Technical Report HL-96-17
September 1996

US Army Corps of Engineers
Waterways Experiment Station

Equipment for Contaminated Sediment Dredging

by Trimbak M. Parchure

Prepared for Headquarters, U.S. Army Corps of Engineers

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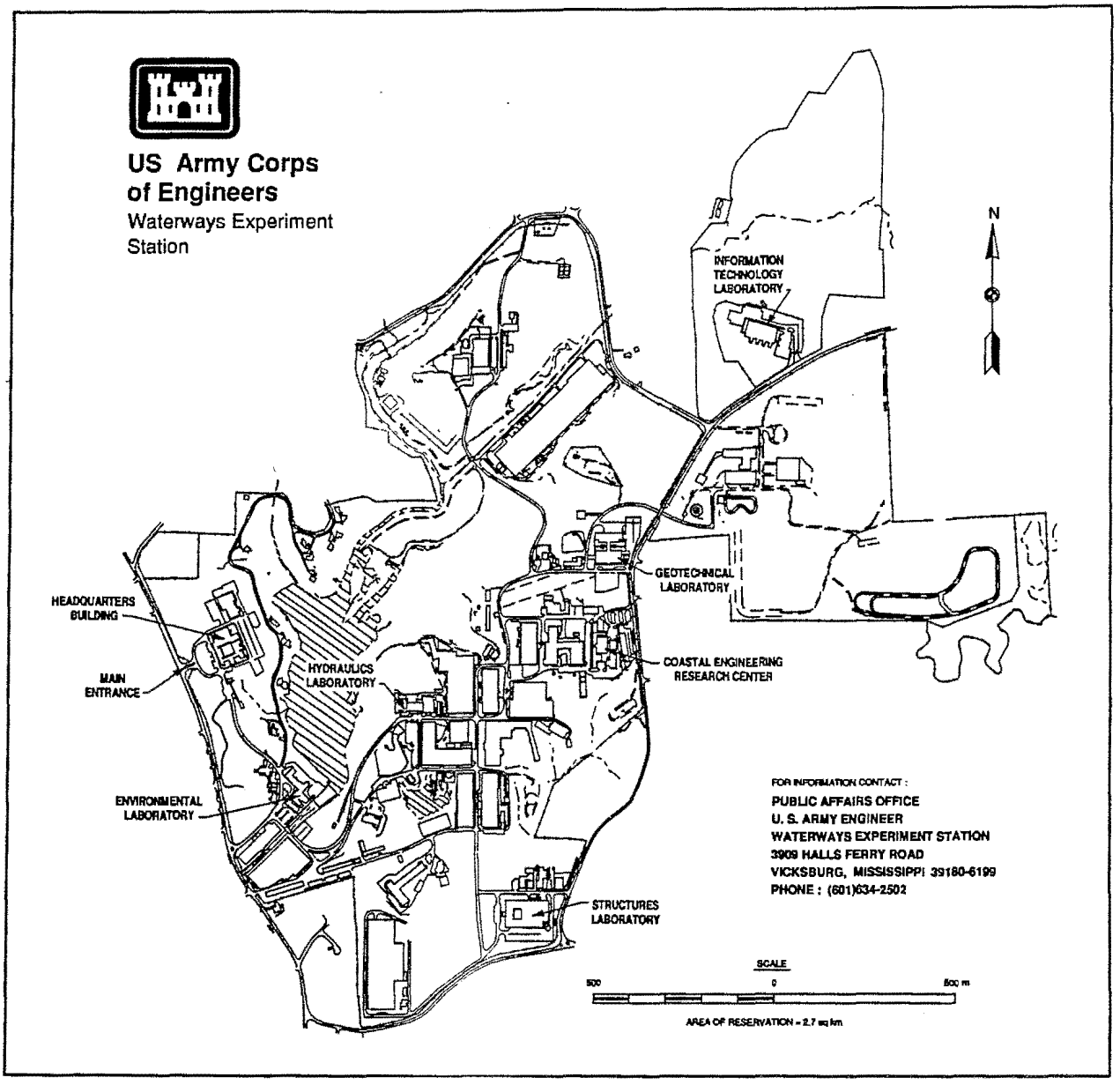
U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Final report

Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000



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Contents

Preface

This survey was conducted by personnel of the Hydraulics Laboratory of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, in 1993. Funding for this project was received through the Dredging Operations Technical Support (DOTS) program.

The study was conducted by Dr. Trimbak M. Parchure, Waterways and Estuaries Division, Hydraulics Laboratory, under the general supervision of Messrs. William H. McAnally, Jr., Chief, Waterways and Estuaries Division; Robert F. Athow, Acting Assistant Director, Hydraulics Laboratory; and Richard A. Sager, Acting Director, Hydraulics Laboratory. Messrs. McAnally and William D. Martin, Chief, Hydro-Sciences Division, Hydraulics Laboratory, provided encouragement and guidance during the course of the project. Advice received from Dr. Robert M. Engler and Mr. Thomas R. Patin of Environmental Laboratory, WES, is gratefully acknowledged.

Cooperation offered by the various vendors of dredging equipment in the United States is greatly appreciated.

During the preparation and publication of this report, Dr. Robert W. Whalin was Technical Director of WES. Commander was COL Bruce K. Howard, EN.

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
cubic yards	0.7645549	cubic meters
feet	0.3048	meters
inches	25.4	millimeters
pounds (mass)	0.4535924	kilograms

1 Introduction

Under the research program entitled Improvement of Operations and Maintenance Techniques (IOMT), a survey of portable hydraulic dredges was undertaken at the Hydraulics Laboratory of Waterways Experiment Station, Vicksburg, MS. Technical Report HL-83-4 (Clark 1983) was published on this study in March 1983. Under the program Dredging Operations Technical Support (DOTS), the guidance provided in the earlier Technical Report was updated and expanded in order to address the aspect of contaminated sediment dredging. Information was compiled on dredging equipment, dredging procedures and monitoring techniques for dredging contaminated sediments.

The objective of the present report is not to select, recommend or promote any particular equipment currently available in the U. S. market, but to simply compile and present the information obtained through an extensive market survey in order to make it easier for the prospective users to select the equipment suitable for the job at hand. The report explains the problem associated with contaminated sediment dredging and presents the findings of the market survey. The scope of this project includes considerations of monitoring during dredging operations involving removal of contaminated sediments, however, there were no opportunities to participate in any field operation; hence, this component of the study is not covered under the present report.

An inseparable part of dredging operation consists of disposal of dredged material without or with treatment. The type of dredging equipment selected at any site would also depend, among other factors, on the method of treatment, if any, and disposal of the dredged material. Innovative technologies are being developed for treatment and placement of contaminated sediments. This aspect, however, is outside the scope of the present study and the report essentially deals with the aspect of only the removal of contaminated sediment from shallow water areas.

2 Background

Contaminated sediments are likely to be found predominantly in inland water bodies such as rivers, estuaries, lakes, ponds and man-made reservoirs which receive organic and / or inorganic nutrients and pollutants from the human habitats in the vicinity. The contaminants may be in the form of heavy metal derivatives, complex organic compounds, bacteria and micro-organisms or radio-active substances which may have reached the water body through agricultural practices, sewage outfalls, industrial effluents, surface runoff, or ground water seepage. Occurrence of contaminated sediment in water is a relatively recent phenomenon subsequent to the industrial revolution. Rapid industrialization and urbanization occurred during the past century on the banks of major water bodies which were exploited for various human needs. In the absence of regulations on the quality of industrial or sewage effluent, these discharges were released indiscriminately into the same or adjacent water bodies with partial or no treatment. Hence the deposits of contaminated sediments are mostly confined to the uppermost, relatively thin layer at the sediment-water interface. Contaminated sediment dredging essentially consists of removing this thin muddy layer from the bed surface. The depth of accumulation of such contaminated sediments varies from a few centimeters to several meters. Dredging of the bottom sediments may be necessary either for initial cutting, deepening or maintenance of navigational channels and harbors, or it may be necessary for removing contaminated sediments with an objective of reducing health hazards to the nearby communities.

3 The Problem

Most natural water bodies have sediment beds consisting of a relatively wide range of particle sizes such as, for example, a mixture of clays and sand, i. e. a mixture of very fine, cohesive sediments and coarse, non-cohesive sediments. Due to the electro-chemical properties and availability of extremely large surface area of fine sediments particles, the pollutants are mostly found to be adsorbed to that component of sediments which consists of fine sediments, namely, clays and fine silt. Coarse sediments such as sand and gravel are mostly free from any contaminants and hence they do not pose significant problems in their removal and disposal.

Three major problems are associated with dredging the fine sediments that are contaminated. The first is related to the physical properties. The fine sediments are cohesive and they form aggregates while settling through the water column. The aggregates collapse on the bed and the self-weight consolidation results in sediment layers which have a high bulk shear strength. It is quite difficult to remove such sediment economically in large quantities by using suction dredging techniques alone. Devices such as cutters, augers, clam shell and water jets are needed for loosening and dislodging the stiff material from the bed which can then be removed from the site by other means. The second problem concerns the ease with which the fine sediment can be resuspended. Although the bulk shear strength of consolidated cohesive sediments is high, the uppermost unconsolidated or partially consolidated layer has a very low shear strength and can be eroded very easily with any low-energy disturbance. Erosion of a few-millimeter-thick top layer increases the suspension concentration of the upper water column by several milligrams per liter. The fine material in its dispersed state gets distributed over the vertical due to turbulence and the dispersed sediment may remain in suspension in the water column for a long period of time. Even a weak ambient current may transport suspended fine sediment over great distances to other areas far away from the dredging site. This phenomenon, therefore, can have profound environmental consequences in rivers and estuaries with flowing water. On the other hand, the dredging requirement may consist of removing bottom sediment from a small, isolated pond with stagnant water. The factor of greater concern could be to find suitable equipment which can pump highly viscous bottom material, which is the third problem encountered in dredging. The aspect of keeping resuspension to a minimum may be less critical in this case.

A concise review of the conventional methods and equipment used for dredging and dredged material disposal is given in Engineer Manual 1110-2-5025 of March 1983. These have been successfully used over the last several decades for removing several millions of cubic yards of sediment from water bodies. However, in order to effectively handle the contaminated sediments without causing adverse environmental impact, resuspension of bed sediment in any large quantity needs to be avoided while dredging in rivers and estuaries. Dredging activity results in resuspension of at least some of the bed material in the water column. Resuspension characteristics of selected dredges have already been examined, the results of which are available in U. S. Army Engineer ETL-1110-2-531 of November 1984. Spreading of contaminants during dredging can be minimized through the use of specialized techniques which are being developed with the prime objective of minimizing resuspension of bed material during dredging operations.

4 General Comments

High energy environments such as beaches and near-shore areas often do not contain deposits of contaminated sediments because the fine sediment gets washed away and the coarse sediments do not readily adsorb pollutants. Hence the need for ocean-going dredges for removal of contaminated sediments is somewhat uncommon. To determine when dredged material is contaminated enough to require special management, either in upland or island containment areas or by capping, Corps of Engineers (COE) generally relies on a series of screening tests. Based on these tests in the year 1987, COE considered about 3 percent (approximately 7 million wet metric tons) of all material dredged in its coastal climates to be highly contaminated and to require special management. It was also estimated that about 30 percent of all maintenance dredging material might be contaminated to some degree. This estimate will change with a revised definition of the degree of contamination, however, the order of magnitude is not expected to change substantially. Due to both these reasons, namely, small volume of dredging and relatively sheltered dredging sites, the specialized dredges available in the market are small in terms of size and production rates, and they are suitable for operation in shallow water in protected, confined environment. Some are designed to be portable by road transport.

Among mechanical devices, the clamshell is effective in removing consolidated fine sediments, provided that the sediment does not contain larger size material which can prevent the bucket from closing completely. The dipper dredge and backhoe dredge are unsuitable for removing fine sediments because a substantial quantity of material may be washed during hoisting the bucket through water column. Among hydraulic dredges, the plain suction dredge is useful mainly for removing sand and sometimes mud with a very low compaction. A cutter suction dredge is effective and efficient in removing consolidated muds. Hopper dredges are most efficient for removing and transporting loose, non-cohesive sediments. Several specialized devices have been designed and manufactured for contaminated sediment dredging. Such devices include the Matchbox Draghead, Clean-up Draghead, Refresher Dredge, Dustpan Dredge, Disc-bottom Dredge, Pneumatic Dredge and Watertight Buckets. A detailed review is given in the WES Misc. Paper EL-91-20 entitled 'Innovative Technologies For Dredging Contaminated Sediments'.

5 Equipment Survey

The problem of dredging contaminated sediments has also engaged the attention of several agencies in countries other than the USA. However, according to the present regulations, dredging work in USA can be carried out only by indigenously manufactured dredges. Special dredging equipment, although available in other countries, cannot be readily employed for dredging operations in USA. Hence the equipment survey is limited mainly to the U. S. market. Only a brief mention of the successful techniques developed abroad is included under the present report.

The earlier WES survey report dated March 1983 was based upon inquiries sent to 29 companies. A literature and market searchundertaken under the present study identified 42 additional domestic companies, thus creating a data base for a total of 71 companies. A list of these 71 companies is given in Appendix A.

Preliminary inquiries revealed that 13 companies from the earlier list had closed down. Inquiry letters were therefore mailed to 57 companies and periodic follow-up was done over telephone. Seven letters were returned by the Post Office although their addresses were obtained from published literature. Three companies had acquired a new name / address. Hence letters were sent to them again. A list of 64 companies which was used for the present information processing excercise is given in Appendix B. The letter addressed to the companies is given in Appendix C.

Out of the total of 64 companies that received the inquiry letters, 32 responded with letters, brochures, phone calls and/or FAX messages. A list of these companies is given in Appendix D and the type of information from them is listed in Appendix E.

It was experienced that, in general, the companies are not readily willing to share any technical or other information to a Government agency such as WES, probably due to the fear of its possible use or misuse by other Government agencies such as EPA in giving adverse remarks on its use without knowing full details. The information could also be misused by the competitors of respective industries. Besides, the companies fail to see a possible direct financial or any other tangible benefits to their company by making this

information available to WES, which is not the end user of the equipment. Companies showed absolutely no interest in allowing WES representatives during the field operation of their equipment for obvious fears that they will probably note many or all the adverse features and make negative publicity which might have a damaging impact not only to the reputation of the company but may also result in heavy financial losses in the future. These are serious issues and must be kept in mind in appreciating whatever information that has been obtained and compiled in this report.

6 Promising Equipment

The parameters determining the preference and suitability of equipment for contaminated sediment dredging are the following:

a. Small size and low operating draft

b. Low weight and portability by road

c. Minimum water content and maximum sediment content in discharge pipe

d. Acceptable and economical production rate

e. Minimum resuspension of bed sediment during dredging

f. Low initial and operating cost

g. Adaptability for varying types of bed sediment

h. Alternative uses during idle time

i. Availability

All of the above requirements may not be satisfied by any single dredger and some compromise may be needed depending on site requirements. After examining information received from each of the vendors, it was noted that equipment offered by seven companies was promising based on the details provided by them. A list of these companies is given in Appendix F. Although not complete in respect to each parameter, the information as received from the vendors is summarized below in no particular order. For further details see Appendix G.

Keene Engineering Company, Northridge, CA

The company has offered their portable Model 8DX reclamation dredge NESSIE. Out of several cutter heads available, the company has stated that the Bucket Wheel Cutterhead lifts and cuts sediment extremely fast with a minimum of turbidity. It is also claimed that turbidity screens are normally not required with this type of cutterhead. The details of Model 8DX are given below:

Length: 19 ft 1 in.	Width: 7 ft 2 in.	Draft: 16 in.
Weight: 14,500 lb.	Operating Depth: 21 ft 9 in.	
Suction and Delivery Pipe Diameters: 8 in. x 8 in.		
Production Rate: 200 cubic yards per hour.		

Aquatics Unlimited, Martinez, CA

The company has offered portable dredges under their series AQUAMOG. It is stated by the company that these are shallow draft multi-purpose vessels that perform functions from debris / oil cleanup to bucket / suction dredging to emergent / submerged aquatic plant control using interchangeable attachments. The machines are available with cutter heads and / or augers depending upon the type of materials to be dredged and job-specific requirements. The company has stated that the system minimizes turbidity on account of the shrouded auger and the high suction available. The details of Model PRX 163 are given below:

Length: 30 ft 6 in.	Width: 10 ft	Draft: 18 in.
Weight: 18,500 lb.	Operating Depth: 20 ft	
Suction and Delivery Pipe Diameters: 6 in. x 6 in.		
Production Rate: 60 cubic yards per hour with 6 inch pipe		

Ellicott Machine Corporation, Baltimore, MD

The company has offered their MUDCAT, which is designed as a portable hydraulic dredge mounted on pontoons. A horizontal auger feeds slurry to the suction intake of a centrifugal pump. The dredge is propelled along an anchored cable and the dredged material may be discharged through a floating pipeline. It can operate in water depth ranging from 1.5 ft to 20 ft. The

company has stated that low rate of resuspension can be achieved by adjusting the rotation speed of auger, depth of cut and the suction rate. Further, the auger can also be shielded for reducing turbidity. The details of their Model SP-815 are given below:

Length: 31 ft 1 in.	Width: 8 ft	Draft: 22 in.
Weight: 13,200 lb.	Operating Depth: 15 ft	
Suction and Delivery Pipe Diameters: 6 in. x 6 in.		
Production Rate: 50 cubic yards per hour.		

Dredgemasters International, Hendersonville, TN

The company have stated that their standard model units, which are portable, hydraulic cutter suction dredgers, have been used in the past for contaminated sediment dredging. The standard production units are available in 8, 10, 12, 14, and 16 inch size. The standard units can also be modified for a specific purpose. However, no details of the proposed modifications are given by the company. Details of Model HPC-8EC, which is one of their several standard models, are given below:

Length: 36 ft	Width: 10 ft	Draft: Variable
Weight: Custom designed	Operating Depth: Custom designed	
Suction and Delivery Pipe Diameters: 10 in. x 8 in.		
Production Rate: cubic yards per hour.		

Dredging Supply Company, Harvey, LA

The company has stated that they are presently designing a bucket dredge with a pump-off system for a large superfund project. No further details are given by the company. The dredges are available either on lease or on sale and the standard models can be modified to meet specific requirements. The company has also developed a Bio-remediation process in which microscopic organisms are used to digest contaminated sediments and produce waste products that are less hazardous and toxic than the original sediments. Out of the three standard portable models, namely, Piranha, Barracuda and Shark, details of the Barracuda 8 inch size cutterhead dredge with swinging ladder are given below:

Length: 54 ft 9 in.	Width: 17 ft 8 in.	Draft: 3 to 4 ft
Weight: 50,000 lb.	Operating Depth: 13 ft 6 in.	
Suction and Delivery Pipe Diameters: 8 in. x 8 in.		
Production Rate: Variable		

Innovative Material Systems, Olathe, KS

The company has stated that they have designed dredge pumps especially for pumping exceptionally thick, viscous materials and for minimizing turbidity in the surrounding waters. The system has been used in Florida and Michigan. The company has stated that they have a hydraulic submersible pump called VERSI-DREDGE, which has a shrouded cutterhead and hence it is particularly suited for contaminated sediment dredging. Details of the Model 4010 are given below:

Length: 30 ft 2 in.	Width: 9 ft 4 in.	Draft: 20 in.
Weight: 12,000 lb.	Operating Depth: 20 ft	
Suction and Delivery Pipe Diameters: 10 in. x 10 in.		
Production Rate: Variable		

It may be noted that field operation of each of the models described above will have to be monitored carefully before endorsing their suitability for contaminated sediment dredging.

Oceaneering International, Inc., Upper Marlboro, MD

The company has not yet marketed the product which is pending for a patent. They are currently developing an underwater excavation device that is specifically designed for contaminated sediment retrieval. The Total Contaminant Clamshell Dredge (TCCD) is designed to precision dredge "hot" zones while minimizing all possibilities of spreading the contamination. Two primary objectives were set during the TCCD design. The first objective was that disturbed sediments would not be able to escape the system. The second was that the volume of associated water be kept to an absolute minimum.

Total containment is accomplished by incorporating a hyperbaric soil receiving chamber. This is an air-void that provides space for the incoming sediments. This void eliminates the displacement of an equal volume of contaminated water. It also minimizes the volume of associated water captured with each "bite" of sediment. Leakage containment is assured by operating in a negative pressure differential mode. Essentially, the pressure within the system is adjusted to be less than ambient water pressure during system operation. This results in leakage into the apparatus rather than outward.

