DREDGED MATERIAL RESEARCH PROGRAM

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FIRST STEPS TOWARD ACHIEVING DISPOSAL AREA REUSE

by

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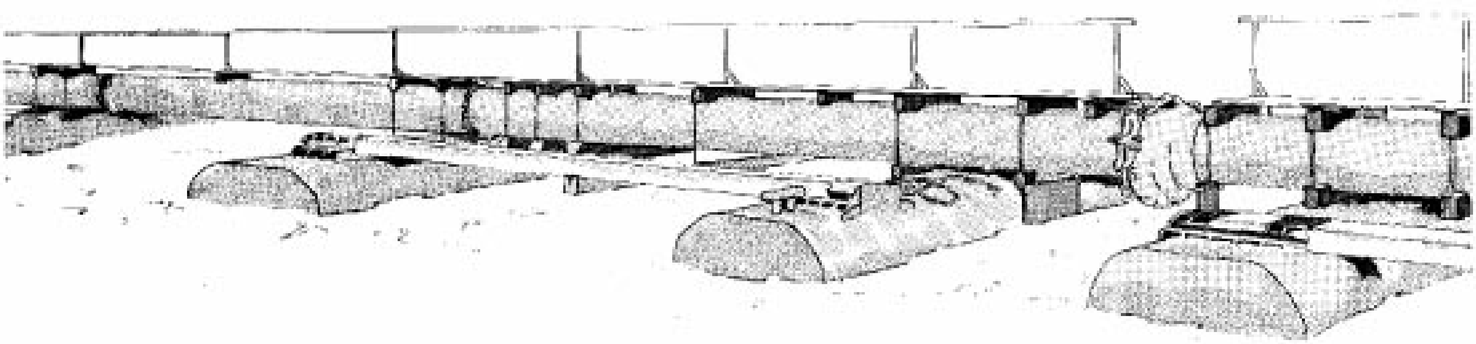
Final Report



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The objectives of research on disposal area reuse are simply to develop procedures for maintaining a dredged material disposal area for an indefinite period while providing environmentally acceptable disposal operations. The reusable dredged material disposal area is a collection and processing site where valuable portions of the dredged material are made available for productive use while unusable material is, if necessary, treated and disposed of. Methods and procedures must provide for continuous or periodic (Continued)

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removal of dredged material for use or storage elsewhere in order to increase the life expectancy of the facility. In the Mobile Bay Area, plans for expansion of disposal areas have been abandoned in some cases because of objections from local residents and environmental constraints. Thus, the need for maximizing the useful life of existing sites in this area is pressing. This paper presents results from a field study in the Mobile Bay Area outlining the first steps taken toward the development of a reusable disposal area. Plans and concepts are discussed regarding the long range planning required to maintain use of sites for indefinite periods. This paper does not present a panacea for dredged material disposal problems because it is not available now nor will it be in the future. Each reusable disposal area will have to be developed based on its own needs and local environment.

PREFACE

This paper was prepared for and presented in Mobile, Alabama, on 27 January 1976 at the American Society of Civil Engineers Specialty Conference on Dredging and Its Environmental Effects.

The work described herein was conducted under Task Areas 5A and 5C of the Dredged Material Research Program (DMRP), conducted for the Office, Chief of Engineers, at the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi. These task areas are part of the Disposal Operations Project (DOP), Mr. Charles C. Calhoun, Jr., Manager.

The paper was prepared by Mr. Raymond L. Montgomery, Chief, Design and Concept Development Branch, and Mr. Michael R. Palermo, Design and Concept Development Branch. The paper was presented by Mr. Palermo in Mobile.

The report was prepared under the general supervision of Dr. John Harrison, Chief, Environmental Effects Laboratory (EEL), and Mr. Andrew J. Green, Chief, Environmental Engineering Division, EEL.

Director of WES during the preparation and publication of the paper was COL G. H. Hilt, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	25.4	millimetres
acres	4046.856	square metres
pounds (mass)	0.4535924	kilograms
pounds (force) per square inch	6894.757	pascals

FIRST STEPS TOWARD ACHIEVING DISPOSAL AREA REUSE

By Raymond L. Montgomery,[1] M. ASCE, and
Michael R. Palermo,[2] A. M. ASCE

INTRODUCTION

Recent years have witnessed a growing concern over the land requirements for confined disposal of dredged material. During this time disposal of dredged material in confined areas on land has been used more frequently because of known, suspected, or alleged adverse environmental effects from disposal of dredged material in unconfined areas in open water. Because of the increase in land disposal, environmental restrictions, shortage of suitable land, and high land costs, it is doubtful that existing methods and procedures used for land disposal of dredged material are adequate to meet future requirements. Most Corps Districts are already hard pressed to meet the needs for adequate land disposal sites(1).

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Under existing land disposal practices, containment facilities are constructed and filled with dredged slurry. The surface of the dredged slurry dries and a crust forms. The underlying dredged material remains at water contents approaching or exceeding the liquid limit of the material for years after disposal operations. The water table generally remains at a perched level just below the surface and is intermittently recharged by rainfall.

Once the disposal area has been filled (in most cases, this occurs in a matter of a few years), a new site has to be located. In heavily dredged areas, suitable or available land is quickly used up and a number of abandoned disposal areas appear near the dredging areas. The dredgers are pressed for new disposal facilities while the marginal land of the abandoned disposal areas lies vacant. In addition to being a poor use of land resources, such practices result in inefficient use of the land made available for dredged material disposal. Inefficient use of containment storage capacity generally continues because nothing is done to lower the perched water table and dewater the dredged material. Consequently, a significant part of the potential storage volume in confined disposal areas is occupied by water.

Few significant improvements have been realized in the practice of confining dredged material on land since the initiation of this practice as a disposal alternative. It is time that a general strategy of disposal area reuse management be developed to promote effective practices in land disposal. In the interim it is imperative that reuse practices be developed through field demonstrations and adopted as standard practices.

