't say it is an experimental site. That's how they're treating their sewage.

Mr. AMBRO. The Campbell Soup Co.?

Dr. HARRISON. Yes, sir.

Mr. AMBRO. "CAPDET," give me that once more. What is that the acronym for?

Dr. HARRISON. Computer-aided procedure for the design and evaluation of treatment systems.

Mr. AMBRO. On page 7 you say: "Field evaluation of the intermittent sand-filtration pilot test facility for treating wash-rack and motor-pool runoff waste was recently completed at Fort Carson, Colo."

The motor-pool runoff waste that you're talking about includes or is comprehended by the field of industrial organics?

Dr. HARRISON. Yes, sir.

Mr. AMBRO. Tetrachloroethylene, trichloroethylene, things like that?

Dr. HARRISON. Usually not, in this case, sir. Usually it is primarily a problem of soil, oil, and grease. The strong solvents are usually not used. The problem has been in the past the extremely high solids concentrations that come off these facilities, vehicles.

Mr. AMBRO. What is the groundwater condition at Fort Carson, Colo.?

Dr. HARRISON. At Fort Carson, Colo., sir? I don't know.

Mr. AMBRO. Does anyone know?

[No response.]

Mr. AMBRO. Where does the potable water supply come from in that area? Is it surface water or groundwater?

Dr. CHOROMOKOS. It's groundwater, but from the mountains.

Mr. AMBRO. From the mountains?

Dr. CHOROMOKOS. Yes, sir.

Mr. AMBRO. So there's no leaching effect to this, and the study did not include that, I suppose?

Dr. CHOROMOKOS. We were treating the wash rack on the base.

Dr. HARRISON. The treatment consisted, sir, of collecting the runoff from the wash rack. There are great volumes of water with very high solids, which means, collecting, sedimentation, filtration, recycling of the water, and disposal of the contaminants in landfill, the contaminants being the ones we mentioned earlier.

Mr. AMBRO. Let me see if I can straighten this out because, while it's interesting, I don't think I have it clearly in mind.

If the motor pool runoff waste was grease, or material like that, what did you use in your pilot test to dissolve the grease?

Dr. HARRISON. I presume—I'm not sure of this—that some sort of fairly light solvent was used, and it was also absorbed in the particulate matter. That would be the main method of removal. As unsophisticated as that is, it does the job and provides the least contamination.

Mr. AMBRO. And then what happens to the combined product of the grease and the solvent? What do you do with it?

Dr. HARRISON. It's disposed in landfill, sir.

Mr. AMBRO. In landfill?

Dr. HARRISON. Yes, sir, much like sludge from either industrial or domestic waste disposal.

Mr. AMBRO. I don't think we have time to pursue that, but maybe we will later.

You say, on page 8, "A national workshop was held to evaluate marsh/estuarine water quality and ecological models to solve identified problems." And, in fact, you refer to national workshops throughout the testimony.

Can you describe, just for the record, for a second, what a national workshop is?

Dr. HARRISON. Yes, sir. On a particular subject area, in this case marsh/estuarine water quality and ecological models, these are research tasks that we have developed in our specific programs, and this is a method that we use in one or two steps of our research, the first being, as a kick-off step, to gather experts on the subject area and also people who may not be academically expert, so to speak, but

who have a very pressing interest in the particular area, to get them together for a certain number of days and discuss the subject at length, almost a brainstorming session.

The second type of workshop that we would use would be to, if you will, bounce alternatives off of these groups of people: "We have come up with these alternatives, with these possible solutions. What do you think of them?"

Mr. AMBRO. So it's a form of transfer of information and technology.

Dr. HARRISON. Yes, sir. But it's mainly a form of feedback for these types of workshops that I'm talking about. We do have workshops, seminars, classes, to transfer technology mostly out to the field-operating elements. These I refer to are mostly feedback type of workshops, sir.

Mr. AMBRO. I see.

The DOTS program, do you consider that a transfer program?

Dr. HARRISON. It is purely a transfer program.

Mr. AMBRO. Purely a transfer program.

You say you have assembled information from a variety of Federal and State agencies for field guidance on cost-effective methods for difficult construction site restoration problems.

What do you do with the information you assemble, the facts that you gather, the reports that you develop? Apart from your own group, does that data go out to the private sector, to, as you put it a second ago, the nonacademic types who have a great interest in this? How does it get out into the hands of interested people throughout the country?

Dr. HARRISON. It can get out in one of two ways, Mr. Chairman. The first is that on almost every one of our work items we write a technical report, which would be like a masters thesis or a Ph. D. dissertation. This is published for two reasons. The first is to be made a matter of record so that people do not go back and reinvent the wheel. The second is so that if someone wants the detailed data he can obtain the detailed data. Then from that document we summarize the basic information, the basic conclusions, "how-to-do-it," the "what-to-do," into a guidance document of some sort, usually for the Corps of Engineers because in almost every case those are our particular customers, and it comes out in the form of an engineer regulation, an engineer manual, an engineer technical letter, or some other form of technical engineering guidance, which is sent to the field.

Now, the people outside these user communities can obtain this information in one of two ways: from either a report that we have written, which is public information, unless the material is classified, and it very, very seldom is; or they can get it from the summarized "how-to" version that goes to the field-operating agencies.

Mr. AMBRO. So there's no deliberate, concerted effort to provide information to the general public on the part of your group? For example, you say—just to take a little one—"We have successfully stabilized eroding banks with marsh plants in a number of intertidal environments."

We've had that problem where I come from, and we called in some private people and they used a method, I think, called hydroseeding. They fired a gun at the side of the eroding bank and tried to plant seeds in order to get some vegetation to hold it.

If I represented a municipality, how would I know that the Corps had done studies and had successfully stabilized eroding banks? Where would I, as a municipal official, go for that kind of information, which I think might be very vital and save us lots of money and provide us with a successful method? How would I know where to go to find that sort of data?

Dr. HARRISON. You have four places that you can go to.

Mr. AMBRO. Maybe a fifth after this session.

Dr. HARRISON. Yes, sir. Maybe more than that.

The first is the Corps of Engineers District in which the problem resides. They receive these documents directly that are produced by the laboratories. That is the function of the laboratories.

Another way is NTIS, the National Technical Information Service, which we input all our information to. The system is easy to use on some subjects, not so easy on others. The Federal Laboratories Consortium and the Government Printing Office are other sources that you can obtain exactly the same information from.

Dr. CHOROMOKOS. There is also an interagency committee that has State officials that intersect with the various Federal agencies to exchange problems that the cities and States are having and to try to get the information or any type of research that is being done in any of the Federal agencies to support the cities and States. I forget the exact title of the interagency committee, but I know it's in the science and technology field.

Mr. AMBRO. On page 16 you say:

DMRP results showed definitely that widely held fears over the short-term release of contaminants to disposal site waters are unfounded. As long as the geochemical environment is not basically changed, most contaminants are not released from the sediment to the water.

First: Define for me the geochemical environment. What is that?

Dr. HARRISON. I would like to make just a very short broad statement and then ask Dr. Engler to address your question directly, Mr. Chairman.

When we began the DMRP in 1973 we sensed that the strongest fear was the short-term release of contaminants. That was at that time, 7 years ago. This is no longer the case now.

But with that very short introduction, I would like Dr. Engler to answer your direct question.

Dr. ENGLER. There are two significant changes that can occur. An example would be removing highly anaerobic or anoxic sediment from a harbor bottom, placing it upland and allowing it to dry to an upland soil consistency. This is a significant change in the geochemical environment, from anaerobic to oxidizing.

Another is a change in pH from acidic to alkaline or from neutral to acidic or neutral to alkaline, which also has serious implications on the contaminant retention or mobilization.

Mr. AMBRO. These conclusions are based on a short-term lethal effects study, is that correct?

Dr. ENGLER. They're based on: short-term studies, as described by 2 years, approximately 2 to 3 years monitoring in the field; shorter term monitoring in the laboratory, days to possibly 9 to 12 months; and also evaluating long-term disposal sites, that is, a site that's been there for 25-50 years, by looking at the biota that live on these sites and the water quality of the interstitial water, the bound water, and the water immediately above the sites.

So we assess this from several directions: in the lab, in the field during disposal operations, and, where appropriate or where possible, at long-term disposal sites.

Mr. AMBRO. But the evaluation of long-term disposal sites is certainly not an indepth study or something which is so reliable you can base long-term conclusions on it, is it?

Dr. HARRISON. No, sir, it is not. We, again, do not feel comfortable with long-term conclusions. We do feel comfortable with the short-term conclusions.

Mr. AMBRO. Then how can you feel comfortable with short-term conclusions when we're looking to intermediate and long-range effects as well? Aren't we attempting as well to feel comfortable with conclusions that go beyond short-range or short-term?

Dr. HARRISON. Yes, sir, we are. We cannot speed up nature in a modeling sense. At least we don't know how in this particular case, and so it involves, as Dr. Engler said, long-term laboratory and field tests. We have had only time in the last 3 years of the Dredged Material Research Program [DMRP] and in spot, continuing monitoring since completion of the program, which has entailed only a time of 5 years. We do not consider this to be long-term effects, so that's the only reason, is time, Mr. Chairman.

Mr. AMBRO. The conclusions are, if I can use the word, kind of dogmatic. "As long as the geochemical environment is not basically changed, most contaminants are not released from the sediment to the water." Now, that's a conclusion.

Dr. HARRISON. Yes, sir.

Mr. AMBRO. Which is based on short-term data.

Dr. HARRISON. No, sir.

Mr. AMBRO. It's not?

Dr. HARRISON. No, sir. That's based on long-term data.

Mr. AMBRO. What long-term data?

Dr. HARRISON. With regard to the short-term release of contaminants. If we're talking about hours or days in the matter of release of contaminants, if you take data for 2 years, you have pretty well pinned down that there will be no release in hours and days. That's what the statement is meant to say, Mr. Chairman. It is not meant to say that—

Mr. AMBRO. How about the statement: "Consequently, the turbidity standards used by some State and Federal agencies cannot be technically justified." What about the long-term effects?

Dr. ENGLER. Most turbidity standards are based on a long-term exposure. That's exposure of days, sometimes weeks, or a lifetime exposure. The turbidity associated with a dredging or a disposal operation is normally measured in minutes; sometimes for a few hours you have something above ambient turbidity in a barge disposal or a hopper disposal. Background is reached in a very short period of time, 15 minutes to 2 hours. Most of the turbidity criteria or standards are based on a lifetime exposure at some level.