Total containment is further assured by active silt curtains. Hard curtains that seal the sides of the clamshell buckets are lowered to close off the gap between them during closure. This prevents disturbed soil from extruding out of the system.

A working prototype of the TCCD is currently in factory testing with operational field testing scheduled in the early spring of 1996. The TCCD will be produced in three sizes to accommodate a variety of applications. A second TCCD is designed to use a vessel of opportunity as a floating base which provides the flexibility to bid projects in any market area.

7 Overseas Development

Although the objective of present data collection effort was to concentrate on domestic market, letters were also mailed to 21 overseas companies in order to explore the stage of development and availability of suitable equipment in foreign market. Response was received from 3 companies, out of which 1 appears promising. Ham Company, Rotterdam, The Netherlands, have offered an Auger dredger in which the auger is fitted as T head to the dredger's suction pipe. A flexible skirt is provided around the draghead and the dredging is carried out within the area enclosed by the skirt. The second device offered by this company is a visor dredging grab. Inside the regular grab, there is a revolving visor flap closed by means of two hydraulic cylinders. After the grab is filled, the visor is closed before raising the grab. A rubber strip along the edge of the visor ensures a watertight closure. Both these devices are claimed to be effective in contaminated sediment dredging.

Information on the past and recent developments in The Netherlands, Japan and Canada was obtained through literature search, the salient details of which are given below:

Volker Stevin Dredging Company, The Netherlands, have developed a hydraulic suction type matchbox dredge which consists of a draghead with funnel intake provided with valves and a triangular cover. This was used successfully in 1981-1983 in the First Petroleum Harbor, The Netherlands, for dredging polluted sediment containing pesticides and chlorinated hydrocarbons. The suspended solids at a distance of 2 to 5 m from the suction head during dredging were about 12 mg/l near the water surface and 12 to 80 mg/l at 7 to 11 m depth below the surface. These were only marginally higher over the background concentrations in the area.

TOA Harbor Works, Tokyo, Japan, have developed Clean-up dredges for removing contaminated sediments which has been used at 45 projects as of the end of 1981. This device consists of a rectangular cover fitted over an auger cutter and a centrifugal pump for suction. A sonar device monitors the elevation of the draghead and ensures its horizontal position.

Environment Canada have published a brief report in March 1993 entitled 'Selecting and Operating Dredging Equipment: A Guide to Sound

Environmental Practices'. In addition to giving a limited description of the specialized dredging equipment, the report covers important phases of any dredging project, namely, planning, designing, drafting technical specifications and environmental monitoring.

8 Additional Information

Additional information may be obtained from Dr. T. M. Parchure, Research Hydraulic Engineer, (Tel: 601-634-3213), or Mr. W. H. McAnally, Chief, Waterways and Estuaries Division, (Tel: 601-634-3822), Hydraulics Laboratory, U. S. Army Corps of Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS, 39180.

Bibliography

Clark G. R. (1983). "Survey of Portable Hydraulic Dredges", Technical Report HL-83-4, U. S. Army Engineers, Waterways Experiment Station, Vicksburg, MS.

_____ (1983). "Dredging and Dredged Material Disposal". Engineer Manual EM-1110-2-5025, Corps of Engineers, Department of the Army, Office of the Chief of Engineers, Washington, DC.

_____ (1984). "Sediment Resuspension Characteristics of Selected Dredges", ETL-1110-2-531, Department of the Army, Corps of Engineers, Office of the Chief of Engineers, Washington, DC.

_____ (1987). "Wastes in Marine Environments", OTA-O-334, U. S. Congress, Office of Technology Assessment, U. S. Govt. Printing Office, Washington D. C., April 1987.

Zappi P. A., and D. F. Hayes. (1991). "Innovative Technologies For Dredging Contaminated Sediments", U. S. Army Engineers, Waterways Experiment Station, Miscellaneous Paper EL-91-20, September 1991.

Jacques Berube Inc. (1993). "Selecting and Operating Dredging Equipment: A Guide to Sound Environmental Practices", St. Lawrence Centre, Document prepared in collaboration with Public Works Canada and the ministere de l'Environment du Quebec, Cat. No. En 40-438/1993E, 75 pp.

Appendix A
Lists of Companies Contacted

Lists of Companies Contacted in 1983 and New Additions
(29 + 42 = 71 Companies)

Notes: 1 Several companies closed down or changed their address. Details of these are given
2. Companies to whom letters were sent are shown by # followed by serial number.
3. Companies to whom letters were not sent are printed in *Italics*, starting with ****. Their correct addresses were searched and are given next, wherever applicable. Letters were sent on the correct address.

Companies Contacted in 1983
(29 Companies)

#1. 1. Ajax Company
1284 Miller Road — Tel: 216 - 934 - 4442
Avon, OH, 44011

2. **** *AMMCO*
P.O.Box 100923 — *Tel: 615 - 641 - 7533*
Nashville, TN, 37210

#2. 2. American Marine & Machinery Co., Inc.
(AAMCO) — Tel: 615 - 824 - 9699
178 Center Point Road South — FAX: 615 - 822 - 0002
Hendersonville, TN, 37075

3.**** *Assemblers, Inc.* — *No Phone listed*
1115 North Elm Street — *319 -*
West Liberty, LA 52776

4.**** *Clyde Iron / Wiley Mfg.* — *No Phone listed*
2300 West Loop South — *713 -*
Suite 102
Houston, TX 77027

5.**** *Delta Dredge and Pump Corp.* — *Incorrect Address*
11743 Lackland Road — *Tel: 314 - 968 - 4433*
St. Louis, Missouri 63141

#3. 5. Delta Dredge and Pump Corp.
344 Gray Avenue — Tel: 314 - 968 - 4433
St. Louis, Missouri, 63119-3608 — FAX: 314 - 968 - 9635

6.**** *Dixie Dredge Corporation* — *Incorrect Address*
8222 Polk Street — *No Phone listed (314-*
St. Louis, Missouri 63111 — *See #57 for new address*

7. **** *Dravo Corppration* — *Incorrect Address*
4800 Neville Island — *Tel: 412 - 771 - 1200*
Pittsburg, PA, 15225

#4. 7.Dravo Corporation
Engineering Works Division
1800 Neville Island — Tel: 412 - 566 - 3000
Pittsburg, PA 15225

8. Dredge Economy Inc.
12700 Biscane Blvd. — No Phone listed
North Miami, FL 33181 305 -

9.**** *Dredgemasters International Inc.* *Incorrect Address*
Number One Dredge Park — *Tel: 615 - 822 - 3500*
Hendersonville, TN 37075

#5. 9. Dredgemasters International — Tel: 615 - 822 - 3500
200 Center Point Road South — FAX: 615 - 822 - 0002
Hendersonville, TN, 37075 - 2060

10.**** *Eagle Iron Works* — *Incorrect Address*
129 Holcomb — *Tel: 515 - 243 - 1123*
Des Moines, Iowa 50304

#6. 10. Eagle Iron Works
127 Holcomb — Tel; 515 - 243 - 1123
Des Moines, Iowa, 50313 — FAX: 515 - 243 - 8214

#7. 11. Ellicott Machine Corp.
1611 Bush Street — Tel: 410 - 837 - 7900
Baltimore, MD 21230 - 7900 — FAX: 410 - 752 - 3294

Attn: Mr.Edward H. Bond
General Manager
MUD CAT Division
National Car Rental — Tel: 612 - 542 - 8332
P.O.Box 16247
St. Louis Park, MN 55416

12.**** *Guntert and Zimmerman*
Construction Division, Inc. — *No Phone listed*
P.O.Box 1688 — *209 -*
Stockton, CA 95201

#8. 13. Hardcastle Industries Inc.
229 N. Meridian Ave. Tel: 813 - 878 - 2288
Tampa, FL 33602

#9. 14. Hartman Fabco Inc.
1415 Lake Lansing Road Tel: 517 - 485 - 9493
Lansing, MI 48912

#10. 15. Intercontinental Engineering
Manufacturing Corpo. Tel: 816 - 741 - 0700
P.O.Box 9055 800 - 821 - 3182
Kansas City, Missouri, 64168 FAX: 816 - 741 - 5232

#11. 16. Jantzen Engineering Co. Inc.
6655 Amberton Drive Tel: 410 - 796 - 8585
Baltimore, MD 21227

#12. 17. Kenner Marine and Machinery Inc. Closed down in 1990
P.O.Box 1200 Tel: 504 - 652 - 2548
Laplace, LA 70068 See # 23 for New Business

18. *Levingston Shipbuilding Co.*
Second and Front Streets *No Phone listed*
Orange, TX 77630 *409 -*

#13. 19. Maxon Marine Industries Inc.
P.O.Box 349 Tel: 812 - 547 - 2341
Tell City, IN 47586

20.**** *Meckum Engineering Division*
The Peltier Glass Company *No Phone listed*
2027 Champlain St. *309 -*
Ottawa, IL 61350

#14. 21. Minco Inc
P.O.Box 553 Tel: 504 - 581 - 3855
Westwego, LA 70094

22.**** *Mini Dredge Co. Ltd.* *No Phone listed*
1422 Crown Street *604 -*
North Vancouver, BC, V7J 1G5
Canada

23.**** *Paulson Engineering Inc.*
188 Eighth Avenue — *No Phone listed*
Hawthorne, NJ 07507 — *201 -*

#15. 24. Quality Industries Inc
P.O.Box 406 — Tel: 504 - 447 - 4021
1920 Canal Blvd. — FAX: 504 - 447 - 4028
Thibodaux, LA 70301-5214

25.**** *Sefab Inc.*
78 S. Hudson Street — *No Phone listed*
Seattle, WA 98134 — *206 -*

26.**** *Todd Shipyards Inc.*
P.O.Box 9666 — *No Phone listed*
Houston, TX 77015 — *713 -*

27.**** *Twin City Shipyard Inc.*
P.O.Box 43032 — *No Phone listed*
St. Paul, MN 55164 — *612 -*

28.**** *VMI Inc.*
4310 N. Martin — *No Phone listed*
Bethany, OK 73008 — *405 -*

#16. 29. W & S Development Inc.
4957 Main Street — Tel: 517 - 724 - 5463
Greenbush, MI 48738

Additional Domestic Companies Located During Present Survey
(42 Companies)

#17. H & H Pump and Dredge Co.
520 Highway 322 — Tel: 601 - 627 - 9631
Clarksdale MS 38614
Attn: Mr. Howard Stovall

#18. Keene Engineering Co. — "Nessie" Portable Cutterhead Dredger
9330 Corbin Avenue — Tel: 818 - 993 - 0411
Northridge California, 91324 — FAX: 818 - 993 - 0447

#19. Aquatics Unlimited — "Aquamog"
2150 Franklin Canyon Road — Tel: 415 - 370 - 9175
Martinez, California 94553 — FAX: 415 - 370 - 9179

#20. SeaArk Marine Inc.
P.O.Box 210
Monticello, Arkansas, 71655

Custom-designed Dredgers
Tel: 501 - 367 - 9755
FAX: 501 - 367 - 2120

#21. Great Lakes Dredge & Dock Co.
2122 York Road
Oak Brook, Illinois, 60521

Tel: 708 574 3000
FAX: 708 574 2980

#22. **** *Gulf Coast Trailing Co.*
P.O.Box 10
Kenner, LA 70063

Incorrect Address
Tel: 504 - 468 - 3608

Gulf Coast Trailing Co.
P.O.Box 20116
New Orleans, LA, 70141
Atten: Mr. Steve Chatry

Tel: 504 - 461 - 9230

#23. Dredging Supply Co., Inc.
701 Peters Road
Harvey, LA, 70058

Tel: 504 - 367 - 2314
FAX: 504 - 368 - 8359

#24. American Marine Inc.
P.O.Box 940
401 Shearer Blvd.
Cocoa, FL, 32923

Tel: 305 - 636 - 5783

#25. B & B Boatbuilding Inc.
Strar Route Box 3
Brownsville, TX, 78520

Tel: 512 - 831 - 3122
FAX: 512 - 831 - 2745

#26. Barney & Dickenson Inc.
610 Prentice Road
Vestal, NY, 13850

Tel: 607 - 729 - 1536
FAX: 607 - 797 - 3931

#27. Bay Machinery Corp.
543 South 8 th Street
Richmond, CA, 94804

Tel: 415 - 236 - 9000
FAX: 415 - 236 - 7212

#28. Best Equipment Technologies
P.O.Box 429, Hwy 53 South
Poplarville, MS, 39470

Tel: 601 - 795 - 2208

#29. Cargile Co. — Incorrect Address
1201 S. Flagler Dr. B-4 — Tel: 407 - 833 - 9878
W. Palm Beach, FL, 33401
OR
American Mining and Machinery Corp. — Tel: 407 - 820 - 0049
3000 S. Washington Road — FAX: 407 - 820 - 0049
West Palm Beach, FL, 33405
OR
Envirotech Corporation (See # 35)

#30. Consolidated Placer Dredging Co.
17951 Sky Park Circle, Suite C — Tel: 714 - 474 - 1120
Irvine, CA, 92714 — FAX: 714 - 863 - 9261

#31. Crisafulli Pump Co.
P.O.Box 1051 — Tel: 406 - 365 - 3393
Crisafulli Dr. — FAX: 406 - 365 - 8088
Glendive, Montana, 59330

#32. Dredging Specialists
43 Dewitt Avenue — Tel: 217 - 234 - 3344
Mattoon, IL, 61938 — FAX: 217 - 234 - 3347

#33. ****Dredge Technology Corp. — Returned by P.O.
Atlantic Stewardship Bank Buld.
630 Godwin Avenue, Suite 201 — *Tel: 201 - 444 - 0581*
Midland park, New Jersey, 07432-1405

Dredge Technology Corp. — Tel: 201-696-1559
P.O.Box 1520 — FAX: 201-696-3572
Wayne, NJ

#34. Envirotech
1700 Embassy Drive-712 — Tel: 407 - 684 - 4774
W. Palm Beach, FL, 33401 — FAX: 407 - 684 - 4664

#35. Greenville Manufacturing Works
600 Pine Street — Tel: 513 - 548 - 6100
Greenville, OH, 45331

#36. Harnischfeger Corp.
P.O.Box 554 — Tel: 414 - 671 - 4400
Milwaukee, WI, 53201

#37. Hendry Corp.
5107 S. Westshore Blvd. Tel: 813 - 831 - 1211
Tampa, FL, 33681

#38. Hitachi Construction Machinery
611 Lockhaven Drive Tel: 713 - 821 - 2400
Houston, TX, 77073-5599

#39. Humphreys Mineral Industries
2219 Market Street Tel: 303 - 296 - 8000
Denver, CO, 80205

#40. Innovative Material Systems Inc.
15630 South Keeler Tel: 913 - 829 - 2900
Olathe, Kansas, 66062 FAX: 913-829-2989

#41. Kahl Scientific Instrument Corp.
P.O.Box 1166 Tel: 619 - 444 - 2158
737 W. Main Street 1-800 - 800 - 4010
El Cajon, CA, 92022

#42. Land and Sea Diesel Co.
P.O.Box 151 Tel: 617 - 540 - 5350
East Falmouth, MA, 02536

#43. McDermott Inc.
1010 Common Stret Tel: 504 - 587 - 4441
New Orleans, LA, 70160

#44. Nippon Kokan K K
450 Park Avenue Tel: 212 - 826 - 6250
New York, NY, 10022

#45. Oenstein & Koppel
700 Route 46 Tel: 201 - 478 - 8900
Cliffton, NJ, 07015

#46. R.A. Hanson Co. Inc.
P.O.Box 7400 Tel: 509 - 467 - 0770
Spokane, WA, 99207 FAX: 509 - 466 - 0212

#47. ROHR Corp.
P.O.Box 30-J Tel: 513 - 624 - 9220
Cincinati, OH, 45230 FAX: 513 - 624 - 9221

#48. Smalley Excavators
71 Hartford Turnpike South
Wallingford, Connecticut, 06492
Tel: 203 - 265 - 9352

#49. Spectrum Enterprises Inc.
178 Center Point Road-South
Hendersonville, TN, 37075-2060
Tel: 615 - 824 - 9699
FAX: 615 - 822 - 0002

#50. Tacoma Boatbuilding Co., Inc.
1840 Marine View Drive
Tacoma, WA, 98422
Tel: 206 - 572 - 3600

#51. Twinkle Co.
P.O.Box 79
West Liberty, Iowa, 52776
Tel: 319 - 627 - 6655
FAX: 319 - 627 - 4444

#52. United Marine International Inc.
1436 W. River Road
P.O.Box 750
Waterloo, NY, 13165
Tel: 315 - 539 - 5665
FAX: 315 - 539 - 5667

#53. ****_Assemblers, Inc._
P.O.Box 508
Pleasant Valley, Iowa, 52767
Tel: 319 - 332 - 5600
FAX; 319 - 332 - 10089

Assemblers Inc.
2355 Yankee Avenue
Durant IA 52747
Tel: 319-785-6539

#54. Sludge Engineering
43 Dewitt Avenue
Mattoon, Illinois, 61938
Tel: 217 - 234 - 3344
FAX: 217 - 234 - 3347

#55. Allis Mineral Systems
4800 Grand Avenue
Pittsburg, PA, 15225-1599
Tel: 412 - 269 - 5000
FAX: 412 - 269 - 5050

#56. T.L.James & Co. Inc.
P.O.Box 826
Kenner, LA, 70063
Tel: 504 - 467 - 6000
FAX: 504 - 469 - 1332

#57. Dixie Dredge Co.
No. 1, Dredge Park
190 Center Point Road, South
Hendersonville, TN, 37075
Tel: 615 - 822 - 3901
FAX: 615 - 822 - 0002

#58	Dredgemasters International 200 Center Point Road South Hendersonville, TN, 37075 - 2060	Tel: 615 - 822 - 3500 FAX: 615 - 822 - 0002
#59	Ellicott Machine Corp. 1611 Bush Street Baltimore, MD 21230 - 7900	 Tel: 410 - 837 - 7900 FAX: 410 - 752 - 3294
#60	Keene Engineering Co. 9330 Corbin Avenue Northridge California, 91324	"Nessie" Portable Cutterhead Dredger Tel: 818 - 993 - 0411 FAX: 818 - 993 - 0447
#61	Aquatics Unlimited 2150 Franklin Canyon Road Martinez, California 94553	"Aquamog" Tel: 415 - 370 - 9175 FAX: 415 - 370 - 9179
#62	Dredging Supply Co., Inc. 701 Peters Road Harvey, LA, 70058	 Tel: 504 - 367 - 2314 FAX: 504 - 368 - 8359
#63.	Innovative Material Systems Inc. 15630 South Keeler Olathe, Kansas, 66062	 Tel: 913 - 829 - 2900 FAX: 913-829-2989
#64	Oceaneering Technologies 501 Prince George's Blvd Upper Marlboro, MD, 20772	 Tel: 301 - 249 - 3300 FAX: 301 - 249 - 4022

Appendix B
List of Companies Used for Present Information Processing

List of Companies Used For Present Information Processing
(64 Companies)

#1. Ajax Company
1284 Miller Road
Avon, OH, 44011
Tel: 216 - 934 - 4442

#2. American Marine & Machinery Co., Inc.
(AAMCO)
178 Center Point Road South
Hendersonville, TN, 37075
Tel: 615 - 824 - 9699
FAX: 615 - 822 - 0002

#3. Delta Dredge and Pump Corp.
344 Gray Avenue
St. Louis, Missouri, 63119-3608
Tel: 314 - 968 - 4433
FAX: 314 - 968 - 9635

#4. .Dravo Corporation
Engineering Works Division
1800 Neville Island
Pittsburg, PA 15225
Tel: 412 - 566 - 3000

#5. Dredgemasters International
200 Center Point Road South
Hendersonville, TN, 37075 - 2060
Tel: 615 - 822 - 3500
FAX: 615 - 822 - 0002

#6. Eagle Iron Works
127 Holcomb
Des Moines, Iowa, 50313
Tel; 515 - 243 - 1123
FAX: 515 - 243 - 8214

#7. Ellicott Machine Corp.
1611 Bush Street
Baltimore, MD 21230 - 7900
Tel: 410 - 837 - 7900
FAX: 410 - 752 - 3294

#8. Hardcastle Industries Inc.
229 N. Meridian Ave.
Tampa, FL 33602
Tel: 813 - 878 - 2288