This paper discusses a study effort devoted to the development of such practices. The study site is in the Mobile Bay area. In this area, existing containment facilities are almost filled to capacity and new sites for disposal facilities are not available. A study has been undertaken by the Waterways Experiment Station (WES) as a part of the Dredged Material Research Program (DMRP) and in cooperation with the Mobile District of the Corps of Engineers to plan and implement operations designed to increase the storage capacity of a confined disposal area near Mobile Bay. The preliminary results of the study and a general discussion on disposal area reuse management as a means for maximizing the useful life of existing disposal facilities are presented herein.

DISPOSAL AREA REUSE MANAGEMENT

The objectives of research on disposal area reuse are simply to develop procedures for maintaining disposal areas convenient to dredging operations for an indefinite period while ensuring that disposal operations remain environmentally acceptable and operational. Acquisition of suitable land for confined disposal of dredged material has become increasingly difficult because of rising land costs and public objection to land use for this purpose. Research under the DMRP in disposal area reuse addresses these problems and promotes better management of confined disposal areas so that maximum benefits can be derived by all concerns. The basic philosophy is that past land disposal practices have not been satisfactory in terms of conservation of available land areas and new procedures must be developed. Past practices have not been satisfactory mainly because they have required large quantities of valuable land solely for the purpose of waste disposal.

Under the disposal area reuse management concept, the disposal area would be a collection and processing site where valuable portions of the dredged material would be made available for productive use while unusable material would be, if necessary, treated and disposed of. Methods and procedures would provide for continuous or periodic removal of dredged material for use or storage elsewhere in order to increase the life expectancy of the facility.

The advantages of a site that can be reused indefinitely are as follows: (a) permanent sites could be provided convenient to maintenance dredging areas; (b) the expense and objections to providing new lands for disposal sites are eliminated; (c) construction and landfill materials are made available for productive use; and (d) a reasonable alternative is provided for solving land disposal problems and reducing the excessive use of valuable lands.

From these listed advantages it is obvious that the reusable disposal facility has definite advantages over the present conventional land disposal methods. However, this approach to land disposal of dredged material is not a panacea for all land disposal problems. Potentially there are wide areas of application, but there will be areas where disposal area reuse concepts will not be feasible. In all cases, however, better management of land disposal areas would likely result in more environmentally compatible disposal operations(2).

The major factors of a reusable facility include dredged material separation (solids and liquid), treatment to control contaminants, and removal of the solids from the site. Fig. 1 shows a functional diagram for a reusable disposal area facility. Such a facility requires careful planning and designing.

The reusable disposal area is essentially a transfer station where dredged material is collected, dewatered, separated, treated to control contaminants, and either used for productive purposes or transferred to a final disposal area. Table 1 presents the planning and design considerations required to develop a reusable disposal facility and the contributing research from DMRP research tasks. As shown in this table, the development of disposal area reuse management concepts depends heavily upon input from a number of research tasks of the DMRP.

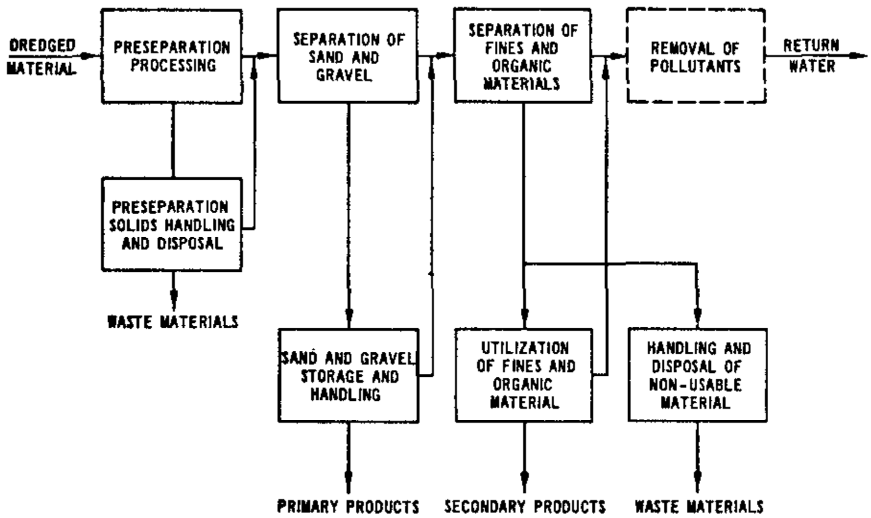


Fig. 1.--Functional Diagram for Disposal Area Reuse

TABLE 1.--Planning and Design Considerations of Reusable Disposal Facilities

Planning and design consideration	Functions	Research input
A. Site selection	a. Develop selection criteria	Tasks 3B, 5C, 2D and 1E
B. Site design and construction	a. Facility design (1) Existing disposal area (2) New disposal area b. Site rejuvenation (existing site) c. Facility construction	Tasks 5A, 6B, 2C, 5C, 2D and 1E
C. Site operation and management	a. Develop operation guidelines b. Develop management guidelines c. Control objectionable environmental conditions	Tasks 2C and 5C
D. Dewatering and classification	a. Recover sand and gravel b. Dewater fine-grained material c. Beneficiation of useful materials	Tasks 5A and 5C
E. Solids treatment	a. Treatment for pollution control	Tasks 6B and 1E
F. Liquid treatment	a. Treatment for pollutant control and effluent turbidity reduction	Tasks 6B, 2D and 1E
G. Resource storage and utilization	a. Develop storage procedures b. Procedures for transportating materials to storage sites c. Identify and promote productive uses of resource materials	Tasks 3B, 4C, 5C and 5D
H. Waste disposal	a. Develop land disposal procedures b. Develop open water disposal procedures for treated wastes	Tasks 1A, 3A, 1B, 3B, 1C, 4C, 1D and 5D

The objective of the DMRP is to provide, through research, definitive information on the environmental impact of dredging and dredged material disposal operations and to develop technically satisfactory, environmentally compatible, and economically feasible dredging and disposal alternatives, including consideration of dredged material as a manageable resource(3). The technical structure of the DMRP is shown in Table 2. A systems approach is taken to develop the reuse management concept where all the input data are considered and the functions of the disposal area are considered as integrated and coordinated activities rather than individual and independent functions. The final objectives of the disposal area reuse research are to provide procedures for selecting and designing reusable dredged material disposal sites and to provide guidance for overall disposal area reuse management.