Mr. AMBRO. How about this statement: "Disposal sites are rapidly recolonized." As we understand it, researchers at the University of Washington have shown that benthic organisms recirculate toxic substances to the marine environment.

Do you want to reconcile those two views?

Dr. ENGLER. There is a strong potential for that. Consequently, we're continuing to look at this in Elliott Bay of Seattle, Wash., in fact, at an open-water site.

The initial findings that we've obtained from sites that had been recolonized for several years showed no increased levels of metals over what they would normally have. So the trend showed for the sites we have studied no potential for enhancement or bioaccumulation. We weren't satisfied. We're still continuing to look. We're looking at it in our ocean site designation work. We're assaying bioaccumulation at each of the 26 ocean dumping sites, and it's part of our regulatory program.

Mr. AMBRO. The last one with respect to conclusions, then, on the same page: "DMRP results conclusively showed that there is no predictable correlation between the total amount of contaminants in the sediment and the resulting environmental impact."

Would you give me your view with respect to that statement and long-term effects?

Dr. ENGLER. Historically, contamination potential was measured by what's called "bulk analysis." You get a container of the mud, totally digest it, and analyze it for its entire consistency. Mercury, for instance, exists naturally in the Earth's crust in a form that's released under geological conditions. On the other hand, a sediment contaminated with organic mercury from some industrial discharge has that mercury in a much different form. All of the mercury in that sediment is not available for biological impact, and no chemical analysis exists right now that clearly identifies that specific portion. Consequently, this is why we include bioassays, toxicity tests, and bioaccumulation tests in our regulatory program, because we feel the organism is the final arbiter of effect, rather than the chemical analysis.

Mr. AMBRO. Our illustrious staff here feeds me material so fast. What he has given me is something which says the following:

With respect to coordination with EPA in development and evaluation of criteria for dredge spoil disposal, specifically in several pending dredging permit applications in the New York District, EPA and the Corps have disagreed on the suitability of certain dredge spoils—that is, in the area of the Refined Syrups plant on the Hudson River—for ocean dumping. Disagreement apparently exists over the significance of bioaccumulation testing of PCBs on the benthic organisms exposed to spoils.

What cooperative effort is planned with EPA to resolve the technical questions?

I think what they're getting at is the fact that EPA initially rejected the Corps' approval of the permit because under the joint bioassay criteria the tests failed, that is, the PCB accumulation tests.

So first what's the use of regulations if they're ignored, and second, tell me about the cooperation between the EPA and the Corps in resolving these kinds of technical questions.

General ROBINSON. Mr. Chairman, let me respond partially, and then I'll give it back to Dr. Engler.

The situation concerning the Refined Syrups and Sugars again was interpretation of test data, as you correctly stated. We stated that the material was satisfactory for disposal and EPA said it was not. The controversy really settled around biomagnification, rather than bioaccumulation, because the amount bioaccumulated by the organisms used in the test was not significant, and not significantly different from the disposal site itself. Our regulatory criteria say that we should look at all factors and determine whether or not there is an unacceptable effect on the environment. We determined that there was not in the case of Refined Syrups and Sugars. EPA decided that there was an unacceptable effect, but because of economic hardship, they would waive the requirement for any further testing.

Mr. AMBRO. On what basis did you determine that they were not?
General ROBINSON. That the material was satisfactory, you mean, for disposal?

Mr. AMBRO. Yes.

General ROBINSON. Based on a comparison to the disposal site, a study of the disposal site, and the MITRE report, which had examined the criteria and the effect of disposal in New York Harbor. Clearly, the material to be disposed was not unlike the material at the dumpsite itself.

I'll ask Dr. Engler to comment further on it.

Dr. ENGLER. A further problem was that EPA Region 2 also felt that additional information could be generated by the District and this was so generated, as General Robinson mentioned. An assessment was made of the characteristics of the dumpsite and the surrounding area, the New York Bight, the New York Harbor area, and it was determined that the organisms showing the uptake of PCBs, which was particularly small, well below FDA limits for a consumable food source, it was determined it was very small and very similar, if not identical, to what exists as a background.

I'm not trying to say that a background level of PCBs is good. It's not. But this is a problem that exists in the New York Harbor, in fact the entire harbor, the New York Bight area.

How are we solving this problem? We've been meeting with EPA almost weekly on two levels: A Washington level, and tomorrow I'll be meeting with the District, the Region, EPA research people to come out with an evaluative protocol to follow in determining where a significant adverse effect from dumping would occur.

The bioassay itself is not a pass-fail test for issuance of a permit for dumping or for whether a Federal project is dumped. There are several other factors that enter into it, but it is one of the key elements for sure.

We are working with EPA continually to resolve these problems.

Mr. AMBRO. And amicably?

Dr. ENGLER. Very amicably.

General ROBINSON. EPA asked if we could have a regional task force, which we convened, to report to us by February 20, to look at the PCB problem in the entire New York Harbor.

The Washington level task force is looking primarily at the technical criteria in an attempt to reach a meeting of the minds on how we interpret the test data once we have it.

Mr. AMBRO. I think someone injected the word "economic" in all of this.

I recall when Congressman Ottinger wanted to dredge some harbors in Mamaroneck, we got embroiled in a bit of problem between balancing the economics of doing that and dumping in one place or another. One place was out on Long Island Sound and the other was in the bay. We did a little study to determine whether or not it was economically feasible.

If we had an horrendous and agreed-upon environmental problem, how do you work out the balances between the economics of moving that contaminated, let's say dredged, material to one place or another weighted against environmental concerns? Who does that? Is it a collection of people who get together and discuss it?

General ROBINSON. Mr. Chairman, the final determination is made by EPA. They have the final determination in the case of disposal of dredged material.

Mr. AMBRO. Regardless of economic impact?

General ROBINSON. Yes, sir. Certainly, if it was an agreed upon major environmental effect, I don't think there would be disagreement on it. We certainly wouldn't want to cause that type of effect.

Mr. AMBRO. I know that EPA can veto, I suppose, a disposal site or an area for a contaminant, but what I'm trying to do is to get to how the relationship works. What do you do, sit down weekly, monthly, or something like that, and discuss it and exchange communications? What comprises that working relationship between the Corps and EPA? How does that work?

General ROBINSON. At the district level, we would run the necessary tests, do the necessary examinations of material which was to be disposed, check the disposal site, make the comparisons, prepare a report, probably consult with EPA while we're doing this so that they would be aware of what was going on. The end result would be a report on the disposal action itself to EPA recommending an action, either dispose or not dispose. EPA would then act on that report. There would be some exchanges back and forth. Perhaps additional data would be required.

Mr. AMBRO. And there's no way that you can get, once EPA has made a judgment, a waiver based on economic considerations?

General ROBINSON. There is a waiver procedure under the ocean dumping criteria which would allow us to go to EPA and request a waiver based on no acceptable alternative, economic hardship, et cetera.

Mr. AMBRO. I've run through your testimony with respect to my questions. Before getting to general questions about budgets and things like that, I'd like to defer to my colleagues. They certainly have questions with respect to all of this.

Mr. Brown?

Mr. BROWN. Thank you, Mr. Chairman.

Gentlemen, I am very much interested in learning more about the scope of your research and development in the environmental area, and I confess to not being very well informed about it.

My first reaction in listening to your review of the Dredged Material Research Program was that this has implications that go considerably beyond the Corps of Engineers' work in terms of the value of the research. For example, the whole question of what happens to toxic materials or contaminants when they enter into the environment is becoming extremely important in connection with these horrendous findings about old toxic chemical dumps that exist around here, and hence information about the transport and fate of these contaminants and the degree to which they are taken up by plants and enter into the food chain, and what happens to them ultimately and their impact on human beings is the subject of considerable interest in other arenas to which this project should make a contribution. I gather that you have been making a substantial effort to see to it that this is coordinated with other related types of research.

Am I correct in this, that we're not missing any bets here, that we might learn something that would be applicable to the toxic waste dump I have out in my district?

Dr. HARRISON. I hope that we're not missing any bets, Mr. Brown. We do make what we consider extraordinary efforts, particularly in the dredged material research area, and in our other programs too, to coordinate with all pertinent groups and individuals and agencies and

to bring them into what's going on before the fact as well as after the fact.

Mr. BROWN. I notice you have a reference here on page 21 to a technical committee of scientists and engineers from the Corps and EPA, set up in late 1975, to act as the focal point for coordinating research. Is that kind of technical committee still ongoing to maintain this coordination?

Dr. HARRISON. Yes, sir, it is ongoing. Its scope is limited, though. It deals with dredging, dredged materials disposal, and regulatory areas within the Corps of Engineers. It does not deal with either the full scope of EPA's mandates or the full scope of the Corps' mandate, but it is ongoing. Dr. Engler is the Corps of Engineers' cochairman of that particular committee.

Mr. BROWN. That bothers me a little bit because it seems to me there are still a lot of unanswered questions in this research field, and some of these unanswered questions have fairly broad implications. You've referred to some of them yourself. I'm trying to find the reference here in which you refer to the uptake of certain minerals, I think, by aquatic plants, and, while you've made some short-term studies of that, there's a lot more work that needs to be done in that area.

That's a general kind of a problem. A lot of questions about the fate of pollutants can only be answered over a fairly long period of years as you trace these things out, and I'm concerned that the Corps can't follow these up, because let's say you've got all the information you need for a particular mission that you have, and you have reflected that in your manuals, and guides, and so forth.

Is the situation such that at the appropriate time additional research programs can follow on and complete, or continue at least, some of these kinds of research that might prove to be valuable in another kind of assay? In other words, I'm concerned about the basic progression of the knowledge base here and whether or not what the Corps is doing is making a contribution to that fairly broad problem.

Dr. HARRISON. I can safely say that the Corps is making a very large contribution to that broad problem, Mr. Brown. However, I cannot say that the problem does not remain, both within and outside the Corps of Engineers. I believe, being associated with research and other related endeavors for a while, that this is a common fault of the business that we all wish would improve, and that the person who develops the foolproof method to insure this very desired continuity will be certainly a hero.