#9. Hartman Fabco Inc.
1415 Lake Lansing Road
Lansing, MI 48912
Tel: 517 - 485 - 9493

#10. Intercontinental Engineering
Manufacturing Corpo.
P.O.Box 9055
Kansas City, Missouri, 64168

Tel: 816 - 741 - 0700
800 - 821 - 3182
FAX: 816 - 741 - 5232

#11. Jantzen Engineering Co. Inc.
6655 Amberton Drive
Baltimore, MD 21227

Tel: 410 - 796 - 8585

#12. Kenner Marine and Machinery Inc.
P.O.Box 1200
Laplace, LA 70068

Closed down in 1990
Tel: 504 - 652 - 2548
See # 23 for New Business

#13. Maxon Marine Industries Inc.
P.O.Box 349
Tell City, IN 47586

Tel: 812 - 547 - 2341

#14. Minco Inc
P.O.Box 553
Westwego, LA 70094

Tel: 504 - 581 - 3855

#15. Quality Industries Inc
P.O.Box 406
1920 Canal Blvd.
Thibodaux, LA 70301-5214

Tel: 504 - 447 - 4021
FAX: 504 - 447 - 4028

#16. W & S Development Inc.
4957 Main Street
Greenbush, MI 48738

Tel: 517 - 724 - 5463

#17. H & H Pump and Dredge Co.
520 Highway 322
Clarksdale MS 38614
Attn: Mr. Howard Stovall

Tel: 601 - 627 - 9631

#18. Keene Engineering Co.
9330 Corbin Avenue
Northridge California, 91324

"Nessie" Portable Cutterhead Dredger
Tel: 818 - 993 - 0411
FAX: 818 - 993 - 0447

#19. Aquatics Unlimited
2150 Franklin Canyon Road
Martinez, California 94553

"Aquamog"
Tel: 415 - 370 - 9175
FAX: 415 - 370 - 9179

#20. SeaArk Marine Inc.
P.O.Box 210
Monticello, Arkansas, 71655

Custom-designed Dredgers
Tel: 501 - 367 - 9755
FAX: 501 - 367 - 2120

#21. Great Lakes Dredge & Dock Co.
2122 York Road
Oak Brook, Illinois, 60521

Tel: 708 574 3000
FAX: 708 574 2980

#22. **** *Gulf Coast Trailing Co.*
P.O.Box 10
Kenner, LA 70063

Incorrect Address
Tel: 504 - 468 - 3608

#23. Dredging Supply Co., Inc.
701 Peters Road
Harvey, LA, 70058

Tel: 504 - 367 - 2314
FAX: 504 - 368 - 8359

#24. American Marine Inc.
P.O.Box 940
401 Shearer Blvd.
Cocoa, FL, 32923

Tel: 305 - 636 - 5783

#25. B & B Boatbuilding Inc.
Strar Route Box 3
Brownsville, TX, 78520

Tel: 512 - 831 - 3122
FAX: 512 - 831 - 2745

#26. Barney & Dickenson Inc.
610 Prentice Road
Vestal, NY, 13850

Tel: 607 - 729 - 1536
FAX: 607 - 797 - 3931

#27. Bay Machinery Corp.
543 South 8 th Street
Richmond, CA, 94804

Tel: 415 - 236 - 9000
FAX: 415 - 236 - 7212

#28. Best Equipment Technologies
P.O.Box 429, Hwy 53 South
Poplarville, MS, 39470

Tel: 601 - 795 - 2208

#29. Cargile Co.
1201 S. Flagler Dr. B-4
W. Palm Beach, FL, 33401

Incorrect Address
Tel: 407 - 833 - 9878

#30. Consolidated Placer Dredging Co.
17951 Sky Park Circle, Suite C
Irvine, CA, 92714

Tel: 714 - 474 - 1120
FAX: 714 - 863 - 9261

#31. Crisafulli Pump Co.
P.O.Box 1051 — Tel: 406 - 365 - 3393
Crisafulli Dr. — FAX: 406 - 365 - 8088
Glendive, Montana, 59330

#32. Dredging Specialists
43 Dewitt Avenue — Tel: 217 - 234 - 3344
Mattoon, IL, 61938 — FAX: 217 - 234 - 3347

#33. ****Dredge Technology Corp. — Returned by P.O.
Atlantic Stewardship Bank Buld.
630 Godwin Avenue, Suite 201 — *Tel: 201 - 444 - 0581*
Midland park, New Jersey, 07432-1405

#34. Envirotech
1700 Embassy Drive-712 — Tel: 407 - 684 - 4774
W. Palm Beach, FL, 33401 — FAX: 407 - 684 - 4664

#35. Greenville Manufacturing Works
600 Pine Street — Tel: 513 - 548 - 6100
Greenville, OH, 45331

#36. Harnischfeger Corp.
P.O.Box 554 — Tel: 414 - 671 - 4400
Milwaukee, WI, 53201

#37. Hendry Corp.
5107 S. Westshore Blvd. — Tel: 813 - 831 - 1211
Tampa, FL, 33681

#38. Hitachi Construction Machinery
611 Lockhaven Drive — Tel: 713 - 821 - 2400
Houston, TX, 77073-5599

#39. Humphreys Mineral Industries
2219 Market Street — Tel: 303 - 296 - 8000
Denver, CO, 80205

#40. Innovative Material Systems Inc.
15630 South Keeler — Tel: 913 - 829 - 2900
Olathe, Kansas, 66062 — FAX: 913-829-2989

#41. Kahl Scientific Instrument Corp.
P.O.Box 1166
737 W. Main Street
El Cajon, CA, 92022
Tel: 619 - 444 - 2158
1-800 - 800 - 4010

#42. Land and Sea Diesel Co.
P.O.Box 151
East Falmouth, MA, 02536
Tel: 617 - 540 - 5350

#43. McDermott Inc.
1010 Common Stret
New Orleans, LA, 70160
Tel: 504 - 587 - 4441

#44. Nippon Kokan K K
450 Park Avenue
New York, NY, 10022
Tel: 212 - 826 - 6250

#45. Oenstein & Koppel
700 Route 46
Cliffton, NJ, 07015
Tel: 201 - 478 - 8900

#46. R.A. Hanson Co. Inc.
P.O.Box 7400
Spokane, WA, 99207
Tel: 509 - 467 - 0770
FAX: 509 - 466 - 0212

#47. ROHR Corp.
P.O.Box 30-J
Cincinati, OH, 45230
Tel: 513 - 624 - 9220
FAX: 513 - 624 - 9221

#48. Smalley Excavators
71 Hartford Turnpike South
Wallingford, Connecticut, 06492
Tel: 203 - 265 - 9352

#49. Spectrum Enterprises Inc.
178 Center Point Road-South
Hendersonville, TN, 37075-2060
Tel: 615 - 824 - 9699
FAX: 615 - 822 - 0002

#50. Tacoma Boatbuilding Co., Inc.
1840 Marine View Drive
Tacoma, WA, 98422
Tel: 206 - 572 - 3600

#51. Twinkle Co.
P.O.Box 79
West Liberty, Iowa, 52776
Tel: 319 - 627 - 6655
FAX: 319 - 627 - 4444

#52. United Marine International Inc.
1436 W. River Road
P.O.Box 750
Waterloo, NY, 13165
Tel: 315 - 539 - 5665
FAX: 315 - 539 - 5667

#53. Assemblers Inc.
2355 Yankee Avenue
Durant IA 52747
Tel: 319-785-6539

#54. Sludge Engineering
43 Dewitt Avenue
Mattoon, Illinois, 61938
Tel: 217 - 234 - 3344
FAX: 217 - 234 - 3347

#55. Allis Mineral Systems
4800 Grand Avenue
Pittsburg, PA, 15225-1599
Tel: 412 - 269 - 5000
FAX: 412 - 269 - 5050

#56. T.L.James & Co. Inc.
P.O.Box 826
Kenner, LA, 70063
Tel: 504 - 467 - 6000
FAX: 504 - 469 - 1332

#57. Dixie Dredge Co.
No. 1, Dredge Park
190 Center Point Road, South
Hendersonville, TN, 37075
Tel: 615 - 822 - 3901
FAX: 615 - 822 - 0002

#58 Dredgemasters International
200 Center Point Road South
Hendersonville, TN, 37075 - 2060
Tel: 615 - 822 - 3500
FAX: 615 - 822 - 0002

#59 Ellicott Machine Corp.
1611 Bush Street
Baltimore, MD 21230 - 7900
Tel: 410 - 837 - 7900
FAX: 410 - 752 - 3294

#60 Keene Engineering Co.
9330 Corbin Avenue
Northridge California, 91324
"Nessie" Portable Cutterhead Dredger
Tel: 818 - 993 - 0411
FAX: 818 - 993 - 0447

#61 Aquatics Unlimited
2150 Franklin Canyon Road
Martinez, California 94553
"Aquamog"
Tel: 415 - 370 - 9175
FAX: 415 - 370 - 9179

#62 Dredging Supply Co., Inc.
701 Peters Road
Harvey, LA, 70058
Tel: 504 - 367 - 2314
FAX: 504 - 368 - 8359

#63. Innovative Material Systems Inc.
15630 South Keeler
Olathe, Kansas, 66062

Tel: 913 - 829 - 2900
FAX: 913-829-2989

#64 Oceaneering Technologies
501 Prince George's Blvd
Upper Marlboro, MD, 20772

Tel: 301 - 249 - 3300
FAX: 301 - 249 - 4022

Appendix C
Copy of Letter Sent for Obtaining Information on Dredgers Suitable for Contaminated Sediment Dredging

Copy of letter sent for obtaining information on dredgers suitable for contaminated sediment dredging

Estuaries Division
Hydraulics Laboratory

You probably know that the U.S.Army Corps of Engineers is responsible for executing about 500 million cubic yards of dredging per year in the United States. About 20 percent of this volume is undertaken by the District Offices of the Corps and the remaing is executed through contractors.

In recent years, we have been required to handle contaminated sediments as a part of the dredging operations. Hence, at the Waterways Experiment Station, we have undertaken the task of preparation of a reference manual which will contain information on the latest technology and equipment available for dredging contaminated sediments from small and shallow water bodies such as lakes and ponds as well as from larger and deeper water bodies such as bays and estuaries. The manual will essentially be a reference catalogue containing details of equipment along with a performance evaluation and applicability of each type of equipment. The dredging equipment to be reported may be portable / non-portable, it may have been marketed for general sale / custom-designed, or it may even be made available for temporary use by domestic or overseas contractors.

Copies of the proposed manual will be made available to the district offices of the Corps of Engineers as well as to practicing engineers and others involved in the planning and execution of small and large dredging operations in order to facilitate selection of proper equipment to meet their specific needs.

We have undertaken a detailed literature search in this connection and we would appreciate receiving your input in order to make this manual as upto-date and comprehensive as possible. We therefore request you to please send copies of the catalogs and pamphlets giving information on the various types of dredging equipment marketed by your company for handling contaminated sediment. They should include all the technical specifications and details of capabilities and special features of each type.

1. We would like to have the following basic information in particular:

- dimensions and weight of the dredger,
- size of suction and delivery pipe,
- pump type and capacity (flow rate and H.P.),
- cutter assembly details,

- working capacity of the dredger,
- anchoring system,
- transport requirements in case of portable dredger,
- description of special design features that make it particularly suitable for dredging contaminated sediment with a minimum of adverse environmental impact,
- a line drawing and a photograph.

2. If the dredger has been already deployed, please give a list of sites, the year of use, volume of material dredged, type of soil, nature of contaminants, and the order of magnitude of cost of dredging per cubic yard. In case such information is not readily available with you, please provide the name and address of the agencies who have used the equipment, so that we might be able to get this information directly from them.

3. We are also considering preparation of a video to accompany this manual in order to provide an audio-visual presentation of the equipment and its actual working features. In case you have a short video which either gives a description of the dredger and / or its field use, we would appreciate receiving a copy of the same along with your written permission to include it in our video, in case it is copy-righted.

4. If you have collaboration with any Company based in U.S.A., please give their name and adress so that we will be able to correspond with them for any further information.

We hope that you will consider the proposed manual as an excellent opportunity to directly reach the prospective users of your equipment and extend your cooperation in its preparation by providing the requested information.

If you have any questions, please contact Dr. T. M. Parchure at 601-634-3213 or Mr. Mike Alexander at 601-634-3904.

Sincerely,

T.M.Parchure

Appendix D
List of Companies Which Sent Information Under Present Survey

List of CompaniesWhich Sent Information Under Present Survey (24 Companies)

01	American Marine & Machinery Co., Inc. (AAMCO) 178 Center Point Road South Hendersonville, TN, 37075	 Tel: 615 - 824 - 9699 FAX: 615 - 822 - 0002
02	Dredgemasters International 200 Center Point Road South Hendersonville, TN, 37075 - 2060	Tel: 615 - 822 - 3500 FAX: 615 - 822 - 0002
03	Eagle Iron Works 127 Holcomb Des Moines, Iowa, 50313	 Tel; 515 - 243 - 1123 FAX: 515 - 243 - 8214
04	Ellicott Machine Corp. 1611 Bush Street Baltimore, MD 21230 - 7900	 Tel: 410 - 837 - 7900 FAX: 410 - 752 - 3294
05	Intercontinental Engineering Manufacturing Corpo. P.O.Box 9055 Kansas City, Missouri, 64168	 Tel: 816 - 741 - 0700 Tel: 800 - 821 - 3182 FAX: 816 - 741 - 5232
06	W & S Development Inc. 4957 Main Street Greenbush, MI 48738	 Tel: 517 - 724 - 5463
07	H & H Pump and Dredge Co. 520 Highway 322 Clarksdale MS 38614 Attn: Mr. Howard Stovall	 Tel: 601 - 627 - 9631
08	Keene Engineering Co. 9330 Corbin Avenue Northridge California, 91324	 Tel: 818 - 993 - 0411 FAX: 818 - 993 - 0447
09	Aquatics Unlimited 2150 Franklin Canyon Road Martinez, California 94553	 Tel: 415 - 370 - 9175 FAX: 415 - 370 - 9179

10	Gulf Coast Trailing Co. P.O.Box 20116 New Orleans, LA, 70141 Atten: Mr. Steve Chatry	Tel: 504 - 461 - 9230
11	Dredging Supply Co., Inc. 701 Peters Road Harvey, LA, 70058	Tel: 504 - 367 - 2314 FAX: 504 - 368 - 8359
12	Barney & Dickenson Inc. 610 Prentice Road Vestal, NY, 13850	Tel: 607 - 729 - 1536 FAX: 607 - 797 - 3931
13	American Mining and Machinery Corp. 3000 S. Washington Road West Palm Beach, FL, 33405	Tel: 407 - 820 - 0049 FAX: 407 - 820 - 0049
14	Consolidated Placer Dredging Co. 17951 Sky Park Circle, Suite C Irvine, CA, 92714	Tel: 714 - 474 - 1120 FAX: 714 - 863 - 9261
15	Crisafulli Pump Co. P.O.Box 1051 Crisafulli Dr. Glendive, Montana, 59330	Tel: 406 - 365 - 3393 FAX: 406 - 365 - 8088
16	Innovative Material Systems Inc. 15630 South Keeler Olathe, Kansas, 66062	Tel: 913 - 829 - 2900 FAX: 913-829-2989
17	ROHR Corp. P.O.Box 30-J Cincinnati, OH, 45230	Tel: 513 - 624 - 9220 FAX: 513 - 624 - 9221
18	Assemblers Inc. 2355 Yankee Avenue Durant IA 52747	Tel: 319-785-6539
19	Sludge Engineering 43 Dewitt Avenue Mattoon, Illinois, 61938	Tel: 217 - 234 - 3344 FAX: 217 - 234 - 3347
20	T. L. James & Co. Inc. P.O.Box 826 Kenner, LA, 70063	Tel: 504 - 467 - 6000 FAX: 504 - 469 - 1332

21	Dixie Dredge Co. No. 1, Dredge Park 190 Center Point Road, South Hendersonville, TN, 37075	Tel: 615 - 822 - 3901 FAX: 615 - 822 - 0002
22	Aquarius Smalley P. O. Box 215 220 N. Harrison North Prairie, WI, 53153	Tel: 414 - 392 - 2162 FAX: 414 - 392 - 2984
23	Commerce Consultants International 4838, 25 th Road North, Arlington, VA, 22207	Tel: 703 - 243 - 8978 FAX: 703 - 276 - 7338
24	Oceaneering Technologies 501 Prince George's Blvd Upper Marlboro, MD, 20772	Tel: 301 - 249 - 3300 FAX: 301 - 249 - 4022

Appendix E
Response Received from Companies Under Present Survey

Response Received From Companies Under Present Survey
(24 Companies)

Note: Names of companies which have offerd promising equipment are shown in bold and with *

No.	Name of Company	Response	Info. Recd.
01	American Marine & Machinery Co. Hendersonville, TN	Lr. Dt. 3/9/93	Folder
02*	**DredgeMasters International Inc. Hendersonville, TN**	**Lr. Dt. 2/1/93**	**Folders**
03	Eagle Iron Works Des Moines, IA	No letter	Brochure
04*	**Ellicott Machine Corp. Baltimore, MD**	**No letter Dredge 'Mud Cat'**	**Brochures Video**
05	Intercontinental Engineering Manufacturing Corpo. Kansas City, MO	Lr. Dt. 1/11/93 Only custom made	
06	W & S Development Inc. Greenbush, MI	Lr. Dt. 5/13/93	Brochure Video
07	H & H Pump and Dredge Co. Clarksdale MS	Lr. Dt. 4/29/93	Folder
08*	**Keene Engineering Co. Northridge CA**	**Lr. Dt. 1/21/93 Dredge "Nessie"**	**Video Catalog**
09*	**Aquatics Unlimited Martinez, CA**	**Lr. Dt. 2/3/93 Dredge "Aquamog"**	**Video Catalog, Folder**
10	Gulf Coast Trailing Co. New Orleans, LA	No letter	Brochure
11*	**Dredging Supply Co. Harvey, LA**	**Lr. Dt. 2/5.93**	**Folder**
12	Barney & Dickenson Inc. Vestal, NY	Lr. Dt. 2/2/93	

13	American Mining & Machinery Co. West Palm Beach, FL	Lr. Dt. 2/4/93	Brochure
14	Consolidated Placer Dredging Co. Irvine, CA	Lr. Dt. 2/1/93	Brochure
15	Crisafulli Pump Co. Glendive, MT	Lr. Dt. 2/93	Folder
16*	**Innovative Material Systems Inc. Olathe, KS**	**Lr. Dt. 2/16/93**	**Brochure**
17	ROHR Corp. Cincinnati, OH	No letter	Folder
18	Assemblers Inc. Durant, IA	Lr. Dt. 1/6/93	Brochure
19	Sludge Engineering Mattoon, IL	Lr. Dt. 2/15/93	Brochure 3 Reports
20	T. L. James & Co. Inc. Ruston, LA	No letter	Folder
21	Dixie Dredge Co. Hendersonville, TN	Lr. Dt. 2/5/93	Folder
22	Aquarius Smalley. North Prairie, WI	Lr. Dt. 5/13/93	Brochures
23	Commerce Consultants International Arlington, VA	Lr. Dt. 8/12/93	Brochure
24*	**Oceaneering Technologies 501 Prince George's Blvd Upper Marlboro, MD, 20772**	**FAX Dt. 9/19/95**	**Note & Photo**

Appendix F
List of Companies with Promising Equipment for Contaminated Sediment Dredging

List of Companies With Promising Equipment For Contaminated Sediment Dredging
(7 Companies in no particular order)

1.	Keene Engineering Co. 9330 Corbin Avenue Northridge California, 91324	"Nessie"	Tel: 818 - 993 - 0411 FAX: 818 - 993 - 0447
2.	Aquatics Unlimited 2150 Franklin Canyon Road Martinez, California 94553	"Aquamog"	Tel: 415 - 370 - 9175 FAX: 415 - 370 - 9179
3	Ellicott Machine Corp. 1611 Bush Street Baltimore, MD 21230 - 7900	"Mudcat"	Tel: 410 - 837 - 7900 FAX: 410 - 752 - 3294
4.	Dredgemasters International 200 Center Point Road South Hendersonville, TN, 37075 - 2060	"Mudmaster"	Tel: 615 - 822 - 3500 FAX: 615 - 822 - 0002
5.	Dredging Supply Co., Inc. 701 Peters Road Harvey, LA, 70058	"Barracuda"	Tel: 504 - 367 - 2314 FAX: 504 - 368 - 8359
6.	Innovative Material Systems Inc. 15630 South Keeler Olathe, Kansas, 66062	"Versi-Dredge"	Tel: 913 - 829 - 2900 FAX: 913 - 829 - 2989
7.	Oceaneering Technologies 501 Prince George's Blvd Upper Marlboro, MD, 20772	"TCCD"	Tel: 301 - 249 - 3300 FAX: 301 - 249 - 4022