All planning and design considerations shown in Table 1 should be considered in the development of reusable sites. However, implementation of all of them at each reusable site is unlikely. A reusable site is considered to be any site where planning and operations are carried out to extend the life of the site. It is expected that initial application of disposal area reuse management concepts will be applied to existing disposal areas to extend the useful life of the area.

Site reuse in its simplest form involves dewatering dredged material in containment areas by promoting the natural draining

Table 2.--Dredged Material Research Program Technical Structure

Project/Task		Objective
Environmental Impacts and Criteria Development Project		
1A	Aquatic Disposal Field Investigations	Determine the magnitude and extent of effects of disposal sites on organisms and the quality of surrounding water, and the rate, diversity, and extent such sites are recolonized by benthic flora and fauna.
1B	Movements of Dredged Material	Develop techniques for determining the spatial and temporal distribution of dredged material discharged into various hydrologic regimes.
1C	Effects of Dredging and Disposal on Water Quality	Determine on a regional basis the short- and long-term effects on water quality due to dredging and discharging bottom sediment containing pollutants.
1D	Effects of Dredging and Disposal on Aquatic Organisms	Determine on a regional basis the direct and indirect effects on aquatic organisms due to dredging and disposal operations.
1E	Pollution Status of Dredged Material	Develop techniques for determining the pollutional properties of various dredged material types on a regional basis.
2D	Confined Disposal Area Effluent and Leachate Control	To characterize the effluent and leachate from confined disposal facilities, determine the magnitude and extent of contamination of surrounding areas, and evaluate methods of control.
Habitat Development Project		
2A	Effects of Marsh and Terrestrial Disposal	Identification, evaluation, and monitoring of specific short-term and more general long-term effects of confined and unconfined disposal of dredged material on uplands, marsh, and wetland habitats.
4A	Marsh Development	Development, testing, and evaluation of the environmental, economic, and engineering feasibility of using dredged material as a substrate for marsh development.
4B	Terrestrial Habitat Development	Development and application of habitat management methodologies to upland disposal areas for purposes of planned habitat creation, reclamation, and mitigation.
4E	Aquatic Habitat Development	Evaluation and testing of the environmental, economic, and engineering feasibility of using dredged material as a substrate for aquatic habitat development.
4F	Island Habitat Development	Investigation, evaluation, and testing of methodologies for habitat creation and management on dredged material islands.
Disposal Operations Project		
2C	Containment Area Operations	Development of new or improved methods for the operation and management of confined disposal areas and associated facilities.
5A	Dredged Material Densification	Development and testing of promising techniques for dewatering or densifying dredged material using mechanical, biological, and/or chemical techniques prior to, during, and after placement in containment areas.
5C	Disposal Area Reuse	Investigation of dredged material improvement and rehandling procedures aimed at permitting the removal of material from containment areas for landfill or other uses elsewhere.
6B	Treatment of Contaminated Dredged Material	Evaluation of physical, chemical, and/or biological methods for the removal and recycling of dredged material constituents.
6C	Turbidity Prediction and Control	Investigation of the problem of turbidity and development of a predictive capability as well as physical and chemical control methods for employment in both dredging and disposal operations.
Productive Uses Project		
3B	Upland Disposal Concepts Development	Evaluation of new disposal possibilities such as using abandoned pits and mines and investigation of systems involving long-distance transport to large inland disposal facilities.
4C	Land Improvement Concepts	Evaluation of the use of dredged material for the development, enhancement, or restoration of land for agriculture and other uses.
4D	Products Development	Investigation of technical and economic aspects of the manufacture of marketable products.
5D	Disposal Area Land-Use Concepts	Assessment of the technical and economic aspects of the development of disposal areas as landfill sites and the development of recreation-oriented and other public or private land-use concepts.

NOTE: This technical structure reflects the second major program reevaluation made after the second full year of research accomplishment and is effective as of August 1975.

and drying processes. The following paragraphs present data resulting from dewatering and densification efforts in an active field study. The study is being performed under research task 5A of the DMRP and disposal area reuse management plans are being developed under research task 5C.

MOBILE FIELD STUDY

Background

Intense opposition to expansion of disposal areas onto adjacent marshland has caused the Mobile District to rely solely on existing sites for continued maintenance of navigation in the lower Mobile River. A joint field study effort between the WES and the Mobile District is seeking to extend the useful life of an existing confined disposal area located on Blakeley Island adjacent to Polecat Bay (Fig. 2).

This disposal area encompasses a total area of about 85 acres and is approximately three-fourths filled, and there are no new sites available in the vicinity. This disposal area was chosen as a field study site for evaluation of dredged material densification and disposal area reuse concepts.

Objective

The major objective of the study is to evaluate under field conditions the overall feasibility of ditching as a technique for dewatering and densifying dredged material. The performance and effectiveness of ditching equipment, quantity and efficiency of