The information is available on the work that the Corps does, and I think it's safe to say the information is available on the research that the other people do. Oftentimes the question of whether it's transferred effectively or not is the overriding question. Unfortunately, it's not always.

Mr. BROWN. I'm not trying to be critical here, because you've acknowledged in your statement that there were unaddressed and unanswered questions.

Dr. HARRISON. Yes, sir.

Mr. BROWN. I was struck by a report prepared by the Library of Congress last year dealing with this general field that we're talking about here, what they call biogeochemical science, which indicated that we're spending about \$100 million a year—that's a rough guess; nobody knew for sure—and that there didn't seem to be an overall

pattern to insure that that \$100 million investment in precisely the sort of thing that you're addressing in this study was being effectively established as a coherent knowledge base on which future plans could be built; and I think the Corps has probably accepted as much responsibility as any agency that I know of for building that base.

I'm still concerned that you might be able to do a better job of it, and I wanted to make sure that you were aware of our concern in that area. Essentially, I think that's what this committee is interested in trying to achieve, that we build that kind of a knowledge base.

Let me explore one other thing.

You have several references here to the waterhyacinth, a very interesting plant.

Dr. HARRISON. Yes, sir.

Mr. BROWN. And you're trying to find ways to eradicate the waterhyacinth, and you are conducting some experiments with herbicides in Panama.

Dr. ENGLER. At Gatun Lake.

Mr. BROWN. At Gatun Lake.

What are the circumstances with regard to this? Are you doing this in Panama because you can use chemicals down there that you can't use up here, or what precisely is the reason for doing it there?

Dr. HARRISON. There are two reasons for it. That is one of them. The second is that we can obtain cheaper logistical support in that area than we can in the United States.

Mr. BROWN. You're not subjecting those poor Panamanians to hazards that you wouldn't do here?

Dr. HARRISON. No, sir, and there's a significant water problem, aquatic plant problem, in the canal.

Mr. BROWN. In the canal?

Dr. HARRISON. Yes, sir, a very significant problem.

Mr. BROWN. The other side of the coin, of course, is that the waterhyacinth takes up some of these contaminants and is very useful for cleansing ponds and lagoons.

Dr. ENGLER. Yes, sir. A plant is not a weed if it's not out of place. It's only a weed when it's out of place.

Mr. BROWN. You're looking at both sides of the waterhyacinth equation, are you?

Dr. HARRISON. No, sir, we're not. We're not looking at the side of the beneficial effects of taking contaminants from the water. We are well aware of that work. It's ongoing.

Mr. BROWN. There are some demonstrations in California of the uses of the waterhyacinth.

Dr. HARRISON. Yes, sir. There are demonstrations as close as the National Space Technology Lab at Bay St. Louis, Miss., right in our own backyard, which we have seen. We're well aware of this work going on. Our mission, we feel, Mr. Brown, is in the aquatic plant control research area, which is the other side of the coin.

Mr. BROWN. That's the main concern of this committee, I think, at the present time, but I think it is important to be aware of other aspects.

In my trip to China a year or so ago, I noticed that the waterhyacinth was being used as a fairly substantial part of the diet of a lot of their ducks over there.

Dr. HARRISON. Yes, sir.

Mr. BROWN. You're not coordinating your work with Agriculture, I suppose, are you?

Dr. HARRISON. Yes, sir. We have two agreements with the Department of Agriculture in the aquatic plant control research program. Obviously, all the quarantine work, that very carefully safeguards the health of everyone, goes through them. We are coordinating our work with the Department of Agriculture. They are very well aware of every facet of the program, not just those facets that they're involved in.

Mr. BROWN. Thank you, Mr. Chairman.

Mr. AMBRO. Thank you, Mr. Brown.

Out of the total budget of nearly \$3 billion the Corps, at least according to the budget figures provided to us, spends \$1½ million, or one-twentieth of 1 percent of the total budget, on its Environmental Impact Research Program, which is supposed to evaluate the environmental effects of the Corps' civil works activities. The total funding for all Corps' environmental R. & D. is less than 1 percent of the total budget.

My first question is: Is the funding adequate for the Corps to assess the environmental impacts of its own civil activities?

Dr. HARRISON. Mr. Martin, would you like to address that, or would you like me to? I would be pleased to.

Mr. MARTIN. The total R. & D. budget of the Corps is 1 percent. It is for fiscal year 1980 29-plus million. That's 1 percent of the total civil works budget for R. & D.

The answer is that the program deals at the present time with the highest priorities, and it does not answer all the questions. There are other questions that could, and should, be answered, but we have to deal with that limited budget on those which are the highest priorities.

Mr. AMBRO. So the \$30 million figure provided to us for environmental research generally is an accurate figure?

Mr. MARTIN. The total civil works budget for R. & D. for fiscal year 1980 is \$30 million. Now, that takes care of things like dam safety, coastal engineering, and flood control and navigation.

Dr. CHOROMOKOS. And ice engineering. That's all.

Mr. AMBRO. Does the Corps, in fact, do more environmental research and monitoring under the Operations portion or the General Investigations portion of its budget than we see on this line?

Mr. MARTIN. No. You see it all.

Mr. AMBRO. We see it all.

Mr. MARTIN. The \$30 million includes the total civil works R. & D.

Now, the Aquatic Plant Program, the Environmental Water Quality Operational Studies, and the other parts represent different types of money in the civil works program: General Investigations, Construction, General, Operation and Maintenance, and, in one case, General Expense.

Mr. AMBRO. Here's what confuses us a little bit. The Corps has provided EPA, the Marine Protection Branch, with about \$7 million over 3 years in order to enable EPA to complete its long-term program at 26 designated dumpsites. Yet that expenditure isn't mentioned in the budget sheet.

Mr. MARTIN. That's right.

General ROBINSON. That's not an R. & D. funded activity. I don't know what the total is—perhaps someone here might—but through

our Operations and Maintenance Branch, those activities which are directly related to performance of those functions are often funded out of those functions rather than through R. & D. Some of it may relate to R. & D., may be accomplished by the same labs, but it's not an R. & D. funded activity, and so there is some crossover of the funds to try to satisfy the requirements that we have across-the-board, not just for what we might call basic research.

Mr. AMBRO. I think that, then, clears it up. I appreciate it.

But then the first question remains: Of the \$30 million, \$1½ million, or one-twentieth of 1 percent of the total budget, is for the specific item of Environmental Impact Research Program.

Now, is funding adequate for the Corps to assess the environmental impact of its own civil activities? What's your view with respect to that?

General ROBINSON. Let me just comment, before R. & D. comments, that in our system of priorities, of course, we have identified those priorities that we feel must be addressed by the labs in the research and related programs. We have what we call a research need system, where our districts tell us what they require. That's evaluated by a committee in Washington. We look at each one of those requirements and try to prioritize. We receive funds both from the R. & D. side and from all of our other appropriation sides, and through a combination of moneys we fund as much of that program as we feel must be funded during that fiscal year. Oftentimes we fall short of items that we would like to do, but they're just not high enough priority to do in that year. There are some items in the dredged material research area that we would like to do right now. The bioaccumulation is one that was mentioned, the effect of bioaccumulation, evaluation of the effect of bioaccumulation. We are funding some of that through our operations program just so we can get started in that evaluation.

I think on balance I would have to say that we insure that those critical items of R. & D. are performed each year. There are some which are nice to have, and don't fall high enough on the priority list, that we don't get to in a given year, and they just have to wait their turn for funding. That's about what it amounts to.

Dr. HARRISON. I might also add, Mr. Chairman, that you mentioned the Environmental Impact Program at \$1½ million, approximately. During my presentation I mentioned, I believe, six other environmental R. & D. programs which are funded from the R. & D. budget, which also, in their ways and in their subject areas, contribute to environmental impact prediction and assessment on the Corps' areas—for instance, the wastewater management area, the fisheries research and protection, recreation, environmental and water quality operational studies, and aquatic plant control.

Although it is a semantic problem, I realize, the Environmental Impact Research Program within the Corps is not the only environmental R. & D. program that addresses environmental impacts. It's more or less an umbrella program.

We've highlighted some of our most difficult problems in these other areas and tried to focus our resources on them particularly so that we'd solve those problems as they came up. So it is not the only environmental impact work that we are doing now by any means. The total figure is—and I'm just guessing now—probably closer to \$14 or \$15 million.

Mr. AMBRO. General Robinson did mention the bioaccumulation tests and their significance. The Corps itself indicated to us a need for research on what, if we look at this list, are to me long-term chronic effects of dredge disposal and on the significance of bioaccumulation—additional research and development needs for dredging and dredged material. You say not only “significance of bioaccumulation,” but “sensitive sampling, analytical techniques for low-level toxic substances, environmental chemistry of toxic substances, regional cumulative impacts of open water disposal, techniques for dredging highly contaminated sediments.”

Now, if that isn't a list of those things which indicate that you recognize a need for research of long-term chronic effects, then I don't know what is, and, therefore, after hearing your comments with respect to that, I would like to get back to the differences between the work that you do on short-term effects and that which you may do on short-term effects over a long period of time, which Dr. Engler mentioned, and the need for long-term effects research.

Can you comment?

Dr. HARRISON. Yes, sir. The former work we have finished, the work on short-term effects.

Mr. AMBRO. I know that.

Dr. HARRISON. There is a need, as we have stated in that list, for work on longer-term effects. We recognize that is a serious need.

Mr. AMBRO. Then that series of questions I asked you earlier about long-term effects really was not answered in a way that I think is compatible with the kind of attitudes that one finds in your paper, especially with respect to dredged material.

If we set the background for this, the DMRP was established in 1970, and terminated, or completed, in 1978. Is that correct?

Dr. HARRISON. It was authorized in 1970, the end of 1970. It was begun in March 1973 and was completed in March 1978. A 5-year timeframe was attached to it. It was completed in March 1978, after 5 years of work, sir.

Mr. AMBRO. Then the short-term effects of the disposal of dredged materials, you conclude, with statements which are rather strong in your paper, are not really serious.

When I asked you about long-term effects, I think the answer was, in effect, that you were satisfied that you have the short-term effects, you have collected considerable data on short-term effects over a long period of time, and therefore, you're satisfied that there really are no undesirable long-term effects.

Wasn't that what we got from that colloquy a while back, especially from Dr. Engler? Isn't that what you said to me?

Dr. ENGLER. No, sir, not at all.