Appendix G
Details of Promising Equipment

Details of Promising Equipment

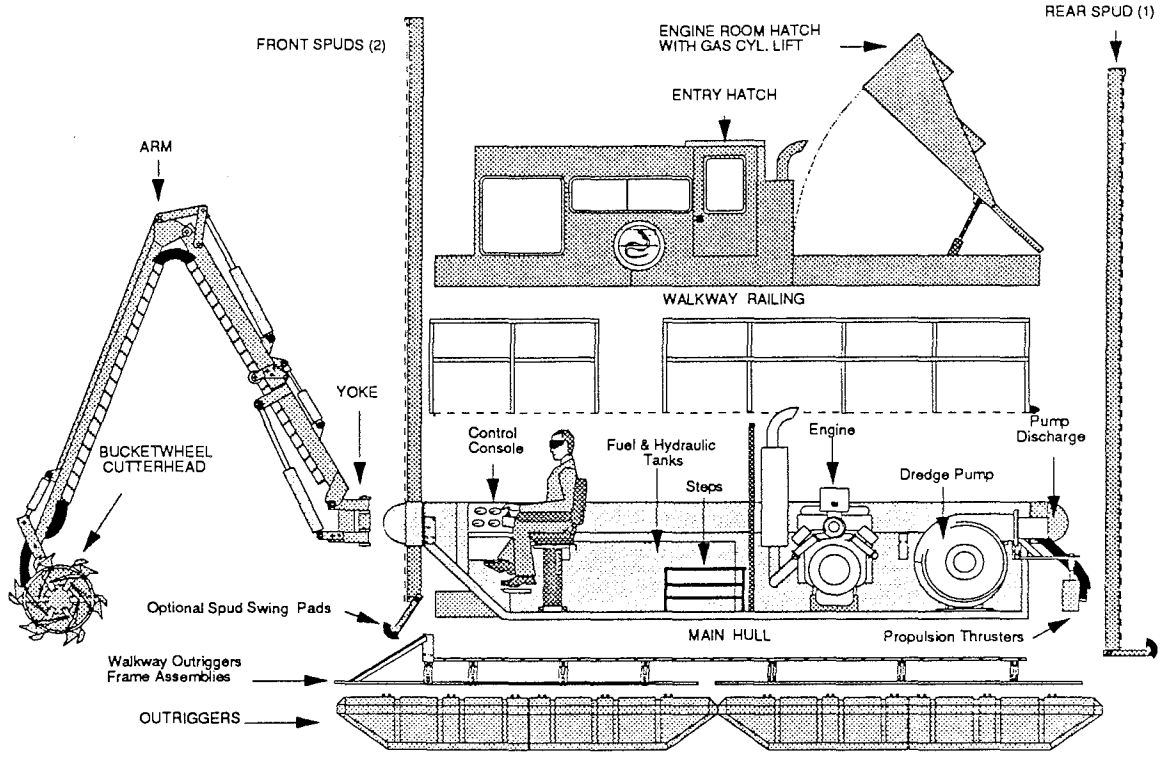
Information received from the following companies is presented in this Appendix :

1.	Keene Engineering Co.	"Nessie"
2.	Aquatics Unlimited	"Aquamog"
3	Ellicott Machine Corp.	"Mudcat"
4.	Dredgemasters International	"Mudmaster"
5.	Dredging Supply Co., Inc.	"Barracuda"
6.	Innovative Material Systems Inc.	"Versi-Dredge"
7.	Oceaneering Technologies	"TCCD"

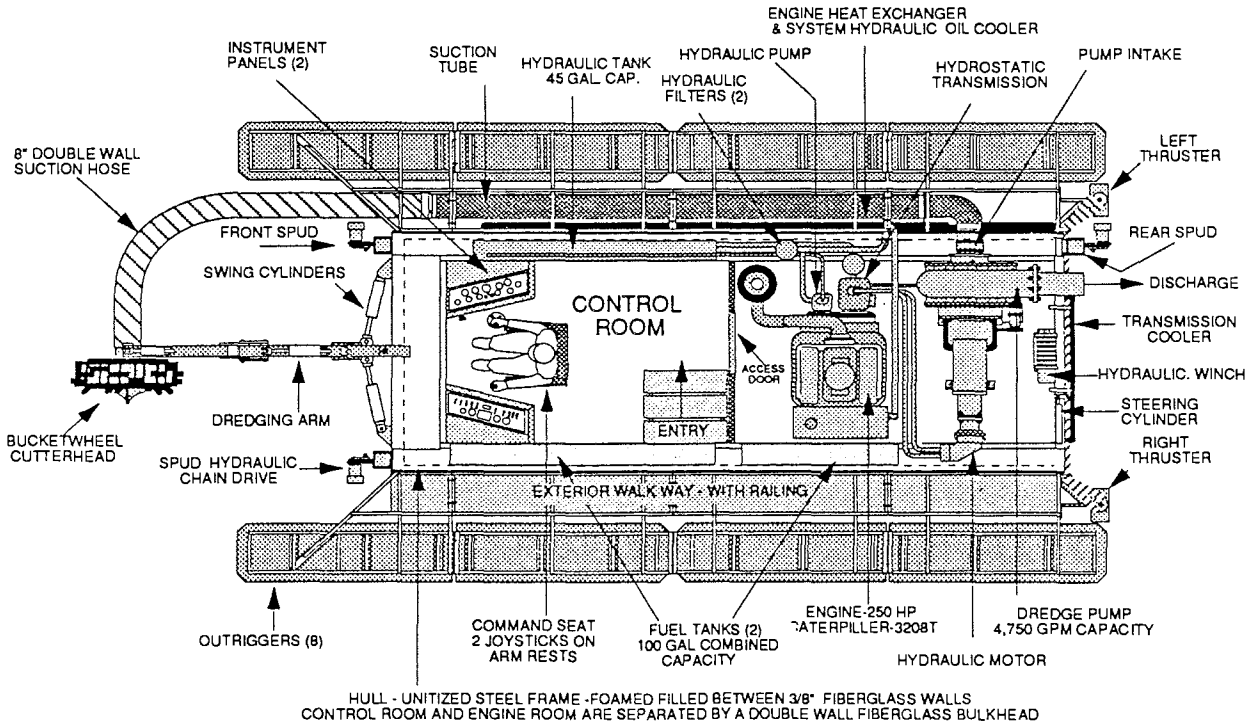
1

Keene Engineering Co. "Nessie"

SIDE PLAN VIEW NESSIE N8DX - GENERAL COMPONENTS



TOP PLAN VIEW NESSIE N8DX - GENERAL COMPONENTS



NESSIE-8DX DREDGE

SPECIFICATIONS MODEL 8DX

GENERAL			
Lenght of Frame	19'1"	Width of Frame	7'2"
Width with Outriggers	13'10"	Hull Height, Dry	89"
Draft (Depth in Water)	17"	Freeboard (Height in Water)	16"
Flotation, Outriggers	8 Floats	Weight of Dredge	14,500 Lbs.
Trailer Dimensions	28' x 8'4"	Weight of Trailer	2,500 Lbs.
Spuds (3each)	5" x 5" x 22'	Weight, each Spud	400 Lbs.
Cutterhead - 8 Inch Bucketwheel			
Dimensions:	36 inch Diameter x 24 inches Wide		
Hydraulic with 18:1 Gearbox		Weight: 540 Lbs.	
Torque:	4,167 Foot Pounds		
Automatic Swing Motion	Lenght of Cut:	6Feet at 45 Degrees	

ENGINE:				
Caterpillar Model 3208T	V-8 Diesel-Turbocharged			
12 Volt, Electric Start	Alternator: 12volts / 51Amps			
Max. Flyweel	Brake Horse Power	at	2,800 RPM	300 HP
Intermittend Duty**	Brake Horse Power	at	2,600 RPM	250 HP
Continiuous Duty***	Brake Horse Power	at	2,400 RPM	200 HP
FUEL CONSUMPTION	2,400 RPM	12.5 GPH		
(FULL LOAD)	At: 2,200 RPM	11.7 GPH		
	1,800 RPM	10.0 GPH		

KEENE DREDGING PUMPS:	
Model 6100 Material: Hi Chrome White Iron.	Hardness: 650 Brinell Minimum.
Impeller Design: Vortex, 8"x 8" x 25"	Weight of Pump: 2,130 Lbs.
Maximum Volume at 250 Horse Power:	4,600 Gallons Per Minute
Maximum Working Pressure:	231 Feet of head / 100 P.S.I.
Maximum Size of Passing Solid Sphere is 8 inches in diameter.	
Priming Pump-Model 350 Hydraulic Powered.	Size: 4x3 Intake & Discharge

HYDROSTATIC TRANSMISSION (Closed Loop)	
Pump	Sundstrand Model 90-Variable Displacement
Motor	Volvo Model F-250-Fixed Displacement
HYDRAULIC POWER SYSTEM (Open Loop)	
EATON "70422-RAU" Piston Pump, variable displacement with pressure / flow, compensated with Load Sensing Control. 2.77 cu.in / rev. = 29 GPM at 2,400 RPM	
Max. Rated Speed & Pressure = 3,000 RPM & 3,100 P.S.I.	
Directional Valves	Fully Integrated Electro-Hydraulic Cartridge System
Directional Controls	Twin Joystics

Model 8DX	**Price F.O.B. Factory (Less Hydraulic Trailer)**	**$127,000.00**
Model 8DXT	**Price F.O.B. Factory (Including Hydraulic Trailer)**	**$135,000.00**

** One hour of operation followed by an hour at or below the continuous rating.
*** Without interruption (Continuous)

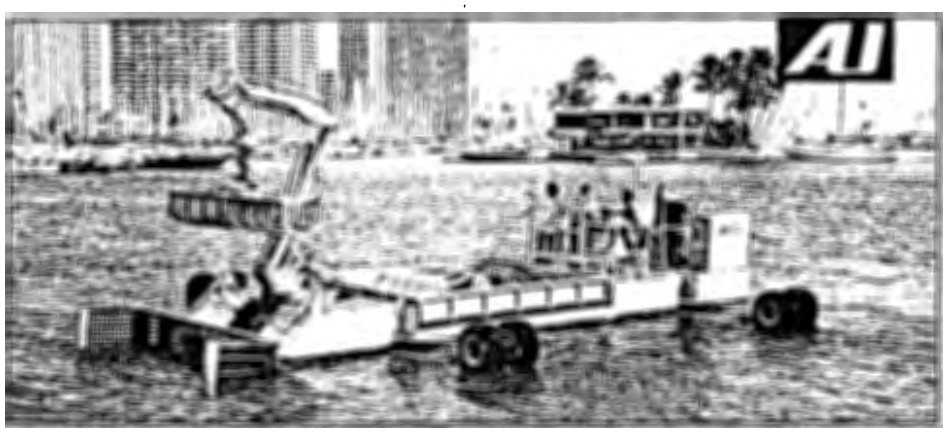
Prices and equipment are subject to change without notice.

2

Aquatics Unlimited "Aquamog"

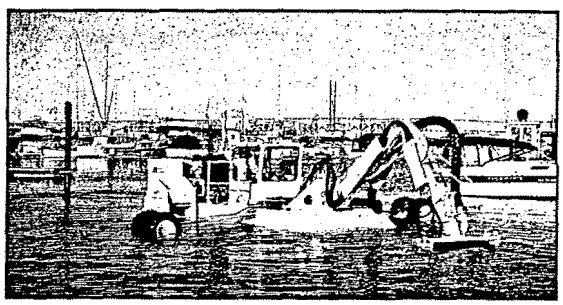
ENVIRONMENTAL RESPONSE VESSELS

Aquatics Unlimited is a design, manufacturing and service company that offers a complete line of Aquatic Ecosystem Creation, Restoration and Maintenance Equipment.



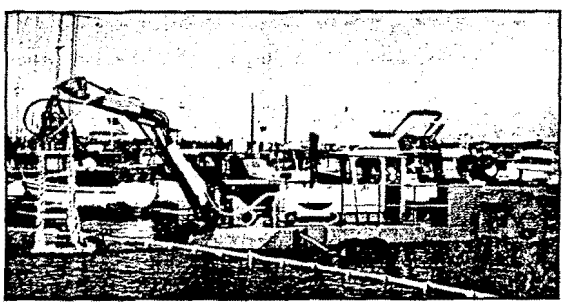
Harbor Mog HRX 109

The **HARBOR MOG** is a *shallow draft* / multi-purpose work boat designed to perform functions ranging from debris / oil cleanup to bucket / suction dredging to aquatic plant control operations to fire fighting to general maintenance activities using interchangeable attachments.



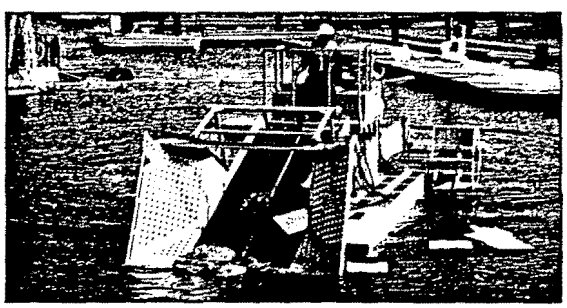
Aquamog SRX 109 / Suction Head

The **AQUATIC DEBRIS / OIL ABSORBENT RECOVERY SYSTEMS** are designed to harvest, transport and unload aquatic plants / kelp, debris and oil absorbents.



Aquamog PRX 163 / Oil Mop

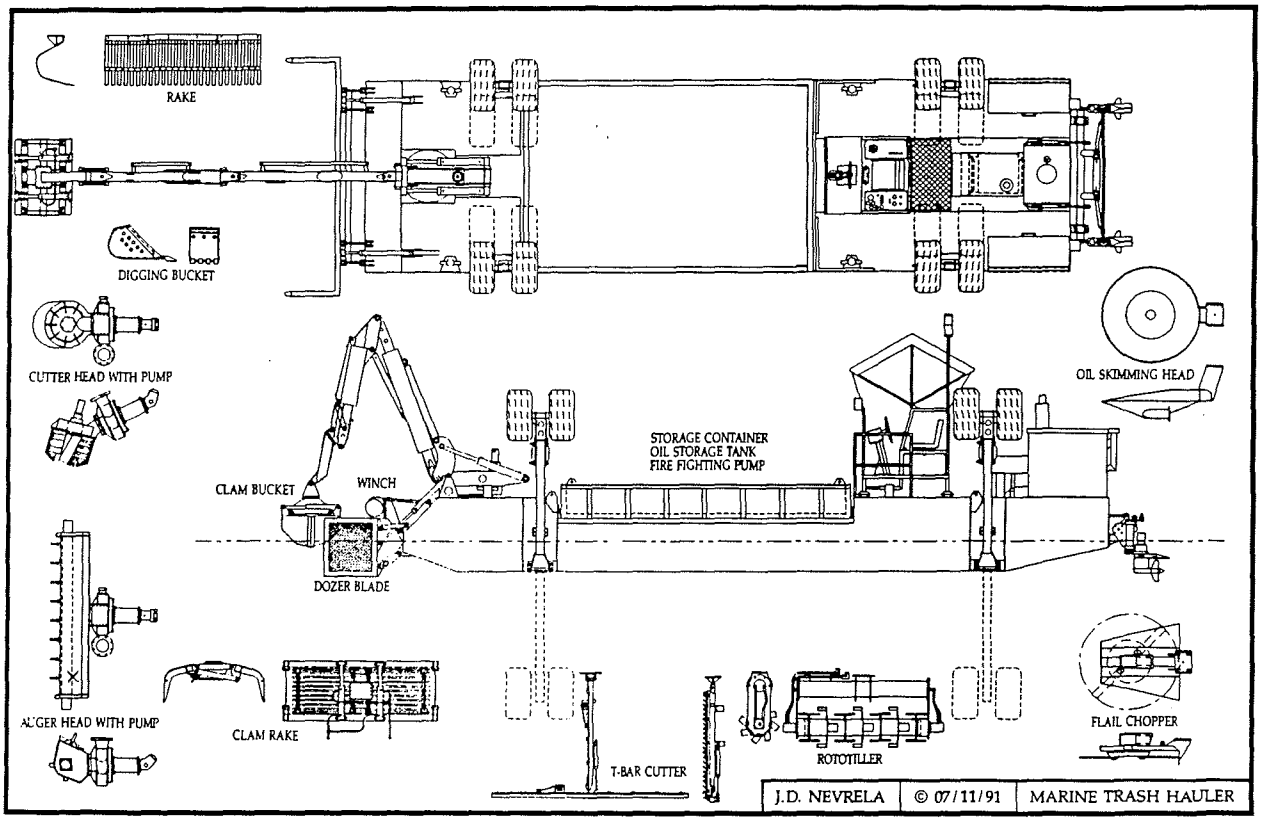
The **AQUAMOGS** are *shallow draft* / multi-purpose vessles that perform functions from debris / oil cleanup to bucket / suction dredging to emergent / submerged aquatic plant control using interchangeable attachments.



AURS8-200

Call us now to meet your **OPA 90** oil spill recovery requirements. The **AQUAMOGS** and **HARBOR MOG** can be equipped with the different types of skimmer and processor attachments available on the market and various tank configurations are available for oil storage.

AQUATICS UNLIMITED
2150 Franklin Canyon Road • Martinez, California 94553 • USA
Phone (510) 370-9175 • 1-800-243-8664 • Fax (510) 370-9179



Debris Control Tools
- **Skimmer/Collector Head 12' to 18'**
- **Clam Rake 8' x 5'**
- **Rake 8'**
- **Tool Rotator, 360 Continuous**
- **Hydraulic Winch, 9,600 Pound**
- **Crane Hook, 3,000 Pound**

Oil Spill Control Tools
- **Submersible Skimming Head**
- **3,000 Gallon Processing Tank**

Fire Fighting System
- **2,000 G.P.M. @ 100 P.S.I.**

Hydraulic Dredging Tools
- **Auger Head 8" Pump,** Dredges to a Depth of 15 ft., 150 T.D.H.
- **Cutter Head 36" Diameter,** 30,000 lb./In Torque, 150 ft. T.D.H.