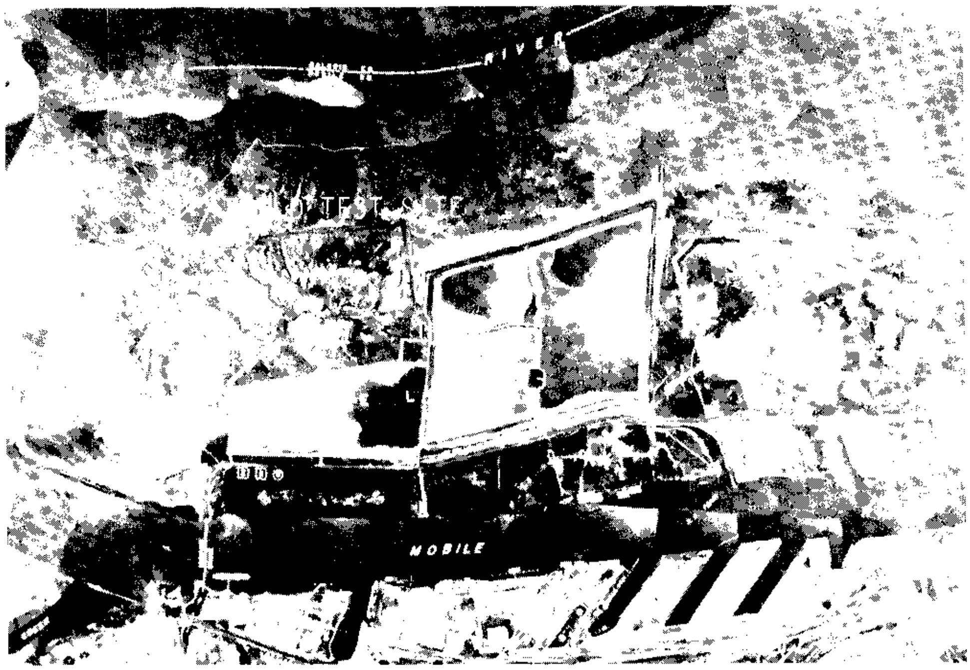


Fig. 2.--Aerial View of Blakeley Island Field Test Site, Mobile, Alabama

water removal through ditching, and densification effects gained through drainage and consolidation will be parts of the evaluation. The related subjects of treatment to control contaminants and removal of the solids from the site are objectives of companion studies.

Study Approach

The field study program was designed to develop optimum methods for densification of dredged material through open ditches and to ultimately develop a disposal area reuse management plan to further extend the useful life of the site. A system of open ditches was specified to allow drainage of the area, which will thicken the dried crust and induce consolidation and shrinkage of the dredged material, thereby restoring site capacity. Ditching of the site is being accomplished using both conventional and experimental equipment.

Field Investigations

Field investigations at the site were performed by the Mobile District, Corps of Engineers, and consisted of site surveys, dredged material borings, and installation of instrumentation. A general site plan of the ditching patterns and locations of borings and observation wells is shown in Fig. 3.

Surveys made prior to and during the ditching efforts will be used to determine the volumetric changes that result from dredged material densification.

A total of 26 borings were made at the site to obtain dredged material samples for laboratory testing. The site conditions did not allow use of conventional boring equipment; therefore, the samples were obtained by hand-pushing a three-inch ID vacuum sampler. Maximum depth attained was 12.5 ft. A total of 102 undisturbed samples of dredged material were obtained. All material was classified in the field as highly plastic clay (CH), although numerous samples contained sandy and silty lenses, organic material, and vegetation. The dredged material generally exhibited consistent appearance and composition below the dried crust, resembling a very heavy axle grease. Observation wells were installed in 24 boreholes to monitor fluctuations in the groundwater table because of the ditching efforts. Data from the wells have been obtained periodically since the initiation of the study.