Mr. AMBRO. No?

Dr. ENGLER. Sublethal effects are long-term effects. They cannot be measured in a short period of time. They can only be looked at after many cycles. Chronic effects are long-term effects.

Dr. HARRISON. We did not mean to give that impression.

Mr. AMBRO. Well, I got that. “DMRP results showed definitely that widely held fears over the short-term release of contaminants to disposal site waters are unfounded.” I asked you, “What about long-term effects?”, and I think the answer was there was no problem. What about long-term effects? Or shouldn't we worry about them?

Dr. HARRISON. I think we should worry about them, Mr. Chairman, at least until we understand them, which we do not.

Dr. CHOROMOKOS. I think we admit that the DMRP did not answer all the questions on dredging and dredged material. I think we've gone on record on that statement there.

Since we have completed the DMRP there have been other unanswered problems, or questions, that came up. The DOTS program monitoring these particular sites is getting additional data for us, and we are presently formulating research to look at these long-term effects in 1982.

Mr. AMBRO. Now we get to the nub of it though, and I don't want to go through these statements that are very specifically concluding, in my view, that there really is no big problem. But the nub of it is that the kinds of research and development needs that you address in your own paper are not being funded, or will not be funded, and therefore there will be a gap in addressing the kinds of concerns that we have over long-term effects.

How do we propose to remedy this? Where can we go to look to satisfying your needs in a variety of areas so that you can develop the kinds of data that will satisfy our needs, for example?

Dr. ENGLER. Mr. Martin, would you like me to answer that, or would you like to?

We realize the deficiency in our knowledge. To answer your previous question, we do not have a handle on long-term effects. We do not have a handle on sublethal or chronic effects. We are getting to the point in our knowledge after the DMRP, which was completed in 1978, and after our monitoring efforts and our technology-transfer efforts and our feedback from these technology-transfer efforts, that this work, which you describe, Mr. Chairman, exactly, is very much needed and is reaching the critical point on our scale, and we hope very much to initiate this work in fiscal year 1982.

Mr. AMBRO. That's it precisely. I think our concerns are the same, but we have a recitation of needs for R. & D. in this specific area and we have, on the other hand, a realization that there are no funds to be available in fiscal year 1981 for it, much less fiscal year 1980. Do we have fiscal year 1980 funds for addressing these kinds of needs, or any funds?

Dr. HARRISON. Yes, sir.

Let me back up.

There are no fiscal year 1980 or fiscal year 1981 funds to address those research requirements that you have listed on that page in front of you.

Mr. AMBRO. So you're saying that this is reaching a critical point and will be addressed in 1982. What assurance do we have that, in the first place, that's sufficient time, and, in the second place, it will be funded? Why not now?

Dr. HARRISON. Because of our lack of having, in my estimation, a firm foothold from which to launch ourselves into these items which you have on your list.

Now, we are devoting a fair amount of effort to the operational side of the house where we are transferring the technology from the Dredged Material Research Program. That's very important, and getting feedback from it, that's just as important. Monitoring selected long-term open-water habitat development sites, and also verifying the engineering procedures, and also doing work to assist our field

elements in the regulatory program—now, these are all very energetic efforts. They are not R. & D. efforts in the sense of attacking specific objectives, which are very valid, which you have in front of you. We feel that we will have this phase of the dredging and disposal questions, if you will, in hand by the end of fiscal year 1981. We feel it premature, and that it would be launching ourselves from a weak foundation, if we did it sooner.

General ROBINSON. Mr. Chairman, I would like to add that I don't want to get too concerned about the color of the money either. Sometimes when you say R. & D. you're talking R. & D. money, and sometime you're talking other types of money.

I would say that some of these programs that were just described by Dr. Harrison are very, very necessary bridges to get to the type of thing which is needed in the long-range effects program. The monitoring, for example, if you can just get past the next 10 or 15 years, the monitoring will give us some of the answers that we're looking for in terms of long-term effects.

Now, there's some basic research needed. There's no question about that. I think it's the basic research area that we're lacking in right now, but I defer to the R. & D. in terms of when you need to step off on that next step.

Mr. AMBRO. I think it would be interesting to develop this further, and maybe we'll ask our staff to generate a bit of correspondence with respect to it, to see those factors that you're looking at to bring you to the critical point and develop the bridges that would provide a better kind of base for these studies, because it seems to me that there is no point in arguing with the Corps if you suggest that fiscal year 1980 or fiscal year 1981 funds should not be available, but you'll have the base for all of this by 1982.

Do we have anywhere a budget book with all of the environmental R. & D. requests for things like that? Where is the budget book? You, Mr. Martin, look like a budget expert.

Mr. MARTIN. The staff was furnished the fiscal year 1980 program in detail and also the fiscal year 1981 budgetary material released yesterday, so the staff has that.

Dr. CHOROMOKOS. That's for R. & D.

Mr. AMBRO. My colleague from Pennsylvania has been waiting through this fascinating discussion most patiently.

Mr. WALKER. That's right, Mr. Chairman. Thank you.

If I'm correct, most of the projects that the Corps undertakes are preceded by an economic benefit analysis. Is that correct?

General ROBINSON. That is correct.

Mr. WALKER. How do you quantify the environmental concerns that you put into such an economic benefit analysis?

General ROBINSON. There is no quantification of the environmental benefits. As hard as everyone has tried, including all of the environmental agencies, they've never come up with a way to effectively measure the environmental value or devaluation of performing a certain operation. So economically it's not fed into the equation.

Mr. WALKER. The attempts, though, as you move on to preserve the environment, to take whatever steps are necessary environmentally, would certainly have a very significant economic effect in many instances, wouldn't it? That's not quantified in your economic benefit analysis?

General ROBINSON. No. There has not been a good way determined to do that. What we do is, after the project is formulated, if there appear to be certain steps that are either recommended or that we see as advantageous to the environment, and there's a cost associated with that action, whatever it might be, we really assume that the environmental benefit is equal to or greater than that cost. That may not be the case all the time, but we at least give it that value, so that we don't crank into the equation of the project cost a cost for the environment with no benefits.

Mr. WALKER. Doesn't that leave you in the position, though, of saying that you can have tremendous new costs over and above what you're saying in your economic benefit analysis? In other words, the economic benefit analysis, then, is based upon no evaluation of the environmental costs at all.

General ROBINSON. No. I'm sorry if I gave you that impression. That's not the case. I'm talking about a benefit which is, if you will, not directly project essential, let me put it that way. You have some environmental costs that are the result directly of the project and some things that you must do to hold that cost to the environment down. That's included in the project. But oftentimes we may have a method of greatly benefiting the environment at some cost, such as, for example, taking dredged material from a channel dredging project and creating wetlands adjacent to the project. We, I think rightly, assume that the benefit of creating those wetlands far exceeds the cost for so doing. So there are some side events which often occur as the result of our project analysis.

Mr. WALKER. What about the environmental effects of actually doing the dredging?

General ROBINSON. That cost, if there is a cost to mitigate that, that's a project cost which must be included in the project.

Mr. WALKER. But there is the assessment of the amount that's being spent on the dredging with regard to the adverse environmental impact that might take place as a result of the dredging?

General ROBINSON. That's included in the project document.

Mr. WALKER. That's included in the project cost?

General ROBINSON. Yes, sir.

Mr. WALKER. All right. That helps me understand it.

This subcommittee puts a great deal of time and effort and authorizes a good deal of money for Environmental Protection Agency R. & D.

How much do you utilize the R. & D. that they do?

Dr. ENGLER. Every day. We coordinate thoroughly with all of their labs. The committee that I cochair—staff from each EPA research laboratory are members of this committee. We jointly sponsor projects. Ourselves, in the Duluth lab, are publishing a sediment water sampling analytical manual. Our laboratory and Gulf Breeze are co-sponsoring bioassay development. Our laboratory and the Corvallis lab are sponsoring wetlands identification guidance.

So we stay, as well as we can, on top of their research efforts.

Dr. HARRISON. Conversely, they are presently funding us to about \$750,000 a year to help them with their landfill leachate work. That's funded by the EPA and is being performed by us.

Mr. WALKER. What's your impression of their R. & D.? Are you satisfied with the kind of material you get from them? Is it high qual-

ity material? Does it tend to be more short-term oriented than long-term oriented? Does it help you to plan projects ahead of time? What are your general impressions of it?

Dr. HARRISON. My general impression is good. Our research is by and large objective-oriented. It is not what you would term academic research, or basic research in the academic sense, if you will, and EPA, our colleagues in EPA, respond very well to this, at least in answering the questions that we ask of them that are in their areas, and I trust that we respond equally well to the questions that they ask of us that we have more capability to solve than they have. I've been very satisfied with it.

Dr. ENGLER. I think an example would be their clean lakes program, which we're not involved in at all, yet they require some dredging expertise, as well as environmental impact expertise, and we give the information readily to them at their request. So it's an exchange of expertise, and it's been very fruitful in our areas of concern.

Mr. WALKER. When you come up against a project, when you start in on a project that involves some rather extensive environmental concerns, do you usually find that they have a research background sufficient for you to get the data you need on whether or not to go ahead with such projects?

Dr. HARRISON. That all depends, Mr. Walker.

General ROBINSON. Are you talking about an R. & D. project or a Corps' construction project?

Mr. WALKER. I'm talking about a Corps' project, when you're actually down to getting money from Congress to go ahead.

General ROBINSON. Yes, sir. I would say that generally speaking, EPA has been very forthcoming on helping us to address some of the environmental concerns that we have with our projects. I must say, however, that when you get project-specific, it sometimes requires investigation of that specific problem, and that means you have to cooperate and do work together. EPA has been extremely good and cooperative, both in the technical and in the practical sense out in the field. I wish that our policy agreement was as close as our technical agreement.

Mr. WALKER. Where does your bad reputation as environmentalists come from then?

General ROBINSON. It comes from a long history of projects which were constructed prior to NEPA, prior to any concern, really, for the environment, except in the Corps, and I might say that our environmental concern far preceded the significant concern of the Federal Government in creating NEPA.

When you look back on it in hindsight and you look at concrete channels throughout Congressman Brown's area in Los Angeles and you wonder how we could possibly do that to the environment, you just have to realize that back in that time that was the solution.

Mr. WALKER. Are you required, for instance, to go to EPA for an EIS under the NEPA statute?