Bucket Dredging Tools
- **Clam Bucket 48" - 0.7 Cubic Yard**
- **Clam Bucket 24" - 0.35 Cubic Yard**
- **Mud Bucket 48" - 0.4 Cubic Yard**
- **Digging Bucket 18" - 0.2 Cubic Yard**

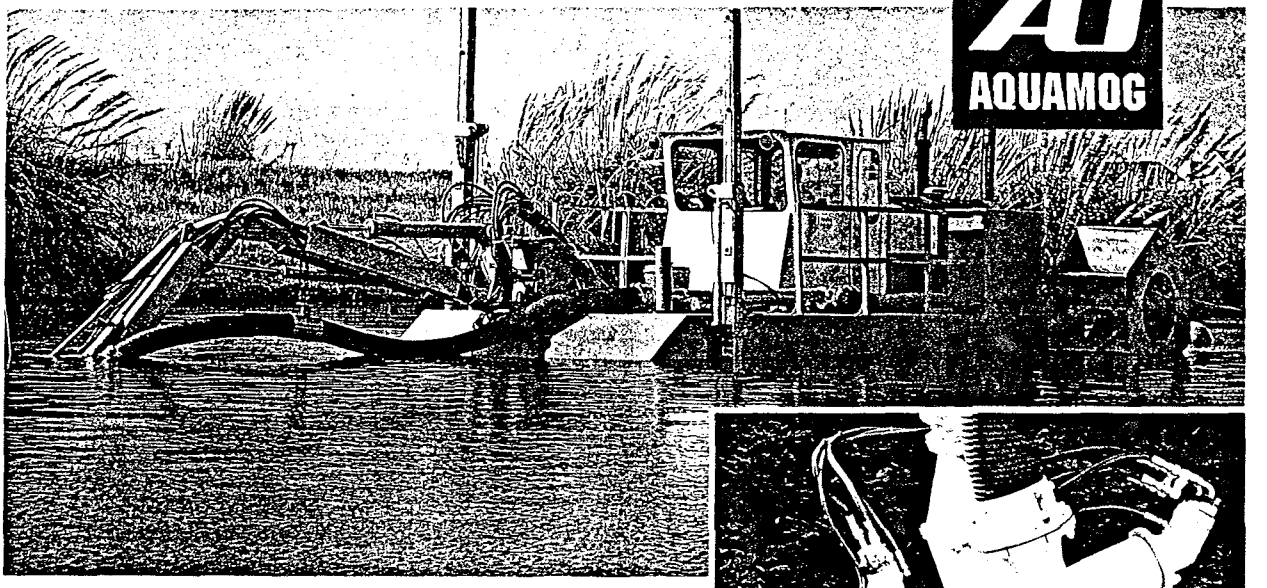
Aquatic Plant Control Tools
- **T-Bar Cutter,** For Submerged Plant Control
- **Rototiller,** Submerged Root Removal
- **Flail Chopper,** Emergent Plant Control

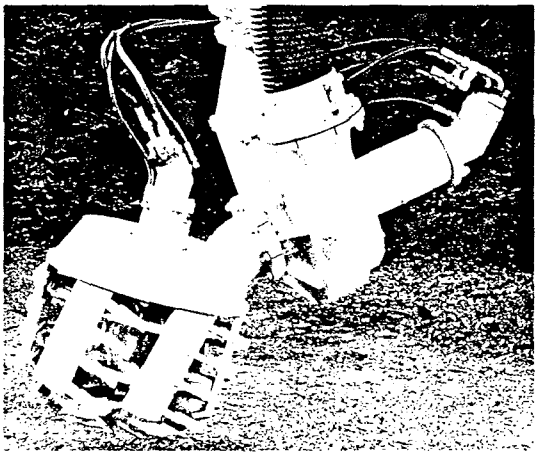
HARBOR MOG HRX-109 SPECIFICATIONS

Transport:	*Length*	40' 0"	12.20m
	Width	10' 0"	3.05m
	Height	9' 6"	2.9m
	Weight	32,000 lbs.	14,500kg
Dimensions:	*Length Operating*	44' 6"	13.56m
	Width Operating	10' to 27'	3.05m to 8.23m
	Width Minimum	10' 0"	3.05m
	Height Minimum	9' 6"	2.9m
	Height Above Water Line	8' 0"	2.44m
Vessel:	*Length*	37' 6"	11.43m
	Width	10' 0"	3.05m
	Depth	30"/46"	.076m/1.2m
	Material	Steel	Steel
	Water Tight Compartments	5	5
Payload Cont.:	*Length*	15' 0"	4.6m
	Width	10' 0"	3.05m
	Height	1.5'	0.5m
	Storage Volume	18 cu. yds.	14 cu.m
	Load	15,000 lbs.	7 Tons
Supports:	*Number*	4	4
	Vertical Movement	105 Deg.	105 Deg.
	Depth Maximum	8' 6"	2.6m
Propulsion:	*High Speed Dual Propeller Drive*		

Excavator:	*Depth at swing pin*	21' 0"	6.4m
	Horizontal Reach	26' 0"	8m
	Vertical Reach	22' 6"	6.9m
	Swing	360 deg.	360 deg.
		Continuous	Continuous
Power Unit:	*Engine*	John Deere	John Deere
	Model	4039T	4039T
	Aspiration	Turbo-Charged	Turbo Charged
	Power Rating	109HP @ 2500RPM	81KW @ 2500RMP
	Electrical System	12 Volt	12 Volt
	Fuel Tank Capacity	160 U.S. Gallons	600 Liters
Hydraulic System:	*System Pressure*	2,200/3,500 psi	150/240 bar
	16 Control Functions All Speeds Infinitely Adjustable		
Control Bridge:	*Visibility*	360 deg.	
	Open Deck, With Canopy and Operators Chair.		
Corrosion Protection:	*Paint*	Epoxy System	Epoxy System
	Anodes	Sacrificial	Sacrificial

All Specifications Subject to Change Without Notice





AQUAMOG PRX 163

- **Bucket Dredging**
- **Hydraulic Dredging, Auger/ Cutter Heads**
- **5,000 Foot Pumping Capacity**
- **Submerged/Emergent Aquatic Plant Control**
- **Debris Removal System**
- **Oil Spill Recovery System**
- **Interchangeable Tools**

Aquatics Unlimited's AQUAMOG PRX 163 LTL is the ultimate multi-purpose aquatic ecosystem creation, restoration and maintenance vessel.

The AQUAMOG performs functions ranging from bucket/suction dredging to submerged/emergent aquatic weed control using interchangeable attachments. Standard attachments range from clam/digging buckets to hydraulic cutter/auger heads for dredging and flail/sickle mowers to rototillers and rakes for aquatic weed control. Other attachments are available to meet specific job requirements such as stump cutters and tool rotators.

The AQUAMOG's excavating arm can reach a depth of more than 20 feet, a height of 20 feet, and swings a minimum of 180 degrees. A unique feature of the Aquamogs is their capacity for quick tool exchange that allows for interchangability from hydraulic to bucket dredging in a matter of minutes.

The AQUAMOG is the only piece of equipment available to perform all pond, lake, reservoir, canal, marsh or wetland maintenance requirements.

Aquatics Unlimited also produces the AQUAMOG SRX 109, the HARBOR MOG, and a complete line of Aquatic Weed Harvesting and Aeration Systems.

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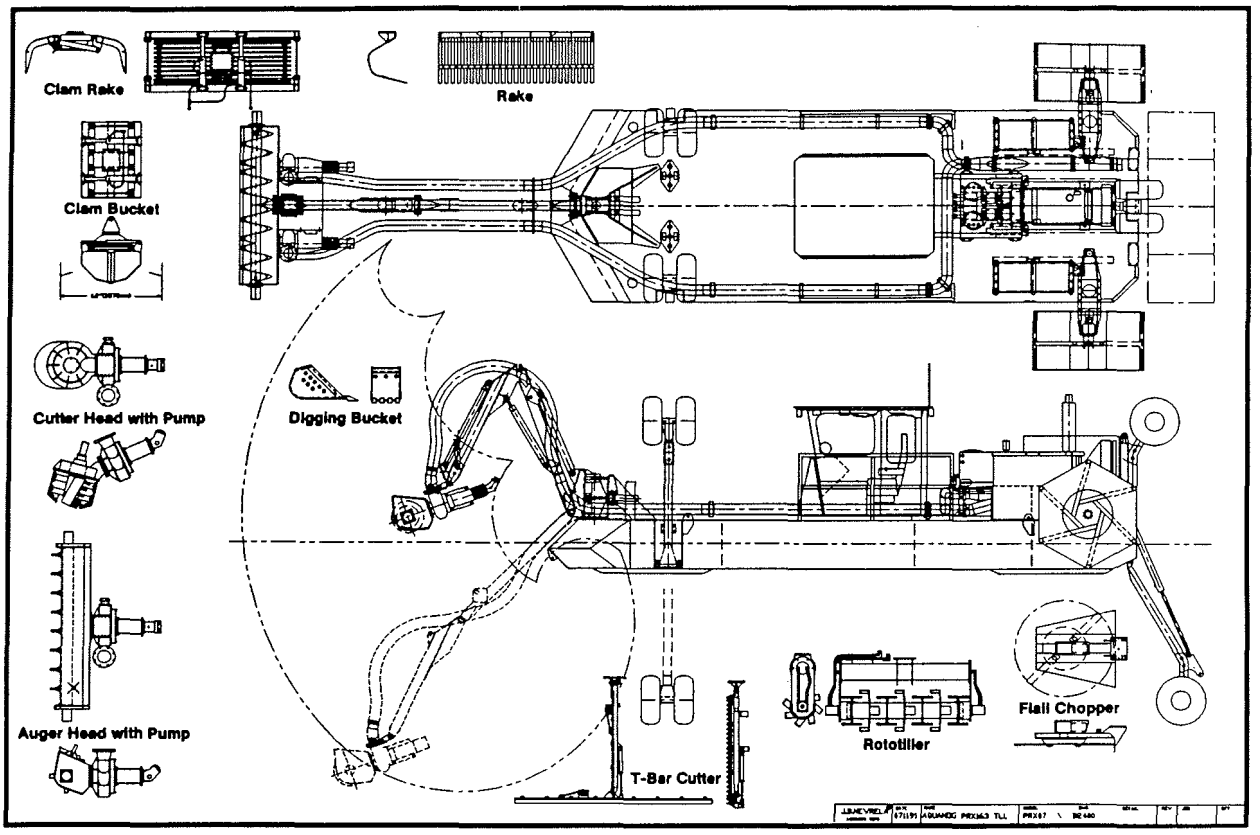


Hydraulic Dredging Tools

- **Auger Head 8′ Pump,** Dredges to a depth of 15′, 180 T.D.H.
- **Cutter Head 32″ Diameter,** 32,000 lb./in. torque, 180 ft. T.D.H.

Bucket Dredging Tools

- **Clam Bucket 48″,** 0.7 cu. yd.
- **Clam Bucket 24″,** 0.35 cu. yd.
- **Mud Bucket 48″,** 0.4 cu. yd.
- **Digging Bucket 18″,** 0.2 cu. yd.
- **Tool Rotator**
- **Hydraulic Reach Extensions**

Oil Spill Control Tools

- **Submersible Skimming Head**
- **3,000 Gallon Processing Tank**

Aquatic Plant Control Tools

- **T-Bar Cutter,** For submerged weed control. Cuts 10′ swath up to a depth of 20′
- **Flail Chopper,** Emergent plant control cuts Cattails and Brush up to a 4″ diameter in a 5′ swath
- **Rototiller,** Submerged root removal cuts an 8′ swath at up to a 15′ depth
- **Clam Rake,** 8′ width for trash/weed pick-up and disposal
- **Sweeper Rake,** Sweeps floating vegetation and debris in a 20′ wide swath

AQUAMOG PRX 163LTL Specifications

Transport Dimensions:
Length ..... 38′-8″ (11,800 mm)
Width ..... 10′-0″ (3,050 mm)
Height ..... 9′-2″ (2,800 mm)
Weight ..... 18,500 lbs. (8,400 kg)

Operating Dimensions:
Length Min. ..... 30′-8″ (9,300 mm)
Width ..... 17′-0″ (5,200 mm)
Width Min. ..... 10′-0″ (3,050 mm)
Height Min. ..... 9′-2″ (2,800 mm)
Height Above Water Line ..... 7′-8″ (2,340 mm)

Vessel:
Length ..... 30′-8″ (9,300 mm)
Width ..... 10′-0″ (3,050 mm)
Depth ..... 30″ (762 mm)
Material ..... 10 GA Steel
Water Tight Compartments 5

Propulsion:
Dual Independently Reversible Paddle .... 68″ dia. × 36″
Wheels Swing Away for Transport (1730 × 920 mm)

Supports:
Number 3
Vertical Movement ..... 105″ (2,670 mm)
Depth Max. ..... 8′-6″ (2,800 mm)
Tires ..... Dual
Diameter ..... 33″ (840 mm)
Width ..... 15″ (380 mm)
Make ..... Goodyear Terra
Size 12.5L-16

Excavator:
Depth (at swing pin) ..... 14 (4,300 mm)
Horizontal Reach ..... 18′ (5,500 mm)
Vertical Reach ..... 18′-6″ (5,700 mm)
Swing ..... 180°

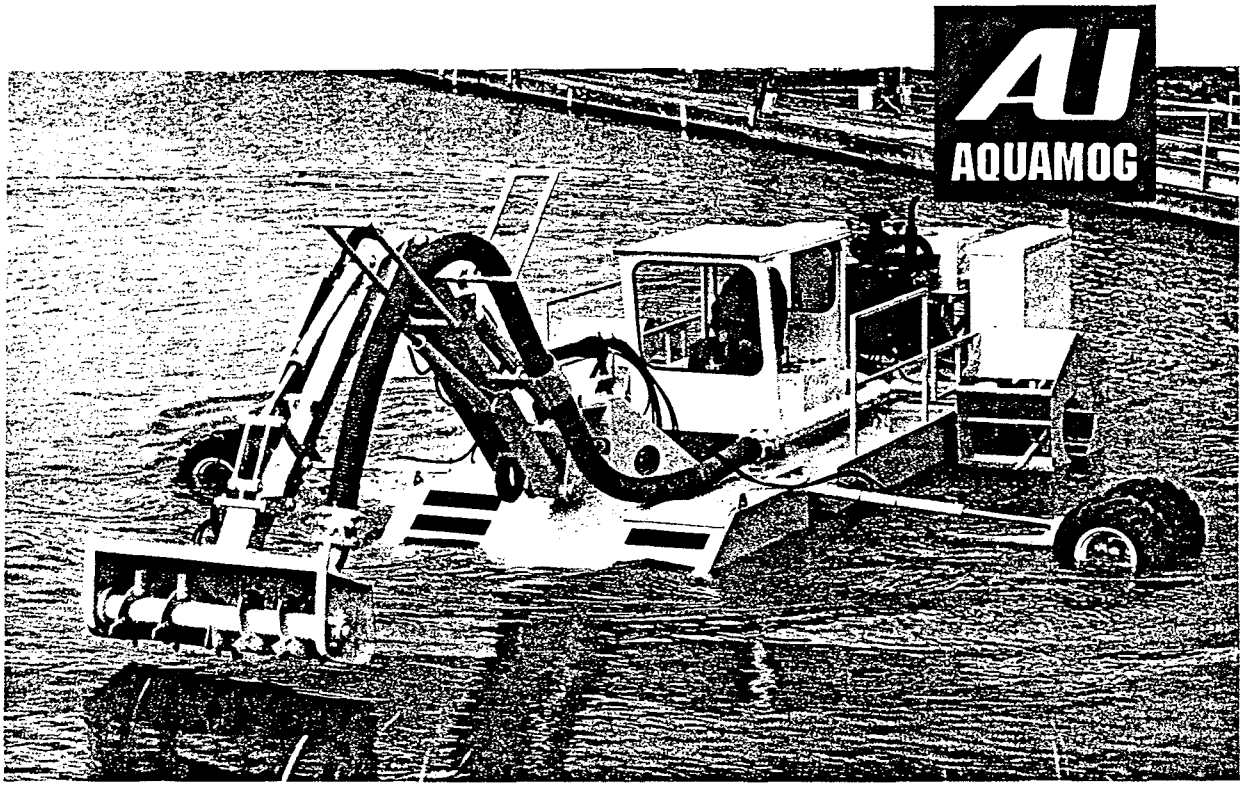
Power Unit:
Engine ..... John Deere
Model 6059T
Aspiration ..... Turbo-Charged
Power Rating ..... 163 hp/2,500 rpm (122 kw)
Electrical System ..... 12 V
Fuel Tank Capacity ..... 180 US gal. (606 liter)

Hydraulic System:
System Pressure ..... 2,200/3,500 psi (152/242 bar)
Pumps 4
Pressure Compensated, Variable Volume Pumps and Load Sensing Valves Control 13 Functions. All speeds infinitely adjustable.
Oil Cooling ..... Forced Air
Oil Reservoir ..... 120 US gal. (455 liter)

Control Bridge:
Enclosed Insulated Heated and Air Conditioned Cab. Operators Chair with Arm Rests ..... Visibility 360°

Corrosion Protection:
AM-E-POX Epoxy System

All Specifications Subject to Change Without Notice



AQUAMOG SRX 109

- **Bucket Dredging**
- **Hydraulic Dredging, Auger/ Cutter Heads**
- **2,500 Foot Pumping Capacity**
- **Submerged/Emergent Aquatic Plant Control**
- **Debris Removal System**
- **Oil Spill Recovery System**
- **Interchangeable Tools**

Aquatics Unlimited's AQUAMOG SRX 109 is a multi-purpose aquatic ecosystem creation, restoration and maintenance vessel — economy and transportability combined.

The AQUAMOG performs functions ranging from bucket/suction dredging to submerged/emergent aquatic weed control using interchangeable attachments. Standard attachments range from clam/digging buckets to hydraulic cutter/auger heads for dredging and flail/sickle mowers to rototillers and rakes for aquatic weed control. Other attachments are available to meet specific job requirements such as stump cutters and tool rotators.

The AQUAMOG's excavating arm can reach a depth of more than 20 feet, a height of 20 feet, and swings a minimum of 180 degrees. A unique feature of the Aquamogs is their capacity for quick tool exchange that allows for interchangability from hydraulic to bucket dredging in a matter of minutes.

The AQUAMOG is the only piece of equipment available to perform all pond, lake, reservoir, canal, marsh or wetland maintenance requirements.

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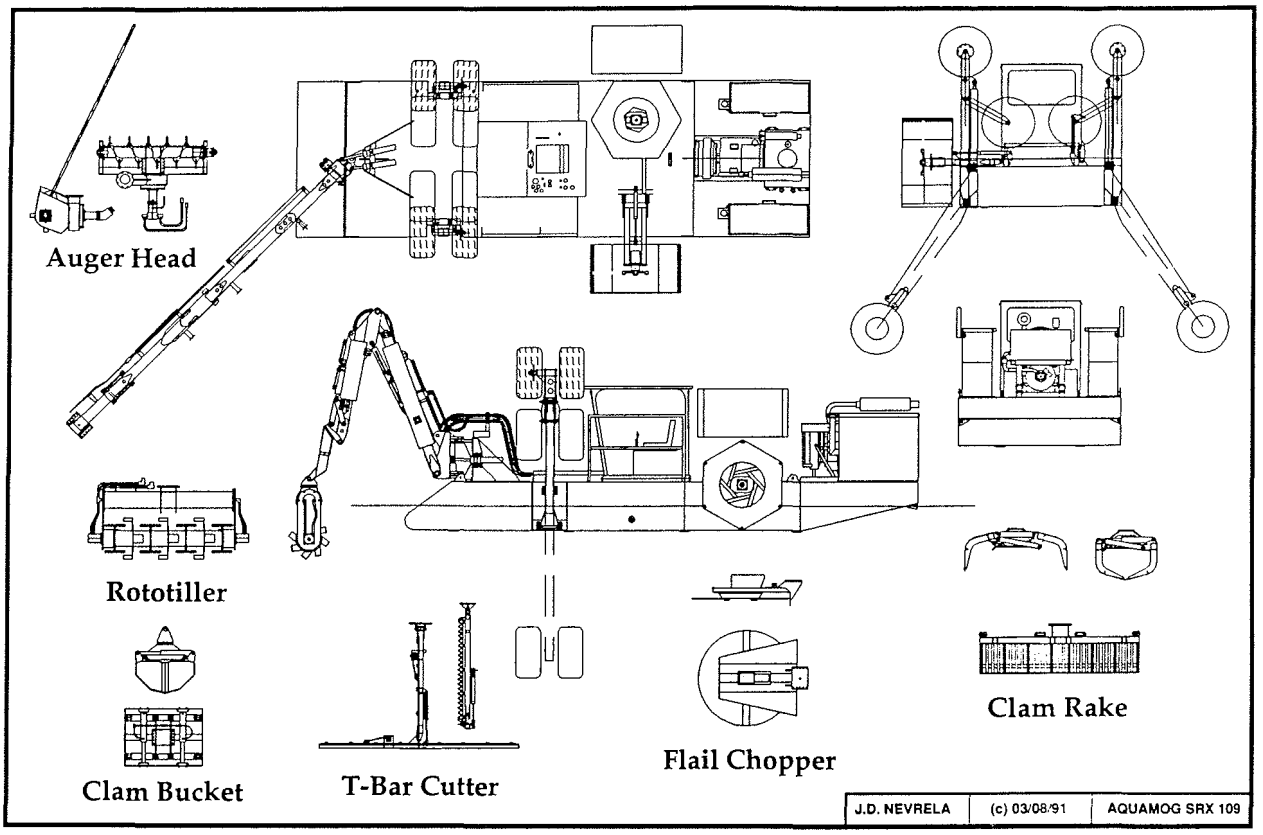


Hydraulic Dredging Tools

- **Auger Head 6" Pump,** Dredges to a Depth of 15', 90 Ft. T.D.H.
- **Cutter Head 26" Diameter,** 15,000 Lb./In. Torque, 90 Ft. T.D.H.