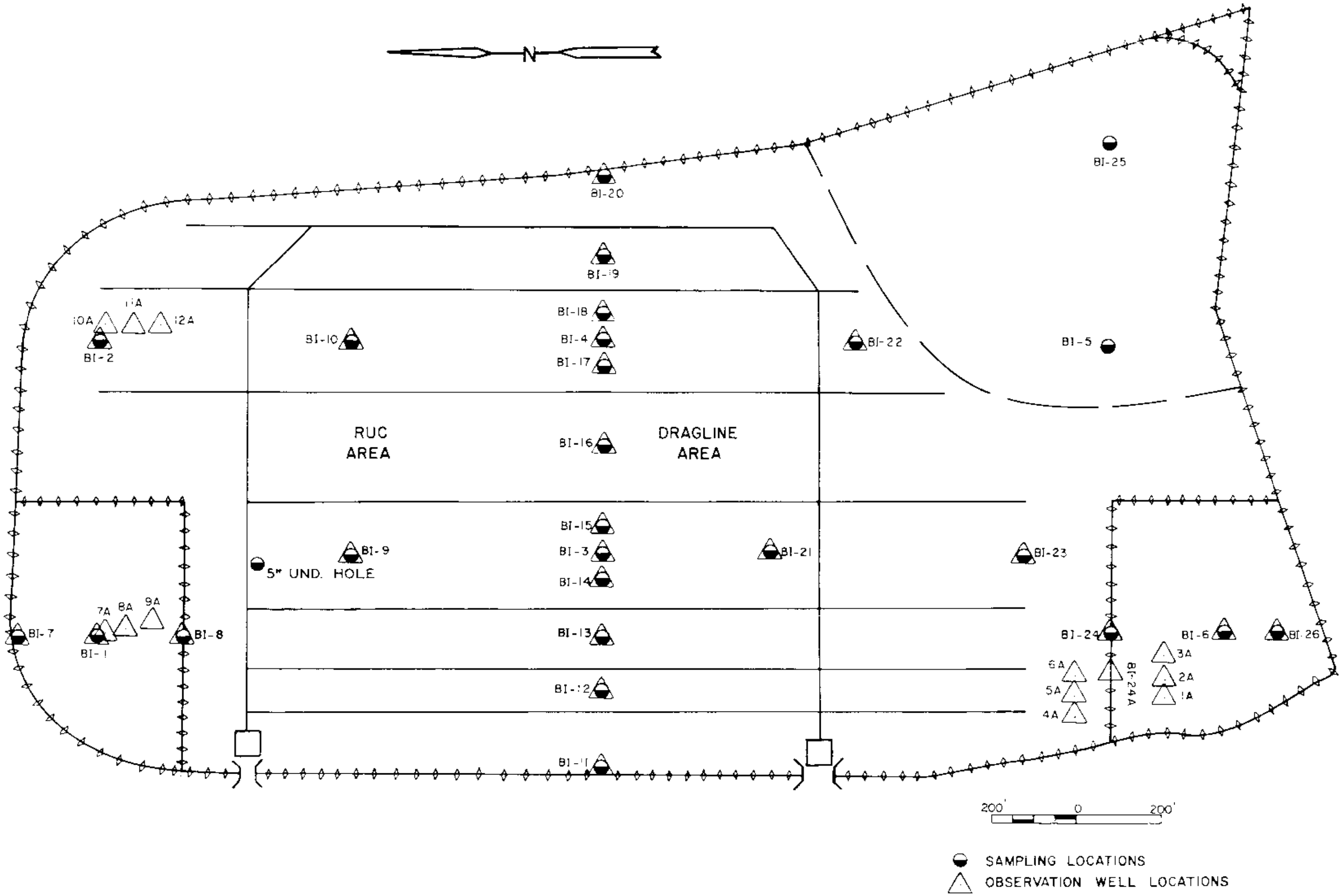


Fig. 3.--General Site Plan, Blakeley Island Field Test Site

Laboratory Testing

Laboratory testing of the undisturbed dredged material samples was performed by the WES Soils and Pavements Laboratory. The testing program included classifications under the Unified Soil Classification System, water content determinations, grain-size analysis, Atterberg limits, density determinations, specific gravity, and consolidation tests. The objective of the testing program was to obtain data for prediction of the behavior of the dredged material during and after drainage as a result of both shrinkage and consolidation effects. A preliminary summary of test results is presented in Table 3.

The dredged material samples proved difficult to work with,

Table 3.--Preliminary Laboratory Test Results

Boring (1)	Sample (2)	Depth, ft (3)	Unified Soil Classification (4)	Water Content in Percent (5)	Atterberg Limits in Percent LL (6)	PL (7)	Initial Void Ratio (8)	Compression Index (9)
B-13	1	2.5	CH	119	150	33	3.27	1.14
B-13	2	5.0	CH	129	99	35	3.45	1.15
B-13	3	7.5	CH	100	86	36	2.82	0.96
B-13	4	10.0	CH	88	89	33	2.58	0.79
B-14	1	2.5	CH	133	105	35	3.64	1.26
B-14	2	5.0	CH	117	77	31	3.14	1.01
B-14	3	7.5	CH	76	79	30	2.10	1.45
B-18	2	2.5	CH	115	98	32	3.20	1.03
B-19	2	2.5	CH	133	76	26	3.71	1.10
B-116	2	2.5	CH	138	93	33	3.87	1.24
B-119	2	2.5	CH	100	78	27	2.78	0.95
B-124	2	2.5	CH	91	78	29	2.57	0.95

and special provisions were necessary for both sample preparation and testing. In addition to conventional soils testing procedures, the procedure used by the Texas Department of Highways for shrinkage limit determinations was modified to obtain data relating drainage of the dredged material and crust drying to potential volumetric savings. Preliminary study indicated that volumetric shrinkage in newly formed crust material contributes significantly to the overall densification of dredged material within a disposal area. A typical relationship is shown in Fig. 4. Additional laboratory soils testing will be restricted to consolidation testing of foundation material samples and minerology analyses of dredged material samples.

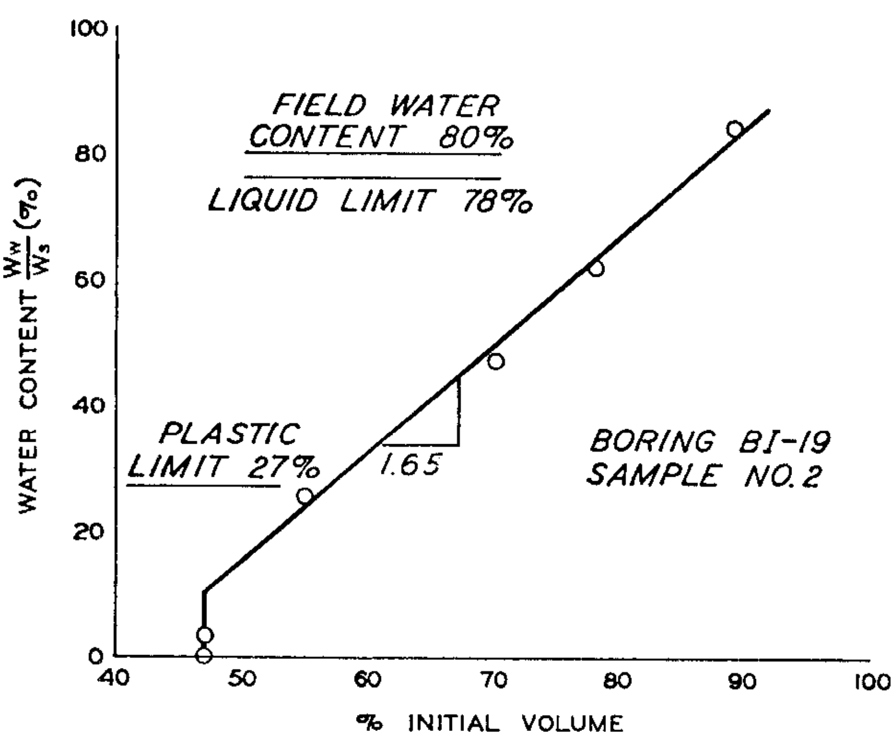


Fig. 4.--Typical Water Content and Percent Volume Relationship for Dredged Material

Laboratory tests are also being conducted to determine the water quality of effluent from the drainage ditches.

Also, tests on the dried material are being performed to determine any potential contamination from leaching effects.

Instrumentation

Open-riser observation wells were installed at 24 of the 26 borehole locations as shown in Fig. 3. The wells are monitored periodically to determine changes in the groundwater table elevation with time and will give information regarding flow characteristics of groundwater through the dredged material into the ditches. Five-ft lengths of slotted plastic pipe with eight-ft lengths of plastic pipe riser were used to fabricate the wells, and the well points were wrapped in filter cloth before placement. The Mobile District installed 12 additional observation wells to monitor groundwater table changes. Other instrumentation at the site consists of a meteorological station used to establish rainfall, wind, and other data for the field study site.