General ROBINSON. All of our EISs are reviewed by EPA and filed at EPA, all the EISs.

Mr. AMBRO. Would the gentleman yield?

Mr. WALKER. Yes; I'll be glad to yield.

Mr. AMBRO. Don't you make the judgment under all of this as to whether or not you need an EIS?

General ROBINSON. Yes, sir. The determination as to whether an EIS is needed is made by the District Engineer down in the district.

Mr. WALKER. The point I'm making—and it's a point that this subcommittee has gone over time and time again with EPA on their R. & D.—is that very often the regulations which get written for business and industry are not backed by adequate research, and what I was trying to get to was whether or not you run into the same problems, as far as your problem is the fact that you're asked to proceed with something without adequate research data to back up what's going on. Do I gather from you that you don't feel that is the case, that you have plenty of research data, and that any problems you run into are kind of your own making, whether they're past history or whether they're site-specific problems that you run into?

General ROBINSON. Most of the projects that will really cause us problems are site-specific problems that relate to a particular project, and none of the environmental agencies are hesitant to point out lacks in our project document if it doesn't properly address the effects on the environment.

Mr. WALKER. But the environmental groups that get up in arms about Corps' projects, they tend to be focusing primarily on localized concerns rather than on general data that could have been given to you through a more intensified research capability?

General ROBINSON. Yes, sir, and I would say that oftentimes it's objection to the project itself, as opposed to the effects that the project has on the environment.

Mr. WALKER. So what you're saying is that the environmental objections are often just following a general objection, and the case of this environmental thing is something to hang their hat on. Is that your general evaluation?

General ROBINSON. Yes, sir.

Mr. WALKER. How do you decide on your research priorities? You talked a few minutes ago about prioritizing in some of these areas.

Dr. HARRISON. We decide on it through what was mentioned by Mr. Martin.

Dr. CHOROMOKOS. I think Mr. Martin can answer this one.

Mr. MARTIN. We have the input from the field, which General Robinson mentioned, in terms of what they see as R. & D. needs. We have input from our laboratories in terms of what they see with their association with the field and with the problem. We have, then, the Office of Chief of Engineers' perspective and what he sees, generally in the longer range than what the field sees. Through the R. & D. office, the setting up the priorities, then, is done through input from all of these media, and we conduct annual program reviews, which will be held next month through April, in each of the programs. Through that, then, we sift out those items which are high in priority and those which are low, and, of course, we can fund within the budget limitations those higher priority ones, and have to, of course, not address those which are down on the bottom of the list.

Mr. WALKER. How much do you take into account what is the general scientific community's knowledge of environmental problems and environmental concerns?

Mr. MARTIN. All of that is factored in. The people in the chief's office, the people in the laboratories, the people in the field, and the R. & D. office are pretty well aware of what's going on in all the other areas.

We have constant communication, and we receive their research lists, what they're funding, and so forth, through the Smithsonian Science Information Exchange. With all these contacts we're aware pretty well of what they're doing, also in the academic community.

Mr. WALKER. Let me give you an example. For instance, we understand that you've undertaken studies on upland and riverine dredge spoil disposal, and yet the general consensus of the scientific community seems to be that the most ecologically dangerous disposal is marsh or estuarine disposal.

Why did you sink the money in the area that, under the general scientific consensus, seems to be the least problem?

Mr. MARTIN. That's getting pretty technical. I think I'd better defer to Dr. Harrison.

Dr. HARRISON. I think I can address that.

What you see is not always the case. We make a complete evaluation in the method that Mr. Martin describes. We do take into account what the state of the knowledge is in a particular area, and obviously this has to be taken into account.

In your particular example, Mr. Walker, we feel we addressed those facets because those are the facets that we will be using. You mentioned estuarine disposal. A particularly large amount of dredged material disposal from pipeline dredges into shallow, quiescent estuarine waters is probably the most dangerous environmental situation. We realize that, and tend to avoid that at all costs. That is absolutely the last alternative for doing something. If that is the last alternative for doing something—

Mr. WALKER. The last alternative in terms of something that you would undertake as a project for the Corps? Is that what you're saying?

Dr. HARRISON. That is correct.

Mr. WALKER. OK.

Dr. HARRISON. If we had a project that had to be carried out in that area we would not dispose—I can't say we would not ever—we would very, very seldom consider disposing in shallow, quiescent estuarine waters from a pipeline dredge. That is so long on our priority list of manners to perform projects that we do not feel it worth investigating.

Mr. WALKER. So, in fact, your research priorities are tied very, very specifically to those items where you think you might have projects in the future? I mean, in other words, you prioritize your research based upon what you think you're going to be doing?

Dr. HARRISON. Yes, sir, and quite often, to be honest, they're where we have problems today and yesterday.

Mr. WALKER. Most of your research, then, tends to be short-term rather than long-term because you couldn't evaluate over a very long haul what the priorities may be. So most of the research that you'd be doing independently would be of a rather short-term nature. Is that a fair assessment?

Dr. HARRISON. No, sir, I don't think it is completely. We perform the research to the duration of answering the question, whether it's a short-term question, whether the question is answered in a short time or a long time. We recognize that. For instance, the long-term effects of dredged material disposal—we know we haven't answered that question. We know that that's been a problem, though, for a long time, and it's a problem that we began to address in the early 1970s. We're still a long way from addressing that problem, but we're very project-related researchers, very applied.

Mr. WALKER. I guess what I'm getting at is that, in terms of evaluating your research based on environmental R. & D., we would not look upon you as providing much in the way of a base of knowledge on long-term environmental effects, simply because the chances are that you would not prioritize a long-term evaluation process very high in your budget analysis. It might well be that some of your short-term research produces the knowledge we can use over the long term, but more than likely you are not undertaking projects based upon that kind of an assumption.

Is that a fair evaluation?

Dr. HARRISON. Not entirely, sir.

That would not enter very strongly into our system of setting priorities for the research to be done. If long-term effects of dredged material disposal are important to us, and we know that they are, those will be up our priority ladder.

General ROBINSON. I would add, Mr. Walker, that the real crunch comes because we would look at that short-term need first, and would go from the short-term to the medium-range to the long-term.

I think you're quite right, in a sense, that we would certainly do the research—or in many cases it's not research, but it's technical assistance from these labs—that we would take some priority for a project that we have on the front burner right now over continuing on to do the longer-range work. We would do it. We would hope we would get to that longer-range work, but the everyday importance of doing our research to meet our current needs would probably take priority.

I might also add too—I guess it's more of a correction of the record—I said a minute ago that the opponents of our projects tend to use the environmental community as a way of getting at the project. I don't mean to say that in terms of all environmental concerns on our projects. We have many legitimate concerns expressed by the environmental community, which we attempt to address. I think that by the time that project has gone through all of its evaluations, we've addressed those concerns. We may not have satisfied all of the environmental community, but we've tried to balance out so that the environment doesn't suffer. Many times what's left over after that is just purely objection to the project.

Mr. WALKER. I'm going to end my questions here, but a general concern of this subcommittee has been also the kind of coordination of research to make certain we're not duplicating over and over again the kind of research that is being developed, that shouldn't be duplicated by somebody else; and from my personal standpoint I'm just trying to get some kind of idea as to where your research priorities lie so that it helps us in assessing them whether we ought to ask some other people, for instance, EPA R. & D., whom you obviously are dependent upon. Maybe we ought to be asking them to make certain that they are putting a lot of emphasis into long-term because that appears to be what you need from them most, in terms of any work that they have with you.

I'm just trying to get some overview of the situation, and I appreciate your comments.

Thank you very much, Mr. Chairman.

Mr. AMBRO. Thank you, Mr. Walker.

I think we've gone a long time and kept you here, and we appreciate that immensely.

I would ask, if I defer asking these questions now, if you would be kind enough to receive communications from the staff and respond in writing to the questions that we submit.

Dr. HARRISON. It will be our pleasure, sir.

[The questions and answers are in Appendix II.]

Mr. AMBRO. The last item I have—Mr. Calhoun, do you want to say something? You're the only one who sat there.

Mr. CALHOUN. I've been whispering enough in Dr. Harrison's ear today.

Mr. AMBRO. I noticed that, but maybe you'd like to get it on record at this time.

Mr. CALHOUN. Since you've mentioned it, you did mention upland disposal, why we looked at that. One case where we have looked at it, under 414, is with the States, who are now into the act, and we have some States that require upland disposal. So it's an alternative that back in the early 1970s we had to look at—we didn't know what we know today—in order to make judgments.

Mr. AMBRO. I appreciate that. Do you mean all those assessments, Dalai-Lamaisms, and those involved phrases that came out of Dr. Engler you whispered in his ear?

Mr. CALHOUN. We travel a lot together.

Mr. AMBRO. I'm going to have you sit next to me from now on.

Dr. CHOROMOKOS. I just want to say thank you very much for your patience. I hope we have answered the majority of your questions satisfactorily, and we will respond when we hear from your staffers on any question that you may have in the future.