Bucket Dredging Tools

- **Clam Bucket 48"** - 0.7 Cubic Yard
- **Clam Bucket 24"** - 0.35 Cubic Yard
- **Mud Bucket 48"** - 0.4 Cubic Yard
- **Digging Bucket 18"** - 0.2 Cubic Yard
- **Tool Rotator**
- **Hydraulic Reach Extensions**

Aquatic Plant Control Tools

- **T-Bar Cutter,** For Submersed Weed Control Cuts 10' Swath up to a Depth of 20'
- **Flail Chopper,** Emergent Plant Control Cuts Cattails and Brush up to a 4" Diameter in a 5' Swath
- **Rototiller,** Submerged Root Removal Cuts a 6' 6" Swath at up to a 15' Depth
- **Clam Rake,** 8' Width for Trash/Weed Pick-up and Disposal
- **Sweeper Rake,** Sweeps Floating Vegetation and Debris in a 20' Wide Swath

AQUAMOG SRX 109 SPECIFICATIONS:

Transport:	Length	32'-10" (10,000 mm)
	Width	8'-2" (2,500 mm)
	Height	7'-6" (2,300 mm)
	Weight	13,800 lbs (6,300 kg)
Working Dimensions:	Length Min.	26'-6" (8,056 mm)
	Width Max. Operating	14'-2" (4,300 mm)
	Width Min.	8'-2" (2,500 mm)
	Height	7'-6" (2,300 mm)
	Height Above Water Line	6'-3" (1,910 mm)
Vessel:	Length	26'-0" (7,925 mm)
	Width	8'-2" (2,500 mm)
	Depth	30" (762 mm)
	Material	10 GA Steel (3.5 mm)
	Water Tight Compartments	4
Supports:	Number	2
	Vertical Movement	105°
	Depth Max.	9'-0" (2,750 mm)
	Tires	Dual
	Tire Diameter	33" (840 mm)
	Tire Width	15" (380 mm)
	Tire Make	Goodyear Terra
	Tire Size	12.5L-16
Propulsion:	Dual Independently Reversible Paddle Wheels.	58" dia. x 30" (1480 x 760 mm)
	Paddle Wheels Retract Hydraulically for Transport.	

Excavator:	Depth (at swing pin)	14' (4,300 mm)
	Horizontal Reach	18' (5,400 mm)
	Vertical Reach	18'-8" (5,700 mm)
	Swing	180°
Power Unit:	Engine	John Deere
	Model	4039T
	Aspiration	Turbo-Charged
	Power Rating	109 hp/2,500 rpm
	Power Rating (Metric)	82 kw/2500 rpm
	Electrical System	12 V
	Fuel Tank Capacity	160 U.S. Gal. (600 liters)
Hydraulic System:	System Pressure	2,850/2,000 psi (200/140 bar)
	Pumps	2
	Pressure Compensated, Variable Volume Pumps and Load Sensing Valves Control 12 Functions. All Speeds are Infinitely Adjustable.	
	Oil Cooling	Forced Air
	Oil Reservoir	78 U.S. Gal. (300 Liters)
Control Bridge:	Cage Type with Roof, Front and Rear Walls with Windows and Open Sides.	Visibility 360°
Corrosion Protection:	Epoxy System	

All Specifications Subject to Change Without Notice

3

Ellicott Machine Corp. "Mudcat"

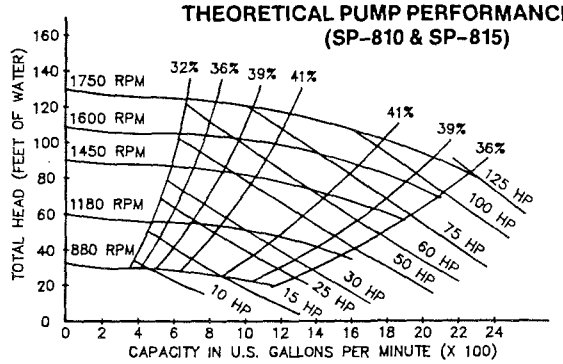
MACHINE SPECIFICATIONS

Model SP-810

General:	Length (O.A.)	25'6"
	Width (O.A.)	8'0"
	Height (O.A.)	8'9½"
	Weight	12,200 lbs. dry
	Draft	22"
	Fuel Capacity	100 gallons
Flotation:	Pontoons—Two 30" x 32" x 22'6" 12 Gauge Steel with Internal Bulkheads and Stiffeners; formed for rigidity; polyurethane foam filled.	
Cutter Assembly:	Auger:	
	Diameter	9"
	Pitch	9"
	Flighting	⅜"
	Speed	Variable to 89 RPM
	Cutter Knives	Detachable Heat-Treated Blades
	Auger Torque	11,000 in. lbs.(nominal) 12,000 in. lbs. (peak)
Mud Shield:	14"x8' Adjustable position	
Working Capacity:	Cut 8' wide x 18" maximum depth	
	Operating Depth	15' maximum
Engine:	Detroit Diesel 4-53T Model 5043-8301 w/N-65 injectors; 160 BHP @ 2100 RPM	
Drive:	Engine	Direct Hydraulic Dual Pump Drive
Pump:	Centrifugal Recessed Impeller	
	Impeller Diameter	12"
	Suction Diameter	6"(8" available as option)*
	Discharge Diameter	6"
	Nominal Pump Performance	1000 GPM against 100' Head (water) @ 1600 RPM
	Lead in Screw (optional)*	
Hydraulic System:	Variable Displacement, Axial Piston, Hydraulic Pump	
	Fixed Displacement Hydraulic Motor	
	Capacity Total	67.6 GPM @ 2100 RPM (engine speed)
	Reservoir	30 Gallons at full mark
	Circuit One	Auger Drive, Boom, Mud Shield and Winch
	Circuit Two	Centrifugal Pump Drive
	Relief Valve Setting:	
	Auger and Accessories	2000 PSI
	Centrifugal Pump	3750 PSI
Propulsion:	Treble Sheave Hydraulic Winch (9" Drum Winch optional)*	
	Traverse Speed	32 FPM Maximum Forward & Reverse
	Average Cutting Speed	8 to 12 FPM
Electrical System:	Voltage	12V
	Alternator Output	42 Ampere
	Battery	12V, 205 Ampere Hour
Finish:	Polyurethane finish coat on corrosion inhibitive primer.	
Colors:	Standard Colors	Red, White and Blue
NOTE:	Specifications Subject To Change Without Notice.	
	Optional configurations quoted upon request.	

*These options are recommended for applications involving thick viscous sludges.

THEORETICAL PUMP PERFORMANCE CURVE (SP-810 & SP-815)



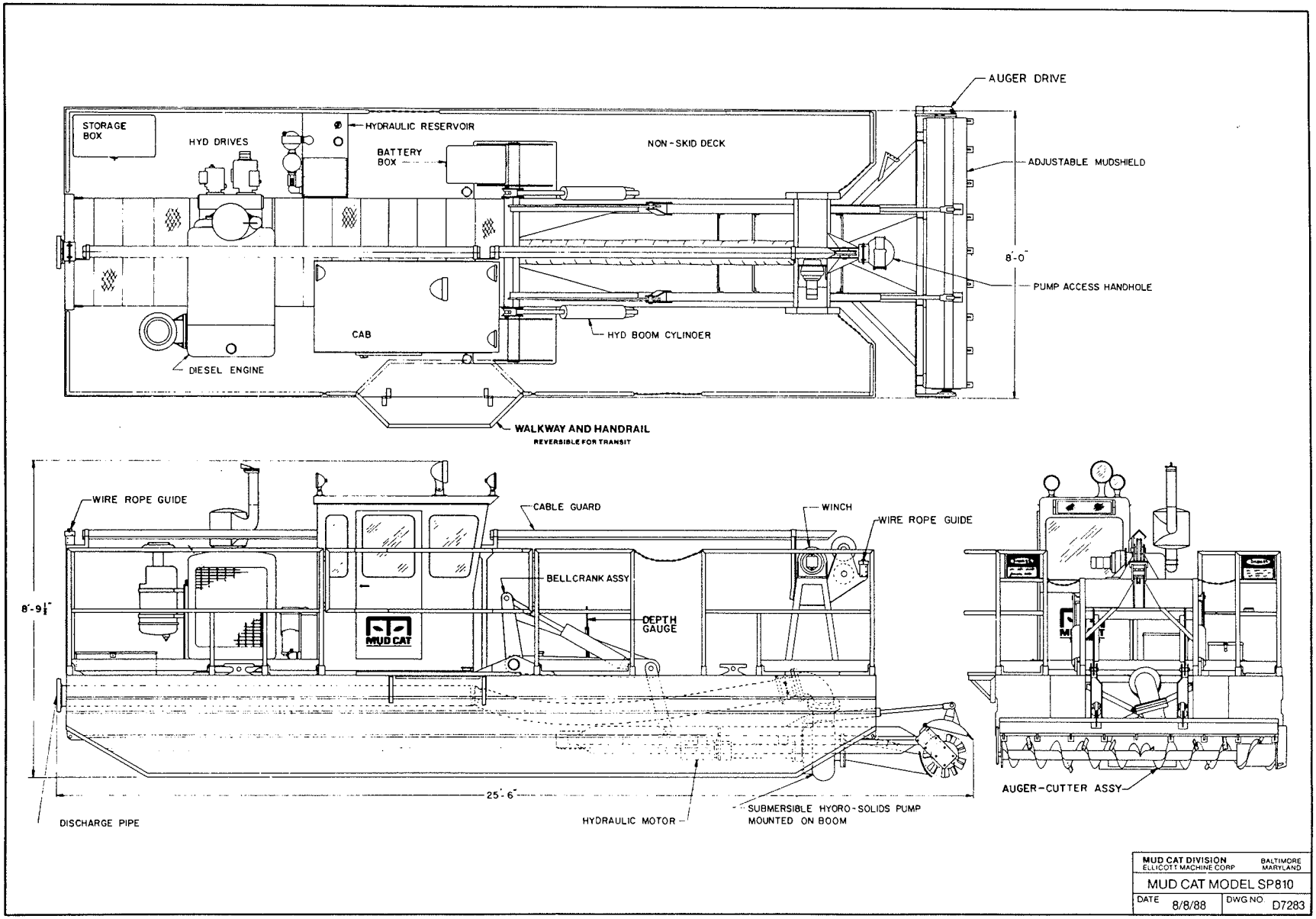
Impeller Dia — 12 Inch
No. of Vanes — 8
Type of Vanes — Recessed
S.G. of Liquid — 1.0

NOTE:
The theoretical performance curve indicates capacity for pumping water only. Contact MUD CAT DIV. ELLICOTT for information regarding capacities for pumping material.

MUD CAT DIV.®
ELLICOTT MACHINE CORP.

1611 Bush Street
Baltimore, Maryland
21230 U.S.A.

MUD CAT machines are operating in a growing list of countries throughout the world. To obtain complete information, call the MUD CAT DIVISION of ELLICOTT MACHINE CORPORATION
Phone: 301/837-7900, 410 -
FAX: 301/752-3294 410 -
Telex: 87621.


AUGER DRIVE
STORAGE BOX
HYD DRIVES
HYDRAULIC RESERVOIR
BATTERY BOX
NON-SKID DECK
ADJUSTABLE MUDSHIELD
8'-0"
PUMP ACCESS HANDHOLE
CAB
HYD BOOM CYLINOER
DIESEL ENGINE
WALKWAY AND HANDRAIL
REVERSIBLE FOR TRANSIT
WIRE ROPE GUIDE
CABLE GUARD
WINCH
WIRE ROPE GUIDE
BELLCRANK ASSY
8'-9½"
DEPTH GAUGE
MUD CAT
25'-6"
AUGER-CUTTER ASSY
DISCHARGE PIPE
HYDRAULIC MOTOR
SUBMERSIBLE HYORO-SOLIDS PUMP MOUNTED ON BOOM
MUD CAT DIVISION
ELLICOTT MACHINE CORP
BALTIMORE MARYLAND
MUD CAT MODEL SP810
DATE 8/8/88
DWG NO. D7283

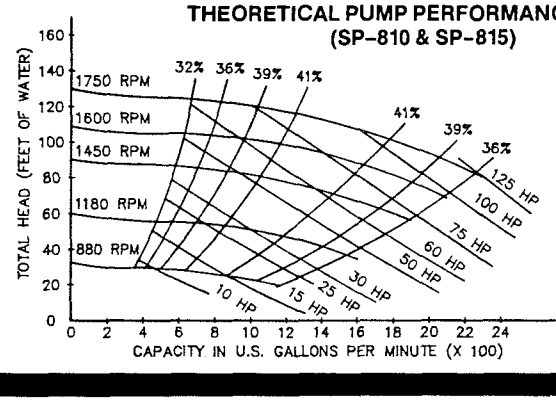
MACHINE SPECIFICATIONS

Model SP-815

General:	Length (O.A.)	31'1"
	Width (O.A.)	8'0"
	Height (O.A.)	8'9½"
	Weight	13,200 lbs. dry
	Draft	22"
	Fuel Capacity	100 gallons
Flotation:	Pontoons—Two 30" x 32" x 25'0" 12-Gauge Steel with Internal Bulkheads and Stiffeners; formed for rigidity; polyurethane foam filled.	
Cutter Assembly:	Auger:	
	Diameter	9"
	Pitch	9"
	Flighting	⅜"
	Speed	Variable to 89 RPM
	Cutter Knives	Detachable Heat-Treated Blades
	Auger Torque	11,000 in. lbs.(nominal) 12,000 in. lbs. (peak)
Mud Shield:	14"x8' Adjustable position	
Working Capacity:	Cut 8' wide x 18" maximum depth	
	Operating Depth	15' maximum
Engine:	Detroit Diesel 4-53T Model 5043-8301 w/N-65 injectors; 160 BHP @ 2100 RPM	
Drive:	Engine	Direct Hydraulic Dual Pump Drive
Pump:	Centrifugal Recessed Impeller	
	Impeller Diameter	12"
	Suction Diameter	6"(8" available as option)*
	Discharge Diameter	6"
	Nominal Pump Performance	1000 GPM against 100' Head (water) @ 1600 RPM
	Lead in Screw (optional)*	
Hydraulic System:	Variable Displacement, Axial Piston, Hydraulic Pump	
	Fixed Displacement Hydraulic Motor	
	Total Capacity	67.6 GPM @ 2100 RPM (engine speed)
	Reservoir	30 Gallons at full mark
	Circuit One	Auger Drive, Boom, Mud Shield and Winch
	Circuit Two	Centrifugal Pump Drive
	Relief Valve Setting:	
	Auger and Accessories	2000 PSI
	Centrifugal Pump	3750 PSI
Propulsion:	Treble Sheave Hydraulic Winch (9" Drum Winch optional)*	
	Traverse Speed	32 FPM Maximum Forward & Reverse
	Average Cutting Speed	8 to 12 FPM
Electrical System:	Voltage	12V
	Alternator Output	42 Ampere
	Battery	12V, 205 Ampere Hour
Finish:	Polyurethane finish coat on corrosion inhibitive primer.	
Colors:	Standard Colors	Red, White and Blue
NOTE:	Specifications Subject To Change Without Notice.	
	Optional configurations quoted upon request.	

*These options are recommended for applications involving thick viscous sludges.

THEORETICAL PUMP PERFORMANCE CURVE (SP-810 & SP-815)



Impeller Dia — 12 Inch
No. of Vanes — 8
Type of Vanes — Recessed
S.G. of Liquid — 1.0

NOTE:
The theoretical performance curve indicates capacity for pumping water only. Contact MUD CAT DIV. ELLICOTT for information regarding capacities for pumping material.

MUD CAT DIV®
ELLICOTT MACHINE CORP.

1611 Bush Street
Baltimore, Maryland
21230 U.S.A.

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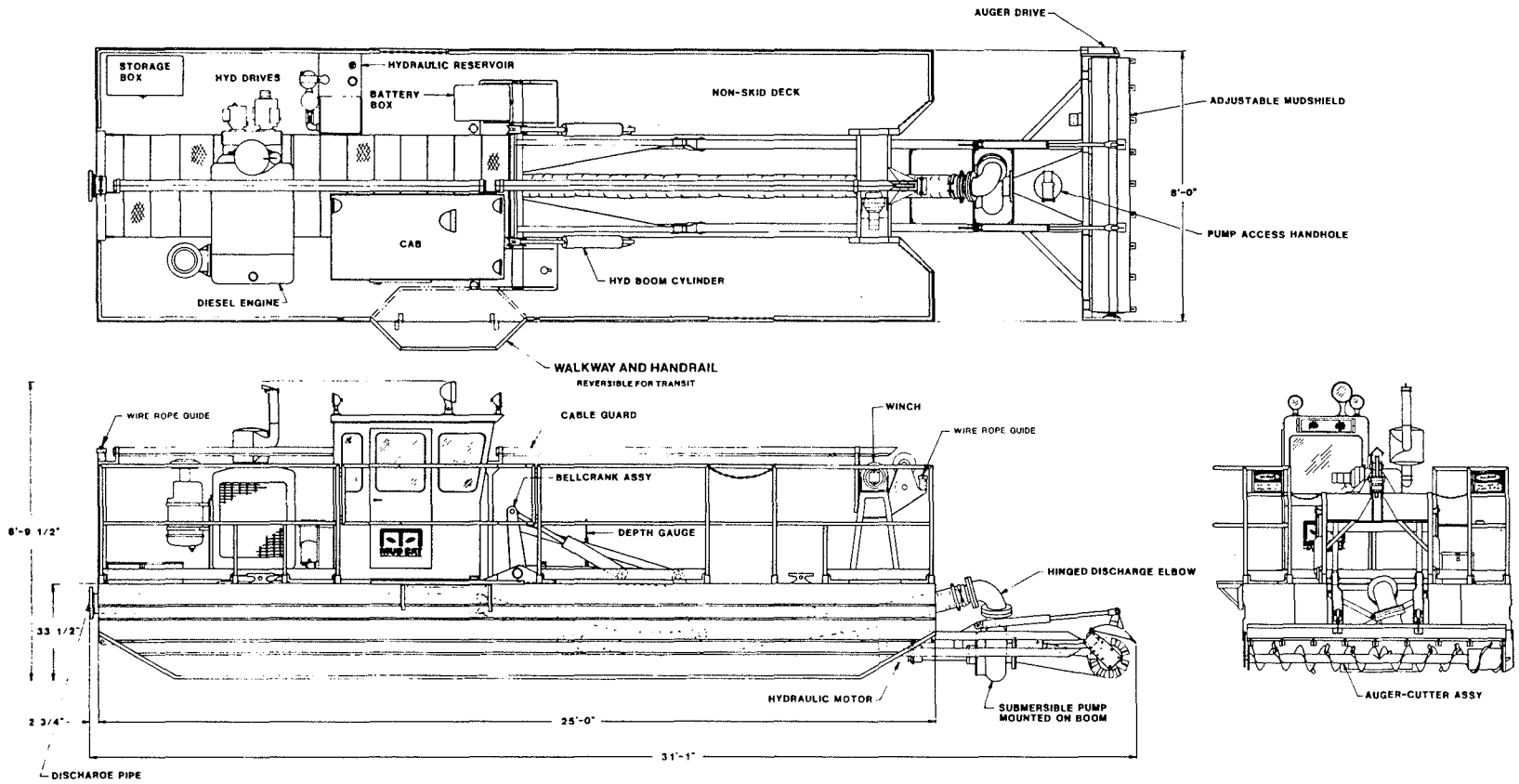


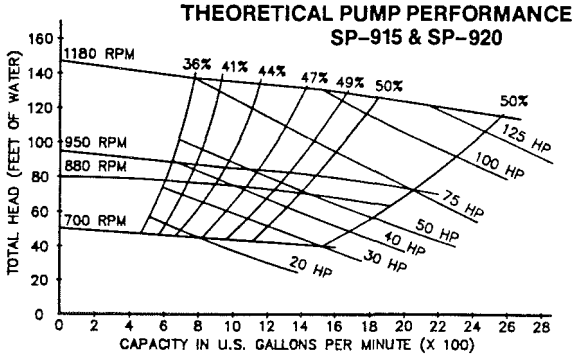
MUD CAT DIVISION ELLICOTT MACHINE CORP	BALTIMORE MARYLAND
MUD CAT MODEL SP815	
DATE 8/8/88	DWG NO. D7403

MACHINE SPECIFICATIONS

Model SP-915

General:	Length (O.A.)	39'5½"
	Width (O.A.)	9'0"
	Height (O.A.)	8'8"
	Weight	23,000 lbs. dry
	Draft	21"
	Fuel Capacity	360 gallons
Flotation:	Pontoons—Two 36" x 32" x 33'0" 10 Gauge Steel with Internal Bulkheads and Stiffeners; formed for rigidity; polyurethane foam filled.	
Cutter Assembly:	Auger:	
	Diameter	13⅝"
	Pitch	11"
	Flighting	⅜"
	Speed	Variable to 92.5 RPM
	Cutter Knives	Detachable Heat-Treated Blades
	Auger Torque	16,660 in. lbs.
Mud Shield:	19"x9' Hydraulically Adjustable	
Working Capacity:	Cut 9' wide x 18" maximum depth	
	Operating Depth	15' maximum
Engine:	Detroit Diesel 6-71 N; 175 Continuous BHP @ 1800 RPM	
Drive:	Engine	Direct Hydraulic Dual Pump Drive
Pump:	Centrifugal Recessed Impeller	
	Impeller Diameter	18"
	Suction Diameter	8" (10" available as option)*
	Discharge Diameter	6"
	Nominal Pump Performance	2000 GPM @ 1180 RPM against 124' Head (water)
	Lead in screw (option)*	
Hydraulic System:	Auger and Accessory Drive—Dual Pumps	
	Capacity Total	26.1 GPM @ 1800 RPM (Engine Speed)
	Reservoir	47 Gallons at full mark
	Circuit One	Auger Drive
	Circuit Two	Boom, Mud Shield and Winch
	Relief Valve Setting:	
	Auger	3000 PSI
	Others	1800 PSI
	Main Pump Drive—Single Pump	
	Variable Displacement Hydraulic Pump	
	Fixed Displacement Hydraulic Motor	
	Capacity	76 GPM @ 1800 RPM (Engine Speed)
	Reservoir	30 Gallons at full mark
	Relief Valve Setting	3750 PSI
Propulsion:	Double Wrap Sheave Hydraulic Winch	
	Traverse Speed	31 FPM Maximum Forward & Reverse
	Average Cutting Speed	8 to 12 FPM
Electrical System:	Voltage	12V
	Alternator Output	65 Ampere
	Batteries	(2) 12V, 205 Ampere Hour, Parallel Wired
	Circuits	2 Wire System Full Ground
Finish:	Polyurethane finish coat on corrosion inhibitive epoxy primer.	
Colors:	Standard Colors	Red, White and Blue.
NOTE:	Specifications Subject To Change Without Notice.	
	Optional configurations quoted upon request.	
	*These options are recommended for applications involving thick viscous sludges.	

