



# DREDGED MATERIAL RESEARCH PROGRAM



TECHNICAL REPORT D-78-41

## PREDICTION OF VOLUMETRIC REQUIREMENTS FOR DREDGED MATERIAL CONTAINMENT AREAS

by

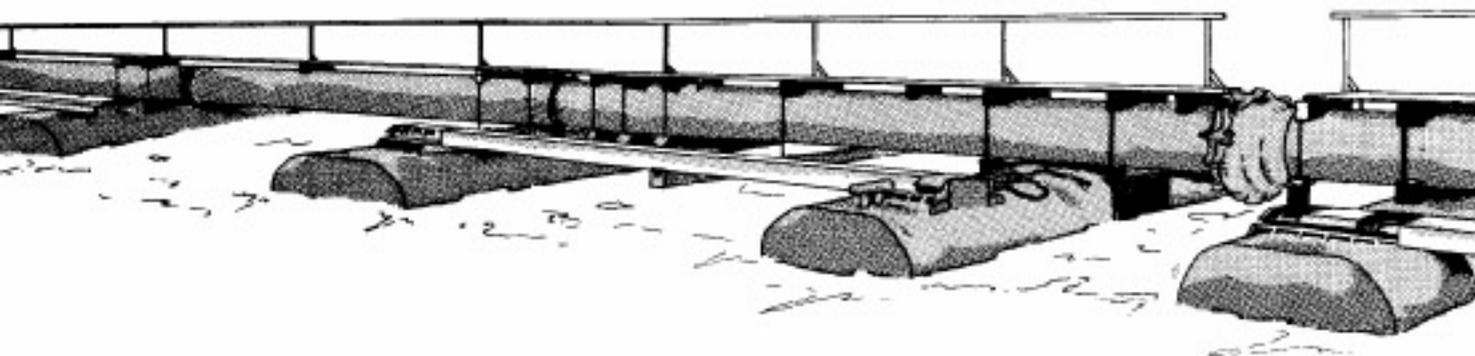
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Final Report

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Monitored by Environmental Laboratory  
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IN REPLY REFER TO: WESEV

15 September 1978

SUBJECT: Transmittal of Technical Report D-78-41

TO: All Report Recipients

1. The report transmitted herewith represents the results of a study conducted as part of Task 5A (Dredged Material Densification) of the Corps of Engineers' Dredged Material Research Program (DMRP). This task was part of the Disposal Operations Project of the DMRP and was concerned with developing and/or testing promising techniques for dewatering or densifying (i.e., reduce the volume of) dredged material using physical, biological, and/or chemical techniques prior to, during, and/or after placement in containment areas.
2. The rapidly escalating requirements for land for the confinement of dredged material, often in urbanized areas where land values are high, dictated that significant priority within the DMRP be given to research aimed at extending the useful life of existing or proposed containment areas. While increased life expectancy can be achieved to some extent by improved site design and operation and to a greater extent by removing dredged material for use elsewhere, the approach considered under Task 5A was to densify the in-place dredged material. Densification of the material would not only increase site capacity but also would result in an area more attractive for various subsequent uses because of improved engineering properties of the materials.
3. Several methodologies for densifying dredged material were developed within Task 5A. However, in order to determine the effectiveness of these methodologies, the volume occupied by the material when no densification technique is applied must first be known. From that point, a method must be provided for estimating the degree of densification expected from the various techniques. To this end this study was undertaken at the Environmental Laboratory of the Waterways Experiment Station.
4. The study required a three-phase approach. The first phase included evaluation of previous work and formulation of a new prediction methodology based on modified consolidation theory and standard weight/volume relationships used in geotechnical engineering. The second phase consisted of developing a prediction methodology. In the final phase, the volume increase predicted by the proposed methodology was correlated with the rate of volume increase measured under field conditions. A computer program (SIZE) based on the prediction methodology was developed during the final phase of the study.

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5. Results obtained from a comprehensive testing program established at the Upper Polecat Bay Disposal Site in the U. S. Army Engineer District, Mobile, provided in part the necessary data to verify the methodology. Additional verification was accomplished by a laboratory testing program that consisted of the development of and collection of data from a column sedimentation-consolidation procedure and correlation of results obtained from standard remolded and undisturbed consolidation testing.

6. This study concluded that results obtained in the laboratory from the column consolidation-sedimentation tests can be used to predict the sedimentation characteristics of dredged material after disposal. The modified one-dimensional consolidation theory presented in this study, when combined with the results of the laboratory column consolidation-sedimentation test, can be used to predict the short-term consolidation characteristics of dredged material. In addition, remolded samples are adequate to be used in the further consolidation testing required by the recommended prediction procedures. The computer program developed in the study provides an effective means for predicting the minimum volume required and the gain in potential storage volume with time.

7. The study reported herein is one of several studies conducted to develop a methodology for sizing containment areas. The recommendations presented in this report should be considered interim guidelines. The final guidelines will be based on some recommendations from this study and the approaches taken in other related studies. The final guidelines will be published in DMRP synthesis reports on Task 5A and on Task 2C (Containment Area Operations).



JOHN L. CANNON  
Colonel, Corps of Engineers  
Commander and Director



## 20. ABSTRACT (Continued).

consisted of correlating the volume increase predicted by the proposed methodology with the rate of volume increase measured under field conditions. Also included in the final phase was the creation of a computer program based on the prediction methodology developed during the study.

The computer program was developed for the purpose of evaluating the effect of various input variables on the gain in available storage volume. Since the program was designed for applicability over a large range of conditions, the results obtained from the computer program are site-specific.

Results obtained from a comprehensive testing program established at the 34.4-ha Upper Polecat Bay disposal site of the U. S. Army Engineer District, Mobile, provided in part the necessary data to verify the methodology. The remaining verification was provided by a testing program created during this study. The additional verification consisted of the development of a laboratory column sedimentation-consolidation procedure in addition to the correlation of results obtained from remolded and undisturbed consolidation testing.

The objective of this study was accomplished by evaluating the interrelationship of the various variables and their effect on the change in potential storage volume with time. Conclusions based on the results of tests conducted and information collected during this study may be summarized as follows:

- a. The results obtained from a laboratory column sedimentation test, based on the theories of hindered sedimentation, can be used to predict the sedimentation characteristics of dredged material after disposal.
- b. The modified one-dimensional consolidation theory presented in this study, when combined with the results from a laboratory column consolidation test, can be used to predict the short-term consolidation characteristics of dredged material.
- c. Remolded samples can be adequately used in a standard consolidation test to predict the long-term consolidation characteristics of dredged material.
- d. The rate and magnitude of the following can be determined as desiccation occurs: (1) the decrease in the elevation of the water table within the disposal site, (2) the decrease in volume occupied by the dredged material above the water table, and (3) the increase in effective stress applied to the underlying strata.
- e. The computer program developed provides an effective means of predicting the minimum volume required and the gain in potential storage volume with time. The computer program also provides an effective method of evaluating the relative benefits to be gained from various design options available.

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