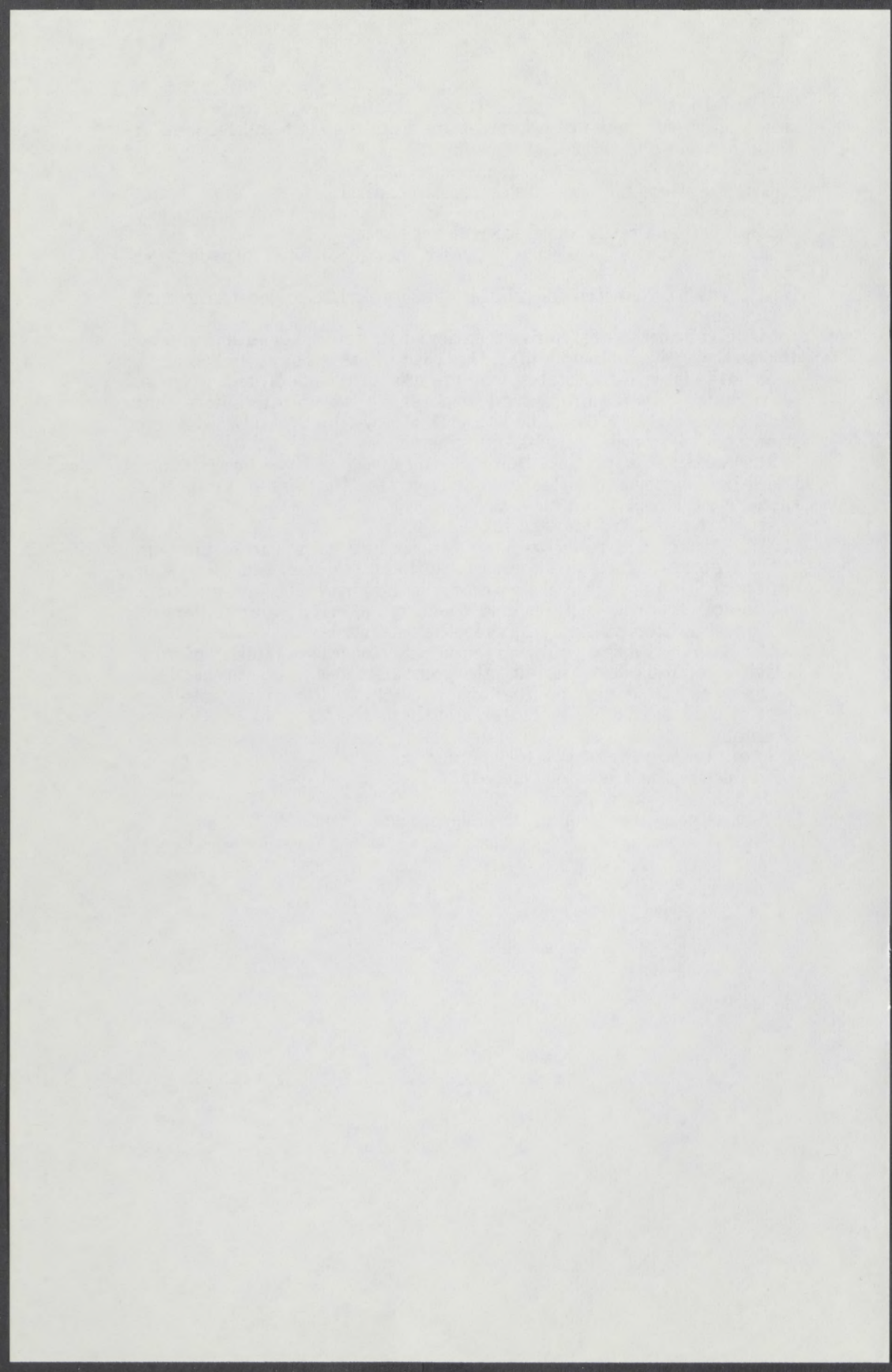
Mr. AMBRO. I'd say you've given us a better understanding of your activities and a better insight into your attitudes, and maybe these hearings, as Mr. Walker pointed out, will help us develop ways to help the Corps R. & D. office be better, and that's the target at which we're all aiming.

So once more, thank you for coming.

I'll declare these hearings closed.

Dr. CHOROMOKOS. Thank you.

[Whereupon, at 4:10 p.m., the hearing was concluded.]



APPENDIX I

"FUTURE RESEARCH NEEDS OF THE CORPS OF ENGINEERS' ENVIRONMENTAL RESEARCH PROGRAMS, AS DEFINED BY THE CORPS' OFFICE OF RESEARCH AND DEVELOPMENT"

	FY 1981 Funding \$000		Out Years**
	Anticipated	Additional*	
Wastewater Management	\$ 550	\$ 400	\$ 2,000
Environmental Impact	1,990	1,500	12,500
Fisheries Research and Protection	1,530		8,000
Recreation Research	705	300	5,000
Dredging and Dredged Material Disposal		3,000	24,700
Environmental and Water Quality Operational Studies	6,650	350	9,000
Aquatic Plant Control***	1,400	1,100	10,000

* These capabilities were developed considering the Civil Works Research and Development Program by itself. The amounts do not consider fiscal constraints, the Administration's assessment of appropriate national priorities for Federal investments, nor the impact of stated capabilities for other individual projects or studies on the Corps' overall capability.

** Out years' funding includes FY 82-86

*** Additional funding is subject to Congressional authorization of an increase in the existing annual appropriation ceiling of \$5,000,000 for the total Aquatic Plant Control Program.

**ADDITIONAL RESEARCH NEEDS
FISHERIES RESEARCH AND PROTECTION**

**MONITORING TECHNIQUES FOR FISH MOVEMENT
AND ABUNDANCE**

**SHORT- AND LONG-TERM RIVER FLOW AND
SPILL CRITERIA FOR MIGRANT SALMONIDS**

**JUVENILE FISH COLLECTION, PASSAGE, AND
TRANSPORT SYSTEMS**

**ADULT FISH COLLECTION, PASSAGE, AND
TRANSPORT SYSTEMS**

**TOOLS AND DETECTION DEVICES FOR
TRANSPORT SYSTEMS**

ADDITIONAL RESEARCH NEEDS
WASTEWATER MANAGEMENT PROGRAM

IDENTIFICATION AND DEVELOPMENT OF
ENGINEERING SOLUTIONS FOR CONTROL
OF NON-POINT POLLUTION ASSOCIATED
WITH CONSTRUCTION ACTIVITIES

DEVELOPMENT AND APPLICATION OF
INNOVATIVE TECHNOLOGY FOR
COLLECTION AND TREATMENT OF
WATER AND WASTEWATER AT PUBLIC
USE AREAS

APPLICATION OF WATER RESOURCE
ENGINEERING PROCEDURES TO
WASTEWATER MANAGEMENT
PLANNING

DEVELOPMENT OF COST ESTIMATING
PROCEDURES FOR MULTI-OBJECTIVE
WASTEWATER MANAGEMENT AREA-
WIDE PLANNING STUDIES

ADDITIONAL RESEARCH NEEDS
ENVIRONMENTAL IMPACT RESEARCH PROGRAM

PREDICTING FATE, TRANSPORT, AND EFFECTS
OF MAJOR CONTAMINANTS AND TOXIC
SUBSTANCES IN ESTUARINE ENVIRONMENTS

ENVIRONMENTAL EFFECTS ASSOCIATED WITH
WATER RESOURCE ACTIVITIES (MAJOR
EMPHASIS ON IMPACT OF ISOLATING
AND DRAINING WETLANDS)

ENVIRONMENTALLY COMPATIBLE ENGINEERING
AND MANAGEMENT STRATEGIES TO MINIMIZE
ADVERSE EFFECTS AND TO RESTORE, PROTECT,
AND MANAGE IMPORTANT NATURAL RESOURCES

ADDITIONAL RESEARCH NEEDS
RECREATION RESEARCH

VISITOR PERCEPTION AT CORPS
RECREATION AREAS

ECONOMIC EFFICIENCY CRITERIA IN
RECREATION DEVELOPMENT

NON-RESERVOIR USE PREDICTION AND
BENEFIT EVALUATION MODEL

LAKE RECREATION USE PREDICTION AND
BENEFIT EVALUATION MODEL

NOTE: PRESENT R&D DEALS WITH DESIGN, CONSTRUCTION, AND
OPERATION OF RECREATION AREAS. IT DOES NOT DEAL
WITH EFFECTS OF DREDGED MATERIAL DISPOSAL.

ADDITIONAL RESEARCH & DEVELOPMENT NEEDS DREDGING/DREDGED MATERIAL

SIGNIFICANCE OF BIOACCUMULATION

SENSITIVE SAMPLING/ANALYTICAL TECHNIQUES
FOR LOW-LEVEL TOXIC SUBSTANCES

TECHNIQUES FOR PREDICTING POLLUTION
POTENTIAL OF DIKED CONTAINMENT AREAS
AND FILL MATERIAL

IMPROVED TECHNIQUES FOR ESTIMATING MIXING
ZONES AND SEDIMENT TRANSPORT

ENVIRONMENTAL CHEMISTRY OF TOXIC SUBSTANCES

LONGER TERM MONITORING DMRP FIELD SITES
TO CONCLUSIVELY ESTABLISH EFFECTS

VERIFY AND REFINE DMRP ENGINEERING METHODS
WETLAND STUDIES

CONTAMINANT MOBILITY AND BIOMAGNIFICATION
FROM WETLAND AND TERRESTRIAL HABITATS

REGIONAL CUMULATIVE IMPACTS OF OPEN-WATER
DISPOSAL

AQUATIC HABITAT CREATION

TECHNIQUES FOR DREDGING HIGHLY CONTAMINATED
SEDIMENTS

**ADDITIONAL RESEARCH NEEDS
ENVIRONMENTAL AND WATER QUALITY OPERATIONAL STUDIES**

**TECHNIQUES TO MINIMIZE ADVERSE
ENVIRONMENTAL EFFECTS OF WATER-
BORNE PATHOGENS**

**EFFECTS OF RESERVOIR OPERATIONS
ON THEIR FISHERIES**

**METHODS OF AERATING/OXYGENATING
HYDROPOWER RELEASES**

**RESERVOIR DESTRATIFICATION
TECHNIQUES**

**DESIGN AND OPERATION OF WATERWAYS
TO ENHANCE ENVIRONMENTAL QUALITY**

**PREDICT FATE, TRANSPORT, AND EFFECTS
OF MAJOR CONTAMINANTS AND TOXIC
SUBSTANCES IN RESERVOIR AND RIVERINE
ENVIRONMENTS**

**INTENSIFIED, ACCELERATED TECHNOLOGY
TRANSFER**

ADDITIONAL RESEARCH NEEDS
AQUATIC PLANT CONTROL RESEARCH

FIELD STUDIES:

- CONTROLLED-RELEASE HERBICIDES
- PROBLEM-ASSESSMENT METHODOLOGY

DISTRIBUTION OF BIOLOGICAL AGENTS IN
OPERATIONAL AREAS

PLANT GROWTH AND SUCCESSION STUDIES

ISOLATION AND DEVELOPMENT OF NATURAL
GROWTH INHIBITORS

MECHANICAL CONTROL SYSTEMS

APPENDIX II

ANSWERS TO ADDITIONAL QUESTIONS FROM HOUSE SUBCOMMITTEE ON NATURAL RESOURCES
AND ENVIRONMENT, COMMITTEE ON SCIENCE AND TECHNOLOGY

1. Indicate the type of coordination which the Corps effects with other Federal agencies in the following areas:

- a. Coordination with EPA in Aquatic Weed Control programs.