Ditching Operations

The character of the material encountered within the site varied considerably. Localized topography, thickness of crust, location of the groundwater table, and presence of vegetative cover all contributed to the overall performance of ditching equipment.

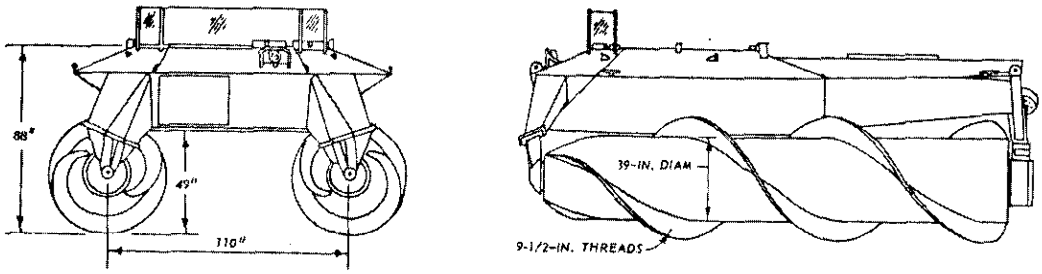
During previous disposal operations, dredge-pipe outlets were located at the southeast corner of the disposal area. This resulted in the site topography generally grading from higher to lower elevation toward the north. Also, a high sandy area was created in the southeast corner of the disposal area. Generally coarser materials are encountered in the south portion of the site consisting of lenses of silts, sands, and wood chips mixed with the fine-grained material. The northern portion of the site consists entirely of fine-grained material. Initial crust thicknesses varied from 1.5 ft in the south portions to zero thickness in the north end. These factors were considered when the ditching efforts were underway, and efforts were made to adapt the operation to specific conditions encountered.

Ditches were generally constructed in the predetermined patterns shown in Fig. 3 with flow channelled to the two existing weirs at the site. The weir inverts are at higher elevations than the ditches; therefore, sumps were constructed at both weirs and accumulated water is pumped over the weir inverts periodically.

Unconventional Equipment

An experimental amphibious vehicle, the Riverine Utility Craft (RUC) was used to ditch the thinly crusted area. The general specifications and data for this vehicle are summarized in Fig. 5. Propulsion of the vehicle is accomplished by rotation of the helical screws, which results in ditch formation in soft material(4). A typical RUC ditching operation is shown in Fig. 6.

This concept for ditching and drainage has been successfully



RIVERINE UTILITY CRAFT

EMPTY WT (INCLUDING DRIVER & FUEL)	11,000 LB
GROSS WT (DRIVER, FUEL & PAYLOAD)	13,000 LB
LENGTH, FT (OVERALL)	246/12 = 20.5
WIDTH, FT (OVERALL)	168/12 = 14
HEIGHT, FT (OVERALL) (LESS WINDSHIELD)	92/12 = 7.67
ROTOR SPACING, CENTER TO CENTER, IN.	110
ROTOR DIAMETER (DRUM ONLY) IN.	39
ROTOR DIAMETER (OVER HELIX) IN.	58
ROTOR LENGTH (OVERALL) IN.	222
ROTOR LENGTH (IN CONTACT WITH GROUND, NO RUT) IN.	195
GROUND CLEARANCE, IN.	49
FLOATING DEPTH (EMPTY) IN. (WATER)	21.5
FLOATING DEPTH (LOADED) IN. (WATER)	24.0

Fig. 5.--General Specifications for Riverine Utility Craft (RUC)

Fig. 6.--Typical Ditching Operation Using RUC

employed in Holland for land reclamation using dredged material. The Dutch employ a vehicle similar to the RUC called an Amphirol, which is used in the initial drainage phases in polder "ripening" operations(5,6).

Two phases of ditching operations with the RUC have been completed. The first phase involved ditching over both thinly crusted and thickly crusted areas in the eastern half of the disposal area. RUC performance on thin crust was good, with ditch formation 6 to 12 in. deep. In thickly crusted areas, ditches 12 to 18 in. deep were formed, but operation caused great mechanical strain on the vehicle because the RUC transmission was originally designed for high-speed, low-resistance operation. Typical appearances of RUC ditches in the two crust conditions are shown in Fig. 7 and Fig. 8. Based on initial performance, RUC operations were restricted to only thinly crusted areas during the second ditching phase. This included reditching over initial ruts after crust had been allowed to reform, resulting in deeper ditches.

Efficiency of ditches formed by the RUC vary considerably with material consistency. Very wet material (water content in excess of 200 percent) tends to flow back into and fill the ditches after the vehicle has passed. Under these conditions, subsequent passes of the vehicle do not help and reformation of crust is necessary before ditch deepening can be accomplished. In stiffer material (water content approximately 100 percent), repetitive

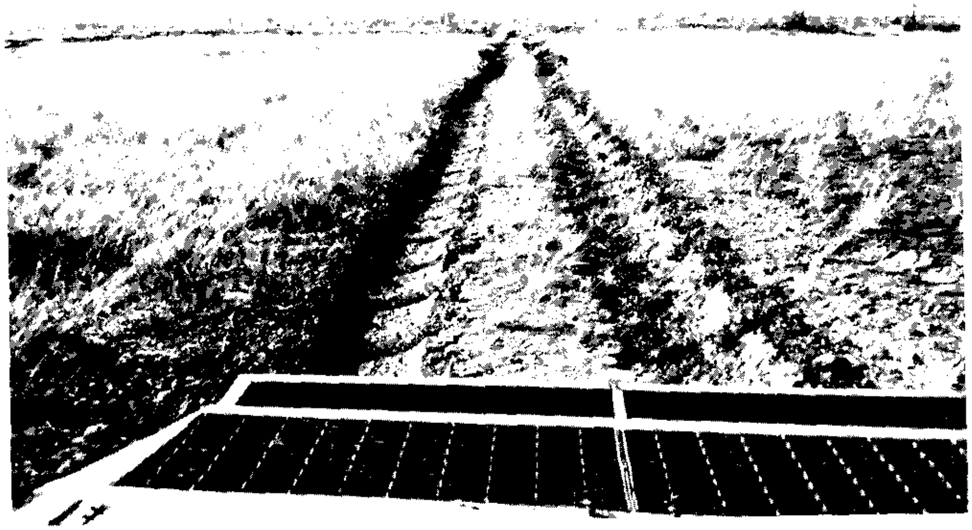


Fig. 7.--Appearance of RUC Ditch in Thinly Crusted Area

Fig. 8.--Appearance of RUC Ditch in a Thickly Crusted Area

passes of the RUC tend to deepen and widen the ditches.