THEORETICAL PUMP PERFORMANCE CURVE
SP-915 & SP-920



Impeller Dia — 18 Inch
No. of Vanes — 8
Type of Vanes — Recessed
S.G. of Liquid — 1.0

NOTE:
The theoretical performance curve indicates capacity for pumping water only. Contact MUD CAT DIV. ELLICOTT for information regarding capacities for pumping material.

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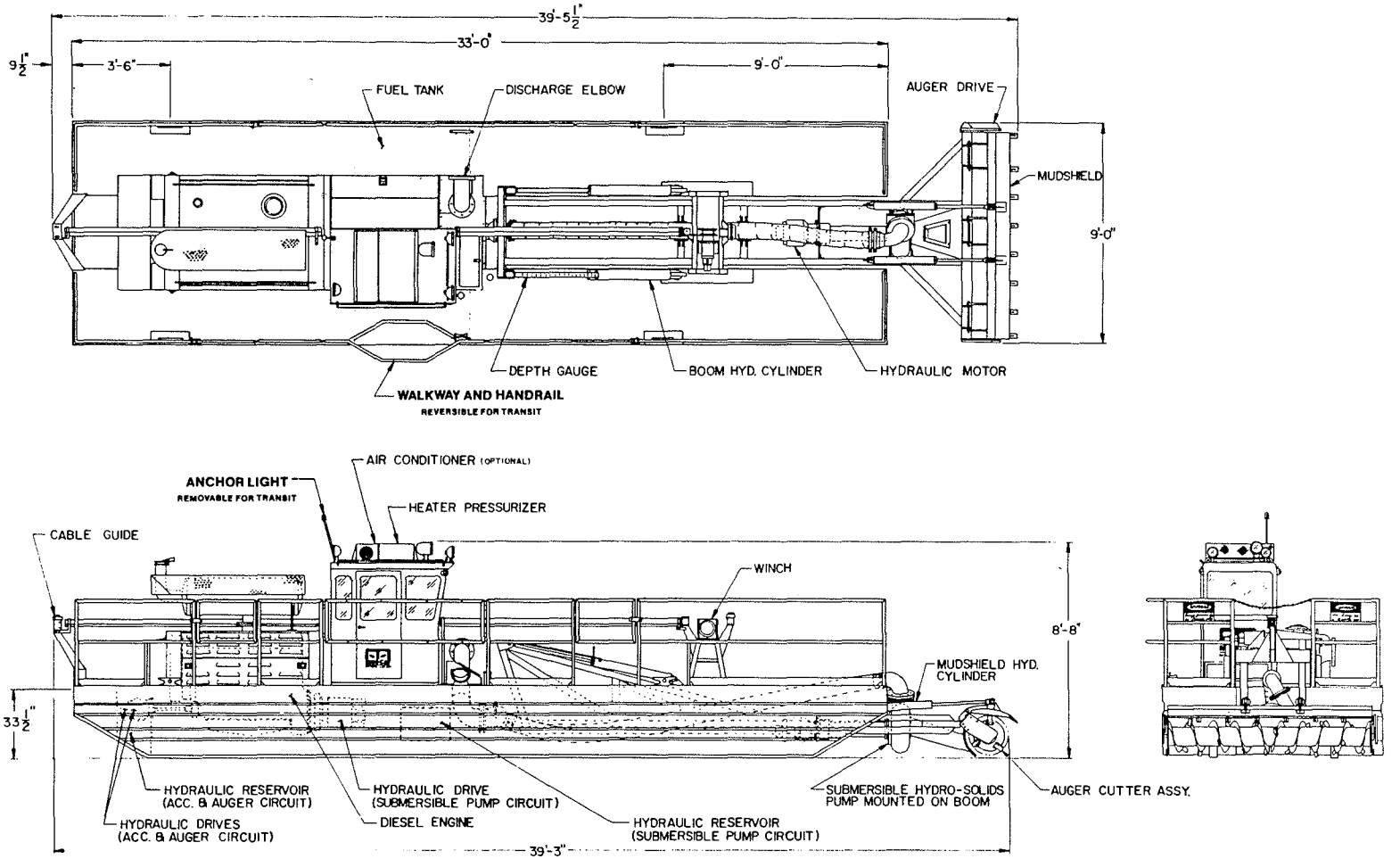


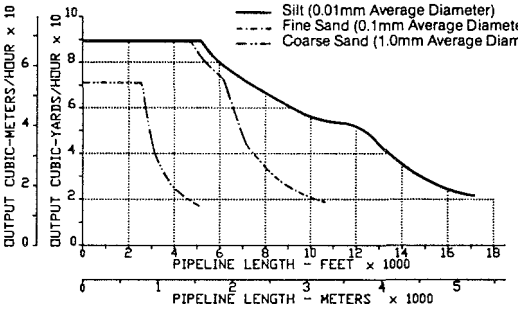
MUD CAT DIVISION ELLICOTT MACHINE CORP	BALTIMORE MARYLAND
MUD CAT MODEL SP915	
DATE 8/8/88	DWG NO. D9185

MACHINE SPECIFICATIONS

Model MC-915

General:	Length (O.A.)	39'1½"
	Width (O.A.)	9'0"
	Height (O.A.)	8'8"
	Weight	22,000 lbs. dry
	Draft	21"
	Fuel Capacity	360 gallons
Flotation:	Pontoons—Two 36" x 32" x 33'0" 10 Gauge Steel with Internal Bulkheads and Stiffeners; formed for rigidity; polyurethane foam filled.	
Cutter Assembly:	Auger:	
	Diameter	13⅜"
	Pitch	11"
	Flighting	⅜"
	Speed	Variable to 106 RPM
	Cutter Knives	Detachable Heat-Treated Blades
	Auger Torque	16,500 in. lbs.
	Rotates to Cut Slope up to 45 degrees	
Mud Shield:	19"x9' Hydraulically Adjustable	
Working Capacity:	Cut 9' wide x 18" maximum depth	
	Operating Depth	15' maximum
Engine:	Detroit Diesel 6-71N; 228 BHP @ 2100 RPM	
Drive:	Clutch—Manual, 14" Dia. Disc & Pressure Plate	
	Single Gear Reduction Ratio 1.8:1	
	Drive Coupling—Flexible Element Type	
Pump:	Centrifugal, Closed Impeller, 3 Vane	
	Impeller Diameter	19½"
	Suction Diameter	8"
	Discharge Diameter	8"
	Shaft Diameter	2⅞"
	Nominal Pump Performance	2000 GPM @ 1160 RPM against 176' Head
Service Water Pump:	Capacity	75 GPM @ 2800 RPM
	Pressure	184 Ft. Total Dynamic Head
Hydraulic System:	Dual Pumps	
	Capacity Total	30.0 GPM @ 2100 RPM
	Reservoir	47 Gallons at full mark
	Circuit One	Auger Drive
	Circuit Two	Boom, Mud Shield and Winch
	Relief Valve Setting:	
	Auger	3000 PSI
	Others	1800 PSI
Propulsion:	Treble Sheave Hydraulic Winch (13" Drum Winch optional)*	
	Traverse Speed	34 FPM Maximum Forward & Reverse
	Average Cutting Speed	8 to 12 FPM
Electrical System:	Voltage	12V
	Alternator Output	65 Ampere
	Batteries	(2) 12V, 205 Ampere Hour, Parallel Wired
	Circuits	2 Wire System Full Ground
Finish:	Polyurethane finish coat on corrosion inhibitive epoxy primer.	
Colors:	Standard Colors	Red, White and Blue.
NOTE:	Specifications Subject To Change Without Notice.	
	Optional configurations quoted upon request.	

CALCULATED OUTPUT CURVES
SERIES MC-915 & MC-920 DREDGES



8 Inch (203.2mm) Suction
8 Inch (203.2mm) Discharge
19.5 Inch (0.495m) Dia. Impeller
Max. RPM = 1160
Max. SHP = 140
10 Ft (3.04m) Terminal Elevation
15 Ft (4.57m) & 20 Ft (6.1m) Digging Depth

NOTE:
Calculated output curves indicate pumping capability only. When used for estimating actual outputs, the nature of the material and job conditions must be considered.

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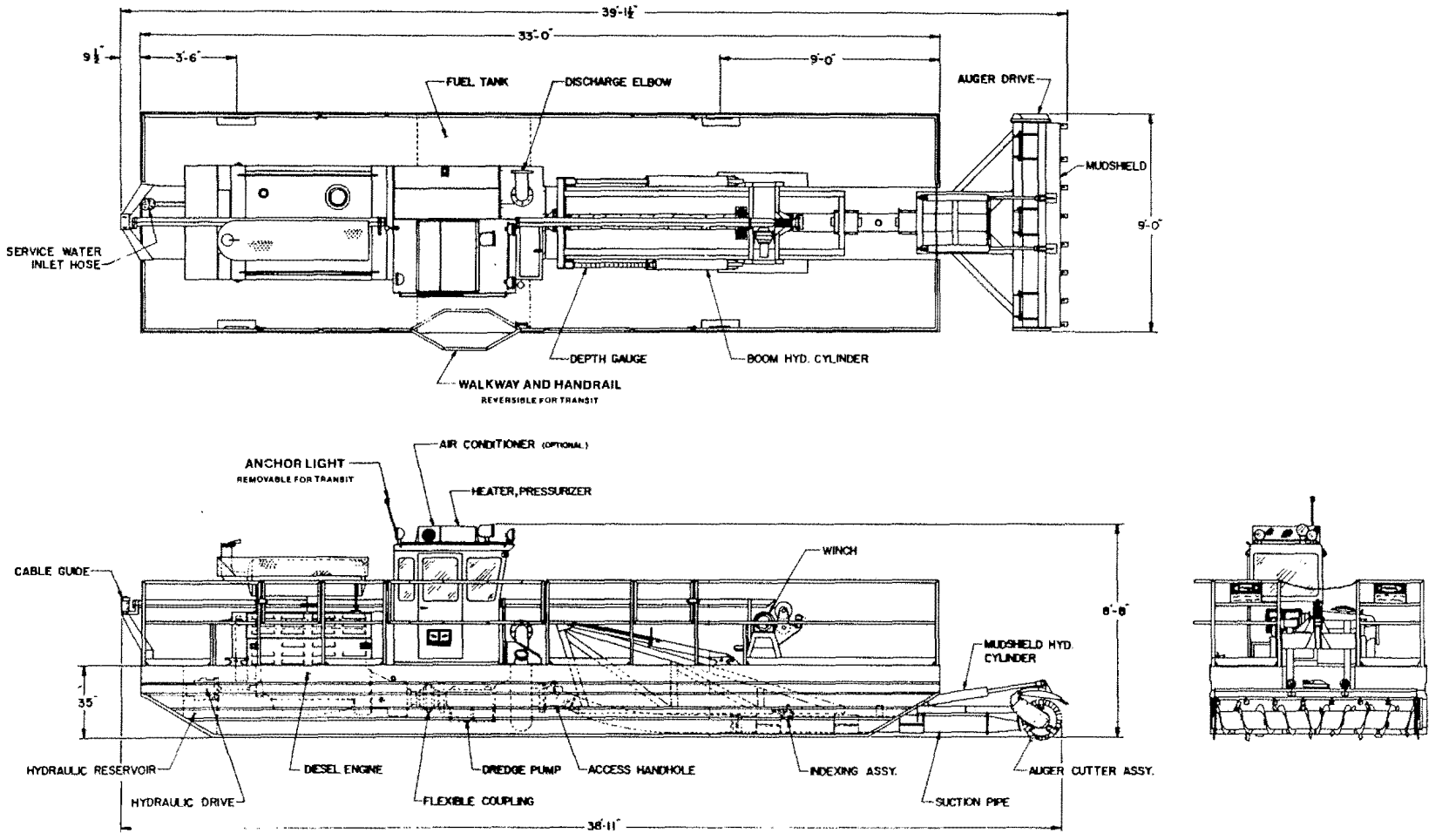

MUD CAT DIVISION ELLICOTT MACHINE CORP	BALTIMORE MARYLAND
MUD CAT MODEL MC915	
DATE 8/8/88	DWG NO. D9000

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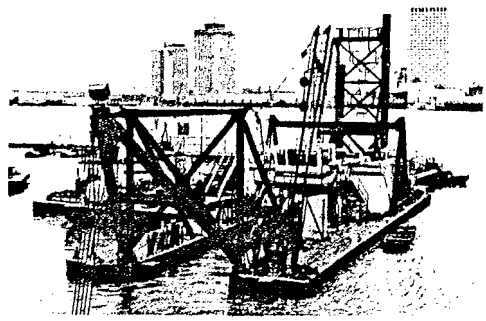
Dredgemasters International "Mudmaster"

RESEARCH AND DEVELOPMENT



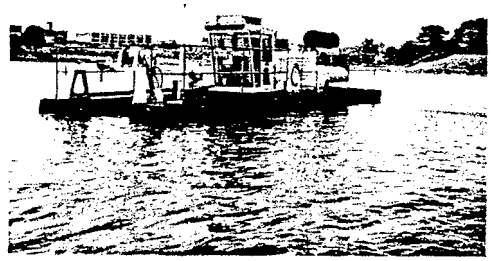
Progress at DredgeMasters International has evolved from our success in solving dredging problems, with each new obstacle demanding a bit more ingenuity than the last. Over the years, various other dredge manufacturers throughout the industry have attempted to develop original designs of one kind or another. Generally, the results of these ventures have either been too costly or too restricted in their application.

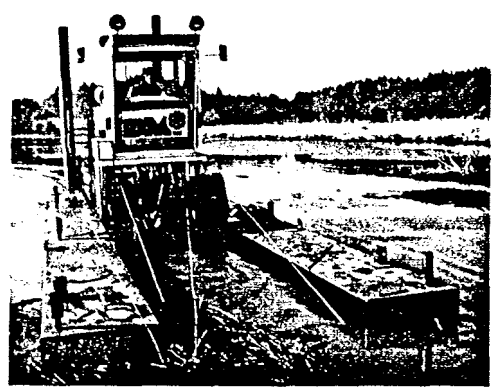
Real technological advances have been closely linked with answers to specific, clearly identified client needs. The MudMaster is indeed a technological breakthrough. It is widely regarded as the most revolutionary machine introduced to the dredging industry in the last quarter of a century.

The MudMaster, like its companion line of standard model DMI dredges, is a product of experienced dredge professionals. The same practicality, performance and quality engineered and built into our larger dredges has been the basic goal in the development of the MudMaster. It is a superbly crafted machine, inspired by a long standing tradition of excellence. It has the strong bloodlines of quality, designed and built to far exceed your production expectations.

This is not just a small dredge. This is a machine that has been critically needed by the dredging industry for years. A machine the industry has been waiting for...has, indeed, been demanding for many years. And now, it's available from DredgeMasters International.

SIMPLICITY IN DESIGN, FLEXIBILITY IN OPERATION





Simplicity is the cornerstone of MudMaster's success. The new arrangement is designed to facilitate economical construction, ease of mobilization and assembly, simplicity of operation and maintenance, and high operating efficiency. The overall design concept features many cost saving ideas which, at the same time, improve performance and reliability. This design also enables the MudMaster to operate and work in extremely shallow depths, which is critically important in the success or failure of many operations.

The flexibility and versatility of the MudMaster is completely unmatched in the industry. It is designed to handle a wide range of projects from cleaning small lakes and ponds, reservoirs and settling basins, to streams, canals, and drainage ditches. It is the first standard model machine ever introduced to back up, unconditionally, claims that other small dredge manufacturers only make. It is designed and built not just for normal small dredge operations, but for an extremely wide range of conditions. It is a truly functional piece of equipment that can be adapted and implemented to satisfy your small dredge needs whatever they may be. A variety of unique interchangeable ladder heads is available, designed to specifically and efficiently handle different materials and job conditions. The MudMaster is the only machine to offer the right tool for the right job.

PROPERLY ENGINEERED, ENERGY EFFICIENT SYSTEMS

MudMaster offers the broadest range of compact dredges in the world. They are available in six model sizes, from 4-inch, 40 horsepower units, to powerful 10-inch, 275 horsepower machines. Each is designed and engineered to provide for maximum efficiency and production at each model level. This means that you can select a standard model machine which will offer precisely the right amount of power without having to purchase more than you need, or having to overwork an undersized unit. The MudMaster is an innovative engineering concept with properly matched and balanced systems throughout, resulting in higher efficiency ratios at all levels.

Special consideration has been given to insure precise compatibility between the engine and the dredge pump for maximum efficiency and power savings. In a time of energy conservation, it is vital to invest in equipment offering real energy savings. MudMaster is in tune with our critical energy problems. The result is more production at less operating cost. That's important to consider!

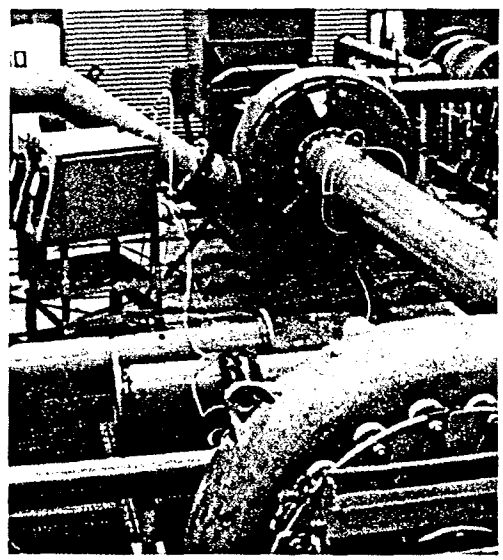
The dredge pump is designed and built to meet the same basic requirements of all HydraMaster pumps—simplicity, efficiency, long service life and smooth performance. Its application means no priming problems, and pump cavitation is virtually impossible. More importantly, the increased operational efficiency of the pump and direct drive result in higher output at significantly reduced power demand...more output, less power consumption...higher profits.