Normal coordination is maintained through the process of obtaining Experimental Use Permits (EUP's) and registration of aquatic herbicides. Data and supportive information are provided to EPA for registration requests.

Close coordination is maintained between the Corps Aquatic Plant Control Research Program (APCRP) and related work of the EPA Gulf Breeze Laboratory which handles the aquatic plant work for EPA. EPA is provided a prominent position on annual APCRP meeting agenda to present EPA programs. Corps representatives participate in EPA workshops. The APCRP Manager is the Chairman of the Federal Working Group for Aquatic Plant Management of the Interagency Research Coordination Conference. The Interagency Research Coordination Conference is made up of the Corps, Water and Power Resources Service, Bonneville Power Administration, and Tennessee Valley Authority. EPA representatives have been offered a seat on the working group as an interested participant but have not yet named anyone. Recently it has been learned that EPA Headquarters' guidance to the field is that the Corps will not be funded by EPA to do any aquatic plant R&D. Therefore, we are increasing our efforts on coordination with EPA field elements through the Federal Working Group to avoid possible duplication.

b. Does the Corps plan to cooperate with NOAA's National Marine Pollution Program Office by providing that office with the Corps' five-year Plan for Ocean Pollution Research?

Yes, the Corps does plan to cooperate with NOAA on long-term research. The Corps is presently developing proposed R&D to be initiated in FY 1982 that will address disposal of dredged material in the ocean. NOAA will be furnished pertinent information on the program to avoid possible duplication of effort and to solicit input. The Corps has been actively involved with NOAA in the development of NOAA's comprehensive five-year plan for Federal ocean pollution research and development and monitoring programs as required by PL 95-273, "National Ocean Pollution Research and Development and Monitoring Planning Act."

2. Discuss research efforts by the Corps in the following areas:

a. Continuing research on feasibility and cost-reduction of alternative methods to open-water disposal of dredge spoil.

Limited verification and refinement studies of Dredged Material Research Program (DMRP) methodologies for planning, constructing, and managing confined disposal areas are ongoing under the Dredging Operations Technical Support (DOTS) program. Research and development needs in this area will be identified and considered for inclusion in the Corps future R&D program.

To date we have not found any alternatives that are less costly than open-water disposal. Our research efforts conducted thus far were initiated as a result of environmental restraints rather than from cost reduction reasons.

Research efforts conducted to date include:

(a) MITRE REPORT - Volume I of this report entitled "Disposal of Dredged Material Within New York District: Present Practices and Candidate Alternatives" was issued in May 1979. Volume II of the study entitled "Preliminary Evaluation of Upland Disposal" will be issued in March 1980.

Volume I categorized alternatives as being (1) not currently reasonable; (2) possible in special cases; and (3) feasible for large volumes of material. Three options were considered feasible for large volumes. These were "shallow" ocean disposal, disposal in subaqueous borrow pits, and confined upland disposal.

New York District is actively pursuing CAPPING at the present Mud dumpsite and at subaqueous borrow pits as immediate and short term solutions for disposal of material not meeting the Ocean Dumping criteria.

(b) Phase I feasibility study entitled "Dredged Material Disposal in New York Harbor (Howard Needles Tammen and Bergendoff) - This study focused on disposal in containment structures within New York Harbor. Special funding would be required to complete this study."

b. Research on methods of reducing siltation at its source so that less dredging is necessary.

The source of much siltation is the result of on-land erosion. Reducing this source is the mission of other Federal agencies, such as the Soil Conservation Service. Bank erosion is reduced by stabilizing channel banks. Therefore, the Corps R&D in bank stabilization and the Corps projects reduce siltation in the channel.

Although not directed to reducing siltation at its source, research is underway to reduce dredging. Work is presently underway to define the use of advance maintenance to reduce dredging frequency. Procedures have been developed for the estuarine environment. Work has been initiated this year to develop procedures for ocean entrances, and efforts are scheduled to be initiated in FY 1981 for riverine environments. Also, R&D is underway to develop design criteria for dikes and groins along streambanks to reduce sedimentation in navigation channels.

Numerical techniques are being developed to define the movement and deposition of material in the estuarine environment. Procedures developed to date are being applied to three specific areas, i.e., Columbia River, the Military Ocean Terminal at Sunny Point on the Cape Fear River, and in the lower portion of the Mississippi River. Improvements to the procedures are presently underway and are now scheduled to be finalized during FY 1982.

Research is also underway to evaluate present procedures to predict navigation channel shoaling. Included in this work is definition of the cause of shoaling, sediment movement and deposition techniques, and definition of areas requiring improvement.

c. Research on improving dredging technology. Specifically, what advances are being made in methods which would make upland disposal of dredge spoil more economical, such as greater dewatering of sediments?

A program to field test and evaluate dredging devices which advertise the capability of producing high-solids-content dredged material was initiated in 1978 with the assessment of an air-actuated dredge pump. The study of this device indicated that high-solids-content mixtures were produced but that energy consumption was extraordinarily high. This program is continuing with the study of various types of mechanical dredging systems. A survey of the literature and canvass of manufacturers and users indicate that high-solids-content dredged material, coupled with low-energy consumption may be possible with some types of mechanical systems. The program is designed to identify both equipment and techniques for performing dredging operations in economical and environmentally acceptable ways. The program was interrupted in FY 1980 for the specific study of agitation dredging techniques required by House Committee Report No. 90-243, but will be reestablished in FY 1981. Interim results will be made available to the technical community through established technology transfer channels.

d. Research on cost-benefit methodology used by the Corps in assessing proposed projects. For example, are you investigating how to incorporate possible long-term environmental impacts into the cost-benefit equation?

The Principles and Standards provide for inclusion of monetized cost and benefits in the National Economic Development benefit/cost ratio.

Furthermore, the recent procedures manual (Water Resources Council) broadened the net benefit rule and allows favorable project recommendations in cases where the monetary benefit/cost ratio is less than one, if non-monetized environmental quality benefits and costs are sufficient to justify the project.

Corps planning methodology R&D includes work on the economic benefits of water quality. Research is ongoing to develop better methods for habitat evaluation, including procedures to assess the impacts due to improved management of wildlife habitat on Corps lands.

3. The Great Lakes Confined Disposal Program for dredge spoils, authorized by the Rivers and Harbors Act of 1970, called for placing behind dikes any material dredged from the Great Lakes which EPA determined to be polluted. As of February 1977, GAO indicated that the program had cost \$263 million.

a. What sort of monitoring is being conducted by the Corps or by other agencies in evaluating the impact of this program on improved water quality in the Great Lakes?

EPA administers a program for monitoring water quality in each of the Great Lakes. The Corps monitoring program is limited to monitoring discharges from the confined disposal areas to assure compliance with local water quality standards.

b. Describe the interaction between the Corps and EPA in determining which sediments are to be confined, and ultimately, how long this confinement program will continue.

EPA either obtains or reviews all bottom sediment data. Periodic retesting is performed to ascertain if continued confinement of dredged materials is required. The Corps currently funds the cost of determining which sediments are to be confined and participates in these decisions.

c. What indications are there that the clean-up effort on the Great Lakes was worth this massive expense? On technical grounds, what was the basis for instituting this program in the Great Lakes, rather than in San Francisco Bay, Chesapeake Bay, or Long Island Sound?

It should be recognized that the resources invested in the confinement of dredged material are only a part of effort dedicated toward the clean-up of the Great Lakes. All industrial firms discharging wastewater or substances into waters of the United States are required to institute various processes and procedures to limit the discharge of harmful constituents under the National Pollution Discharge Elimination System (NPDES) of permits as administered by EPA. Private investment is measured in the billions of dollars. The EPA and local efforts at constructing and upgrading of sewage treatment facilities is also a multi-billion dollar program toward this end. Other programs to limit the runoff containing pollutants or nutrients from farms and construction sites as well as efforts to preserve natural wetlands must be considered in the context of steps to improve water quality. Also of note in this regard are the more recent efforts to control hazardous and toxic waste disposal in a manner that will prevent introduction into the Nation's waterways. The foundations for this total effort are national goals as espoused by the National Environmental Policy Act (NEPA), the Clean Water Act of 1977 and various other related acts and executive orders expressing the will of Congress and the President to improve water quality and the quality of life. Thus the program to confine dredged material is only one portion of a concerted national effort to improve water quality. The large cost

of confining polluted dredged material was well-recognized during the passage of Public Law 91-611. Construction costs were estimated at \$110 million (1969 dollars) at that time. The studies which led to the passage of Public Law 91-611 also attempted to evaluate the benefits from confining polluted dredged material in the traditional economic sense but found that "any benefits from halting open lake disposal are mainly intangible and not susceptible to objective evaluation." The rationale for this conclusion lies in the complexities in determining improvements attributable to this individual environment and in arriving at agreement as to the value in dollars of maintaining and improving elements of the environment. Indicators pointing to successes relative to the 611 programs include the resurgence of fishery in many portions of the Great Lakes and the apparent halting of further water quality degradation.

Concern over the pollution aspects of open lake disposal of dredged material prompted the Corps of Engineers to undertake a study of "Dredging and Water Quality Problems in the Great Lakes." This study was commenced in 1966 and completed in 1969. This study investigated the quality of dredged sediments, and disposal activities, construction and operation of diked areas, modification to dredge equipment and in dredging procedures, functional studies of the effects on lake ecology of open lake disposal, surveys of possible alternate disposal areas and on economic evaluation of benefits which might accrue from improved Great Lakes water quality as a result of cessation of open lake disposal of polluted dredging. Of significance in relation to the question asked is

the following finding - "The effects of dredgings disposal in open lakes disposal areas remains open to question. Any harmful effects on water quality could not be identified as resulting exclusively from dredgings disposal. In some cases, the lake area was found already so degraded that additional pollution from dredgings disposal could not be detected. However, bioassays showed that polluted sediments were toxic to small forms of animal life. The Board of Consultants concluded that 'In lake disposal of heavily polluted dredgings must be considered presumptively undesirable' pending further study."

Among several conclusions of this study were (1) further research is needed and (2) a ten-year program to deposit polluted dredgings in diked areas was desirable. Both of these recommendations were implemented in (1) the Dredged Materials Research Program and (2) Public Law 91-611.