The RUC was effective in controlling surface ponding and promoting the initial phases of surface drying and crust development. Flow of water into the ditches is evident and drainage from the area is in progress. However, since RUC ditches are generally formed at constant depths following the topography of the disposal area, grading of ditch bottoms with the RUC is impossible. This restricts flow in RUC ditches when naturally occurring high and low areas are present. Also, in all but very wet material, bottom grooves or depressions are formed by the screw helix and tend to trap water.

Conventional Ditching

Ditching capabilities of conventional equipment are also being evaluated as part of the field study. Conventional equipment has been successfully used by the Philadelphia District, Corps of Engineers, to ditch in disposal areas for the purpose of improving material for dike heightening(7). Early efforts to procure floatation-type equipment for the Blakeley Island study were unsuccessful; therefore, initial ditching efforts for conventional equipment were made using a large track-mounted backhoe on matting. Specifications called for matting to exert ground pressures not to exceed one psi. This equipment completed sump construction adjacent to the north weir, but broke through the thin crust when efforts were made to ditch toward the west half of the disposal area. The operation was unsuccessful due to the inability of the matting to support loads while the equipment was operating.

A floatation dragline shown in Fig. 9 was later procured and used to complete the ditching pattern in the thicker-crusted south half of the disposal area. The dragline was mounted on twin pontoons and propelled by a continuous chain-driven track system that allows the equipment to swim in open water and track on soft material. Ditches constructed with the dragline varied from three to six feet deep with approximately 1V-on-3H side slopes. Slopes are fairly stable with minor sloughing in some areas. Grading of the dragline ditches to the constructed sumps was possible and groundwater flow into the ditches is evident. Appearance of the ditches is shown in Fig. 10 and Fig. 11.