4. Describe the findings of the EPA/COE Technical Committee on Criteria for Dredged and Fill Material with respect to:

NOTE ON COMMITTEE FUNCTION - The EPA/CE Committee is consultative in nature and has never been asked to study any specific regulatory case nor to design such studies for others to implement. Rather, the Committee has been asked to act as an advisor on an overall basis and draw on the cumulative knowledge and expertise of members rather than site-specific studies.

a. Suitability of dredged material from certain projects in the New York District (i.e., Refined Syrups) for ocean disposal. In other words, what is the Committee's current position on interpretation of bioaccumulation testing?

The position of the Committee on the interpretation of bioaccumulation results is stated in the EPA/CE Implementation Manual for Section 103 of Public Law 92-532, and is quoted as follows (para 32, pp G-14 and G-15):

"At present there are very little data for marine species upon which to base an evaluation of the meaning of a specific concentration of a particular contaminant in the species in question. The only such levels that are fixed from a regulatory viewpoint are those levels set by the Food and Drug Administration for fish and shellfish for human consumption. Therefore, this guidance recommends the environmentally protective approach of assuming that any statistically significant differences in tissue concentrations between control and exposed organisms are a potential cause for concern. It should be kept in mind, however, that at present tissue concentration of most constituents in most species cannot be quantitatively related to biological effects. Therefore, in making the final assessment of bioaccumulation, the District Engineer and the Regional Administrator must objectively consider the magnitude of bioaccumulation shown, the toxicological significance of the material(s) bioaccumulated (i.e., arsenic would be of greater concern than iron), the proportion of sediment sampling sites which produce uptake, the number of different constituents bioaccumulated from the sediment in question, the position in human and nonhuman food webs of the species showing uptake, the presence of mobile species at the site that might serve as transportation vectors removing bioaccumulated materials from the disposal area, and other factors relevant to the particular operation in question:"

This position has not changed since the manual was issued, nor do we expect it to change until extensive research is conducted in the area.

b. What recommendations will the Committee make to the Corps R&D Office concerning future research programs needed in the area of dredge spoil disposal? Does the Committee recommend funding levels for these programs?

The Committee points out perceived research needs on the basis of the knowledge and expertise of its members. The Committee makes broad recommendations but does not suggest which agency might appropriately conduct particular studies. The Committee does not suggest funding levels unless an agency should request such information for a particular research need. The research needs as seen by the Committee and the Committee's perception of the priority of those needs are identified on Pages 13 and 14 of the Activity Report (Attachment 11 provided the Subcommittee). Most of the priority research needs as perceived by the Committee are being at least partially addressed at present by one or the other of the agencies. Accelerated research recommended to commence in FY 1982 is largely based on Committee recommendations.

c. General Robinson has indicated that a small program is currently funded through the Corps' Operations Program to assess the effect of bioaccumulation of toxic materials. Please describe this effort.

The limited effort is two-fold. Part of the funding is directed toward continued evaluation of biological, physical and chemical conditions at two dump sites (and DMRP field sites) used several years ago for the disposal of material of contaminated dredged material. One of these sites is off Ashtabula, Ohio, in Lake Erie. The other is off the Duwamish Waterway in Puget Sound, Washington. The latter site received sediment contamination with relatively high levels of PCBs several years ago. Ongoing monitoring efforts will continue to evaluate long-term consequences of these two disposal

operations, including uptake of PCBs and heavy metals into tissues of organisms in the vicinity. The other phase of the effort is a laboratory study designed to evaluate the bioaccumulation of PCBs from both suspended and deposited highly contaminated sediments. Study organisms include shrimp, clams, and fish. Each species will be exposed to both deposited and suspended phases of the sediment for periods of one month or longer with periodic samples being taken until the ultimate tissue level can be determined. Animals will then be removed from the contaminated sediment and placed in clean water to determine rate of loss of the material from the tissues. This study will determine the maximum levels of PCBs and heavy metals reached in the tissues of these organisms as a result of exposure to highly contaminated sediment. The bioconcentration factor (the degree of increase in the tissues relative to the mediums) will be determined. Chemical evaluations of the sediments will also be conducted in an effort to determine whether it is possible to predict ultimate levels for bioconcentration factors by a chemical procedure.

5. Describe the EPA/Corps program for monitoring proposed ocean dumpsites. Address the following points:

NOTE ON QUESTION: There is presently no EPA/CE monitoring program for ocean dump sites. In the 11 Jan 77, Federal Register (Vol. 42, No. 7), paragraph 228.9 on pages 2483 and 2484 states "(a) The monitoring program, if deemed necessary by the Regional Administrator or the District Engineer, as appropriate, may include baseline or trend assessment surveys by EPA, NOAA, or other Federal Agencies or contractors, special studies by permittees, and the analysis and interpretation of data from remote or automatic sampling and/or sensing devices." This monitoring program, therefore, is initiated as deemed necessary by the Regional Administrator or the District Engineer. There is a joint EPA/CE program under the Marine Protection Research and Sanctuaries

Act to provide official designation (or phase-out) of the ocean disposal sites which currently have only interim designation. Therefore, the responses to the subparts of Question No. 5 will address that program.

a. Bioaccumulation studies at the dumpsites.

The EPA/CE Program for ocean disposal site designation is not carrying out bioaccumulation studies as such. Such studies are generally carried out under a laboratory setting or in the field with confined organisms. The site designation studies do, however, include the collection of organisms which are analyzed for pesticides, PCB's, heavy metals, etc. These analyses provide an estimate as to whether the levels of such substances are less than, equal to, or greater than the concentrations that one would normally expect to find.

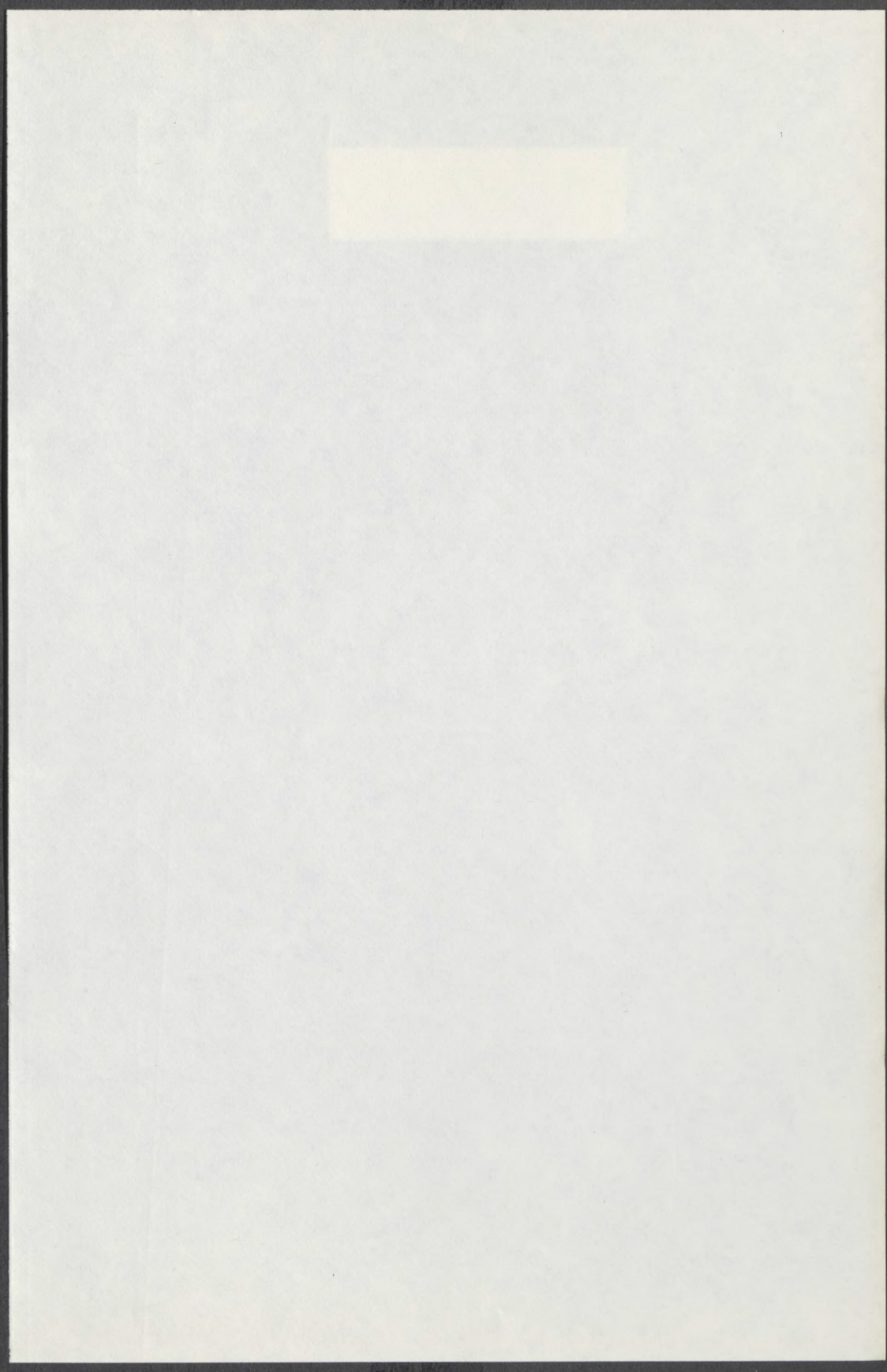
b. Total funds which the Corps has provided and will provide in the future to EPA for completion of these studies.

The Corps has provided \$6.2 million to the EPA for the completion of studies on ocean disposal sites which receive approximately 75 percent of ocean-disposed dredged material. This amount is expected to be increased in the near future to \$7.7 million for the inclusion of a number of sites in the New Orleans District (Mississippi River and distributaries) into the program. With the inclusion of the New Orleans sites, studies will be underway at sites accounting for approximately 90 percent of ocean-disposed dredged material.

c. Coordination with NOAA's Ocean Dumping (section 201) research.

How do the EPA/Corps program and the NOAA Program differ?

The NOAA program is a research program. The EPA/CE program is not carrying out research; it is obtaining information necessary to designate (or phase-out) interim designated ocean disposal sites. However, information developed by NOAA under Section 201 is available and has been used in the site designation project. Examples of this include the Marine Ecosystem Analysis (MESA) Program. MESA results, particularly those dealing with currents, have been of considerable use in site designation.





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