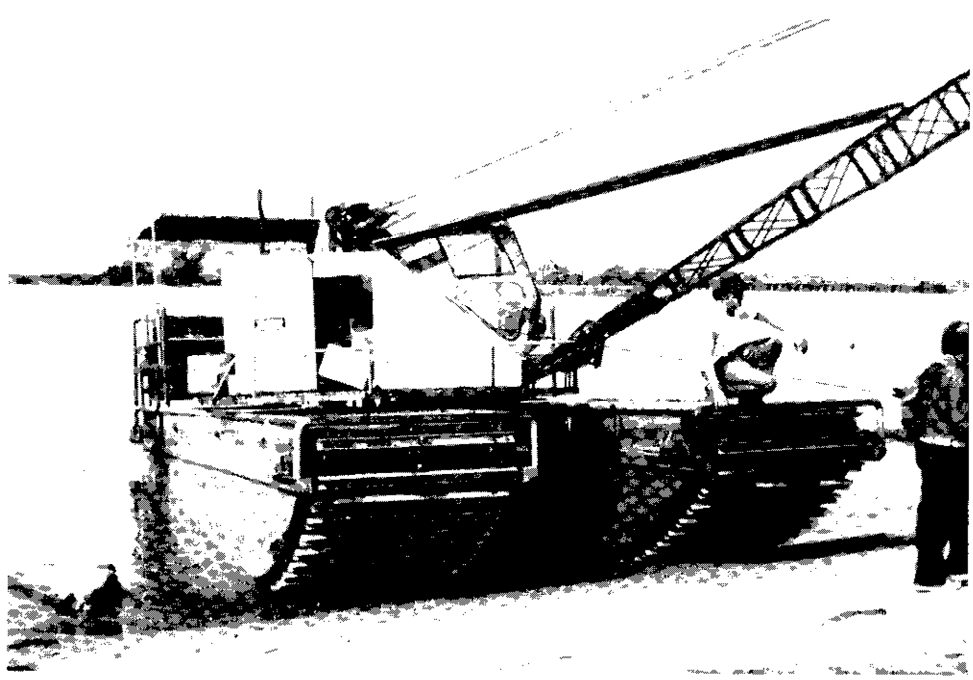


Fig. 9.--Floatation Dragline Used for Ditching in Disposal Area

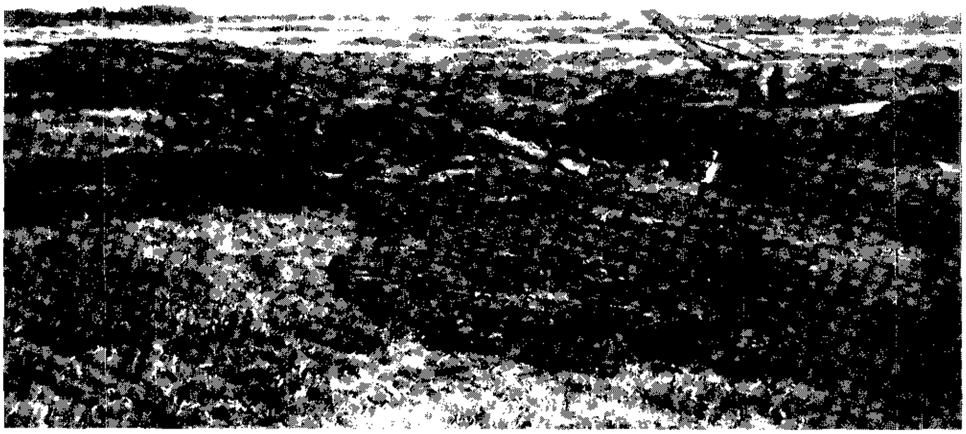


Fig. 10.--Ditching Operation with Floatation-Type Dragline

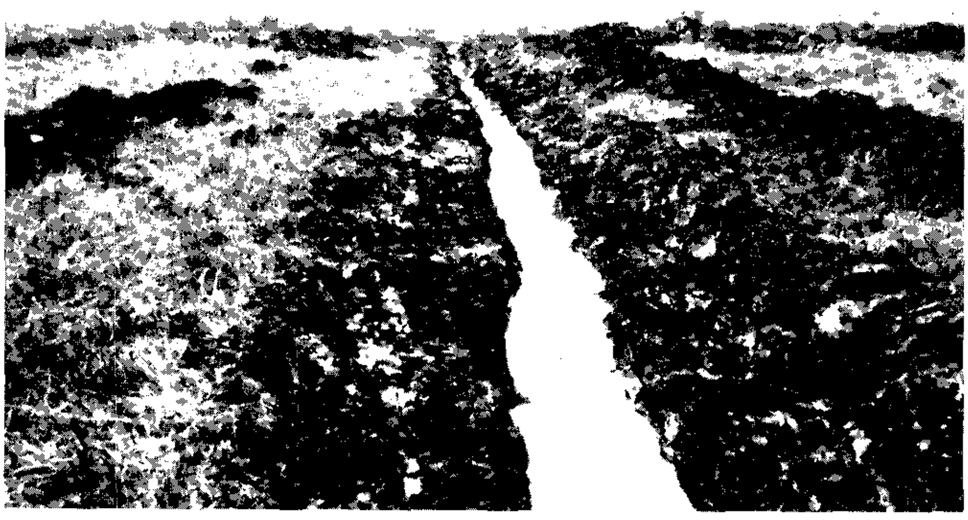


Fig. 11.--Appearance of Dragline-Constructed Ditch

Attempts were also made to ditch with the floatation dragline in the thinly crusted areas. However, when the tracking system broke through the thin crust into the viscous dredged material, conditions were reached where both the swimming and tracking mode of propulsion were ineffective. With crust thicknesses of 12 in. or more, enough traction is attainable for effective tracking.

Continued Ditching

Preliminary data indicate that the groundwater table has been lowered due to the ditching efforts, especially in the southern half of the disposal area where dragline-constructed ditches were completed. These ditches should require no further work at this time to allow effective drainage of the area.

Ditches in the northern half of the disposal area have not been fully developed and efficient drainage has not been realized to date. These ditches require deepening before effective drainage will occur. The scope of RUC ditching has, therefore, been expanded to include use of implements that were either specially designed or were adapted from available items. The implements include large ballasted wheels and agricultural discs and rippers for easier ditching in thicker crusted areas. Use of the implements will add flexibility to RUC ditching operations within disposal areas. Mechanical modifications have also been made to the RUC to allow implement use and to increase power and reliability.

Ditches in the northern portion of the disposal area are now being deepened by successive operations with the RUC, allowing reformation of crust between operations. Grading and further deepening will be accomplished using the RUC with implements.

Further extension of the ditching efforts will include evaluation of other experimental equipment for ditch deepening. This effort will be made in conjunction with possible removal of dried material to stockpiles and reditching to foundation levels.

Disposal Area Reuse Management

The ditching and drainage of the Upper Polecat Bay site will restore considerable volume but will not permanently solve the problem of limited disposal area capacity. Plans are underway to examine feasibility of developing the drainage efforts at the site into a workable disposal area reuse management plan. The plan will address the possibility of further extending the useful life of the disposal area through rehandling or removing the dried material, allowing reuse of the disposal area over longer time periods. Removal of dried material in the thickened crust from the area will allow reditching, perhaps down to the foundation level. In this way, maximum benefits from consolidation and shrinkage would be gained and additional storage space would be created by removal of dried material. The sandy dredged material is being considered for use in a local landfill project.

The site-specific technical feasibility of disposal area reuse management at the Blakeley Island area will be initially evaluated. Factors to be considered include methods of rehandling, removing, and transporting material; availability of equipment; and site conditions required for efficient operation. Methods for removal and transportation of material to be examined will include conventional earth-moving equipment, conveyor systems, cable-bucket systems, and other existing experimental equipment. Economic analyses will then be made on technically feasible schemes and results formulated in terms of conventional benefit/cost ratios. The decision for full-scale implementation of the disposal area reuse plan will ultimately rest with the Mobile District.

CONCLUSIONS AND RECOMMENDATIONS

Completed research at the Mobile field site has determined that drainage of disposal areas and restoration of site capacity is technically feasible. The specific results gained to date include the following:

1. Operation of selected equipment on a confined disposal area is feasible for removal of surface water and ditching.
2. Limitations for effective operation of various types of equipment have been determined including conventional types of equipment on mats, floatation-type equipment, and experimental equipment such as the RUC.

3. Valuable information has been gained on the engineering characteristics of fine-grained dredged material as related to potential benefits from drainage, consolidation, and shrinkage. Additional experience has been gained on sampling techniques and testing procedures for slurry materials.

4. The RUC is an effective tool for control of surface water and promoting the initial phases of surface drying and crust development.

5. RUC ditching on thinly crusted areas overlying very soft material is effective, although use of additional implements may be required for grading and deepening.

6. Conventionally constructed ditches can be successfully excavated in disposal areas where crusting has progressed to one ft or more.

7. Preliminary results indicate that the groundwater table has been lowered by ditching the site and that the densification process is underway.

Additional study at the site will allow an overall evaluation of ditching as a technique for dewatering and densifying dredged material. Design guidelines and equipment-selection criteria relying on technical evaluation of site conditions will be formulated. The final results of the study should enable Corps Districts to consider seriously dredged material dewatering/densification and disposal area reuse management as a viable means of conserving disposal area resources.

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1. Disposal areas. 2. Dredged material. 3. Dredged material disposal. 4. Mobile Bay Area. I. Palermo, Michael R., joint author. II. U. S. Army. Corps of Engineers. (Series: U. S. Waterways Experiment Station, Vicksburg, Miss. Miscellaneous paper D-76-16)
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