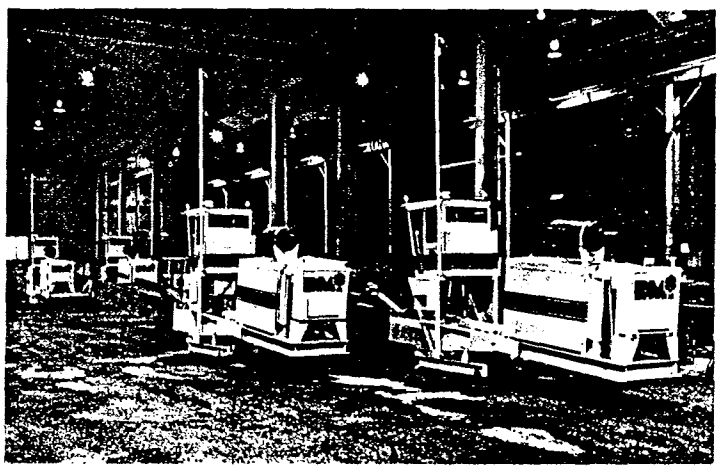
As increasing emphasis is placed on energy conservation, industry is faced with the need to design more fuel-efficient machines. DMI and MudMaster recognize and accept this important challenge.

Another prime consideration is the proper balance between cutter excavation capability and swing winch speed and capacity. Both of these systems are designed to complement each other for maximum performance and smooth operation.

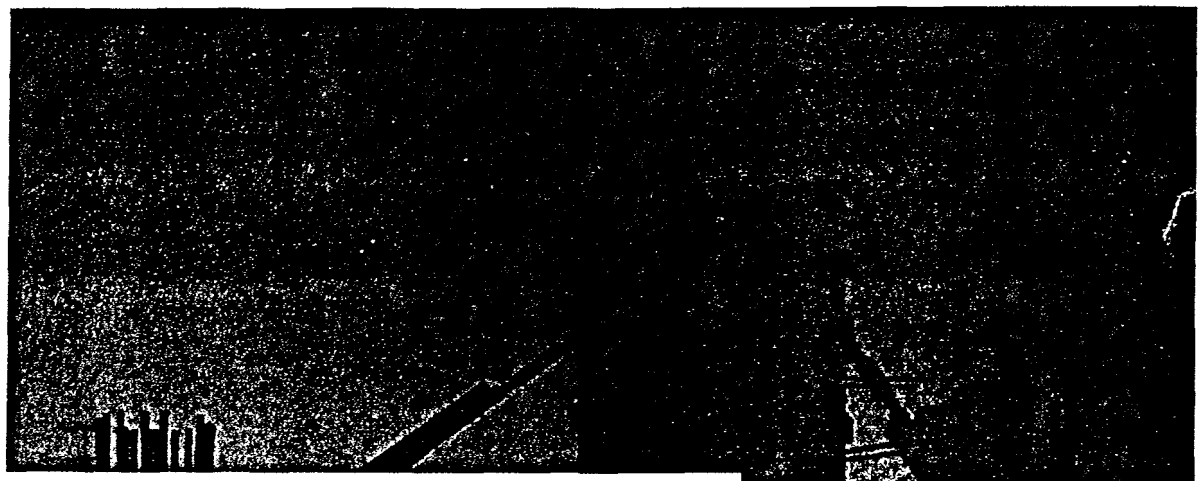
MudMaster is also the most portable machine of its kind anywhere. It can be transported from one job to another on one truck and, in most cases, fully assembled, without permits. While in some cases it may be necessary to remove the flotation pontoons, it only takes a few minutes and is hardly a factor when calculating mobilization time.

A specially designed road package featuring retractable wheels is also available as a special production option.

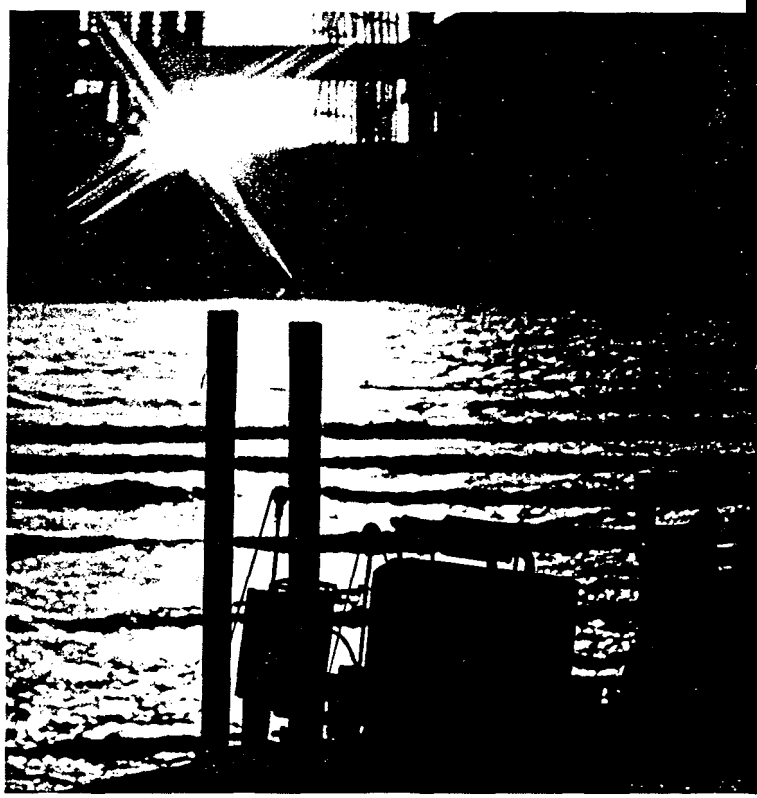




APPLICATIONS



Here at last is a carefully engineered, rugged dredging machine designed and built for small dredging jobs. Tough jobs, like freeing lakes of weed-choked overgrowth, mining coal or cleaning industrial waste settling ponds to meet environmental regulations are routine for the MudMaster. There's practically no limit to its capabilities. This is an amazing unit that can handle jobs the competition wouldn't even consider. It is designed to operate for long periods of time with minimum maintenance. And when maintenance is required, the MudMaster is so designed that maintenance procedures can be facilitated by normal operating personnel. That's an important point to remember when you're working dredges day after day under really tough conditions. Probably the greatest advantage of all is that the MudMaster is engineered, manufactured and guaranteed by DredgeMasters International, Inc., THE DREDGE PEOPLE!



- Maintenance of sewage sludge lagoons.
- Maintenance of canals and boating access areas.
- Maintenance of water works projects of all types.
- Maintenance of fisheries and irrigation projects.
- Maintenance of lakes and marinas, both public and private, launching sites, and recreation areas.
- Maintenance of dock facilities of all types.
- Maintenance of lakes and rivers to prevent silt buildups.
- Construction of dikes, sanitary landfills and land development projects.
- Construction of inland canals.
- Handling wash fines of mining operations.
- Reclaiming coal slurry and coal tailings.
- Recovering sand and gravel as well as other aggregate mining projects.
- Recovering mineral resources.
- Recycling and cleaning fly-ash ponds for environmental and safety purposes.
- Removing vegetation over-growth in all type water or marshy areas.
- Cleaning water areas of dead organic waste materials.
- Cleaning and maintaining manufacturing cooling water ponds of all types.
- Cleaning lagoons, swamps and other marshy areas.
- Cleaning and maintaining waste sites of all kinds, including steel mills, canneries, chemical sites, tanneries, and foundries.
- Cleaning water treatment settling ponds.

THE LIST IS ENDLESS!

COMPLETE LINE

The MudMaster is available in three basic model sizes with a broad range of power applications and pump sizes to fit your specific requirements. The list of options is extensive and includes a number of DMI innovations, all designed to enhance convenience and production, to solve your problems surely and economically.

MINI-MUDSTER

The MiniMudster is the smaller in the range of small dredges, ranging from 4-inch (100 mm) and 48 horsepower, to 6-inch (150 mm) and 64 horsepower.

MIGHTY-MUDSTER

The mid-range or medium duty machines ranging from 6-inch (150 mm) and 87 horsepower to 8-inch (200 mm) and 175 horsepower.

SUPER-MUDSTER

The large range or heavy duty machines that range from 8-inch (200 mm) and 190 horsepower, to 10-inch (250 mm) and 275 horsepower.

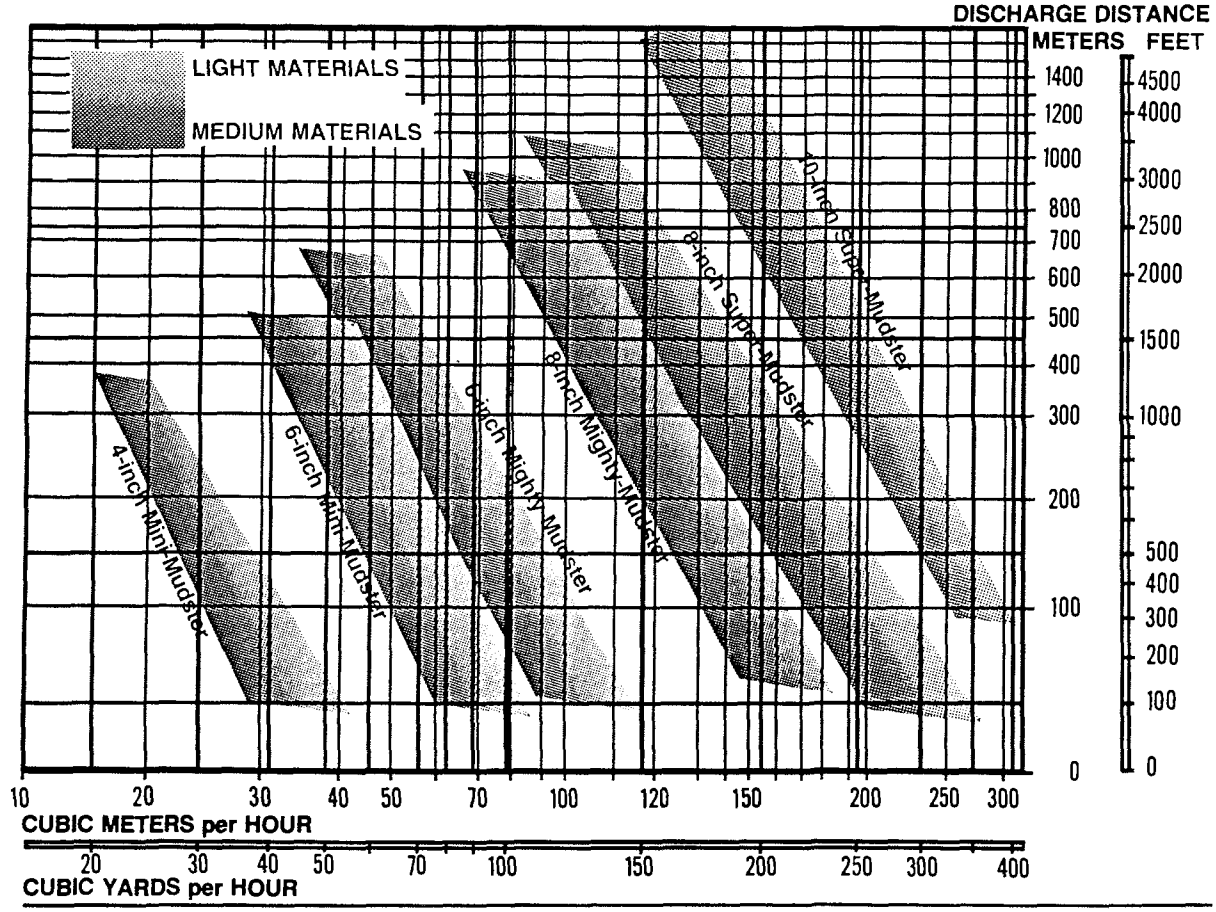
STANDARD SPECIFICATIONS

MODEL	SIZE	STD* ENGINE	BHP (Cont.)	STD. DREDGING DEPTH (Ft.)	OPERATING WGT. (NOMINAL) (Tons)
HP-100 MN	4-inch	GM2-71	48	10	9
HP-150 MN	6-inch	GM3-53	64	10	10
HP-150 MT	6-inch	GM4-53	87	14	15
HP-200 MT	8-inch	GM6V-71	175	14	16
HP-200 SM	8-inch	CAT 3306	190	18	18.5
HP-250 SM	10-inch	CAT 3406	275	18	19.5
AMPHIBIOUS MODELS					
AHP-150 MT	6-inch	GM4-53	87	14	24.5
AHP-200 MT	8-inch	GM6V-71	175	14	25.5
AHP-200 SM	8-inch	CAT 3606	190	18	30.5
AHP-250 SM	10-inch	CAT 3406	275	18	32

*Alternate engines available as regular production option

Special larger models are also available, custom-built for individual requirements. Please consult DredgeMasters International for details.

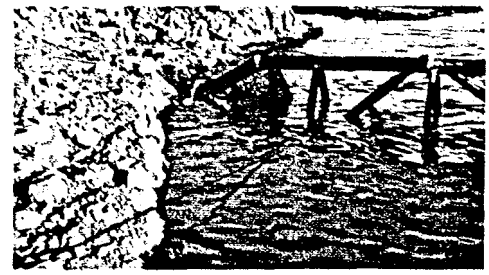
PERFORMANCE CHART

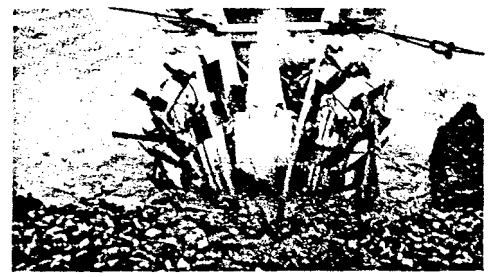


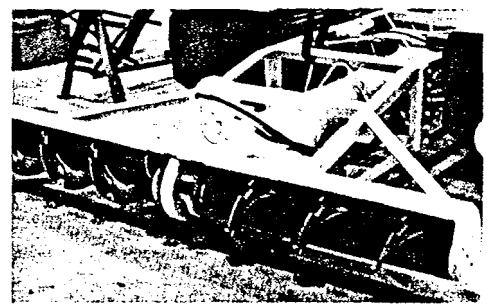
Note: Capacity ranges are calculated for general sizing purposes only and should not be used for any other purpose. Please contact DMI for detailed calculations.

INTERCHANGEABLE LADDERHEADS

Each MudMaster model is offered with a choice of four basic, interchangeable ladderheads. Each ladderhead has its own unique application and advantages and allows you to adapt one machine to many different jobs, efficiently and economically.







ROTATING CUTTERHEAD

A conventional rotating cutterhead is available for more difficult dredging applications involving clay, compacted sand, gravel and other tough materials. This cutter system also offers a more efficient direct drive, including these important features:

- **Sealed Shaft**
- **Oil Lubricated, Anti-Friction Bearings**
- **No Service Water**
- **Minimum Maintenance**

DUAL CUTTERHEAD

The new DMI Dual Cutterhead enables the dredge to excavate tough materials with equal effectiveness in both swing directions. This results in much improved operating efficiency, substantially higher output per operating hour.

REVOLVING HORIZONTAL CUTTER

A revolving horizontal cutter is available to handle softer materials such as mud, fly ash, light sand, coal tailings, slimes, chemical deposits, sludge and other non-compacted materials. This configuration is very effective in small ponds.

OPEN SUCTION "DUSTPAN" ATTACHMENT

An open suction system to handle most loosely compacted and free-flowing materials. It is an extremely effective and economical option and is available to quickly and easily mount on the MudMaster. This system is available with or without water jets to aid in moving material.

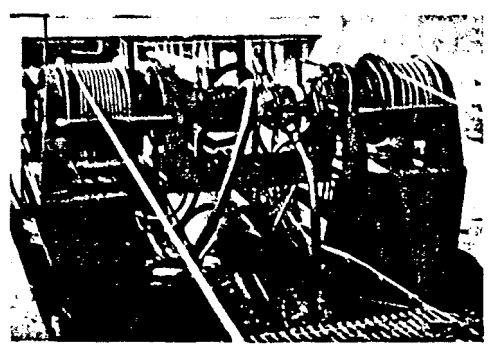
Each of the cutter systems is powered by long-life, gear-type, hydraulic motors, each with variable speed control for optimum operating speed. Each hydraulic circuit is protected against overload damage by automatic pressure relief valves.

OPTIONAL POSITIONING SYSTEMS

Three optional hauling and positioning systems are available that will adapt the MudMaster to your conditions or operating preference.

SWING WINCH SYSTEM WITH SPUDS

A conventional dredge maneuvering system which is used primarily with the rotating and dual cutterhead attachments.



FOUR CORNER POSITIONING WITH FAIRLEADS

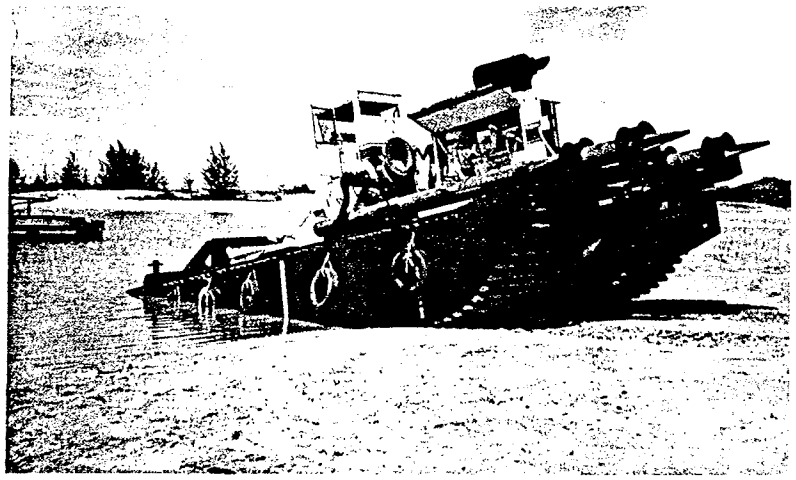
An economical system of positioning and maneuvering the MudMaster that can be used in conjunction with any ladderhead configuration.

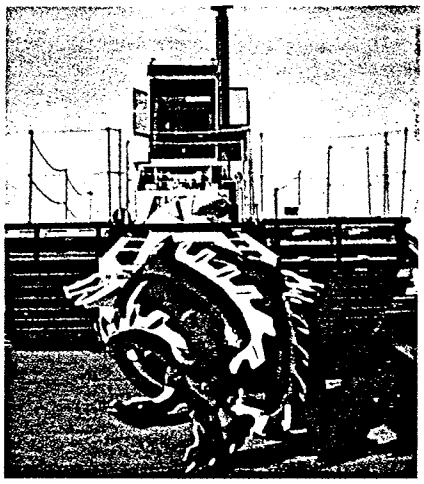
SINGLE WIRE LONGITUDINAL HAULING

A system designed for effectively operating in conjunction with the revolving horizontal cutter or open suction dustpan attachment.

All hauling/positioning systems feature modern, efficient planetary drive hydraulic winches designed and engineered by DMI specifically for their respective purposes. Variable speed control is provided for each winch for optimum operational speed, and each hydraulic circuit is protected against overload by automatic pressure relief valves.

NO COMPROMISE





There is absolutely no compromise in the MudMaster. Not in the development and design. Not in the quality of materials or craftsmanship in construction. Not in the quality controls used to monitor each piece of equipment that goes into its assembly. And not in its versatility and production capability, which, from the standpoint of practicality and performance, represents one of the ultimate achievements in the dredging industry.

When you're true to an ideal, achievement is bound to follow. DredgeMasters International has been dedicated and true to the ideal of excellence since its inception, and the new line of MudMaster Dredges reinforces that ideal.

5

Dredging Supply Co., Inc. "Barracuda"

Shark Cutterhead Portable Dredge

Our **SHARK** dredges are manufactured in sizes that permit transportation in a fully erect configuration. All models are 11'-10" wide (3.61m), thus allowing the units to be hauled over the highway. The only preparation required for transportation is to pull the spud keeper pin and recline the spuds on the deck.

The cutterhead ladder on all models is powered up and down for maximum digging efficiency. The overall height from the water is 9 feet (2.7m) with the spuds down.

Each dredge is equipped with two spuds. The dredge hull is an all-steel welded, single-piece constructed hull. The hull length is 39'-6" (12.04m).

General Machinery:

Swing Winches - Hydraulic Planetary
Spud Winches - Hydraulic Planetary
Cutterhead - Basket type with replaceable edges
Cutter Motor - Hydraulic motor
Cutter Reduction - Gear box
Main Engine - Diesel (Cummins, Caterpillar or Detroit)
Engine Cooling - Keel cooling
Electrical - D.C. System
Dredge Pump - Pekor or equal
Service Pump - Peerless
General - sizes available
10" (25.4cm)
12" (30.48cm)

SHARK CUTTERHEAD DREDGE

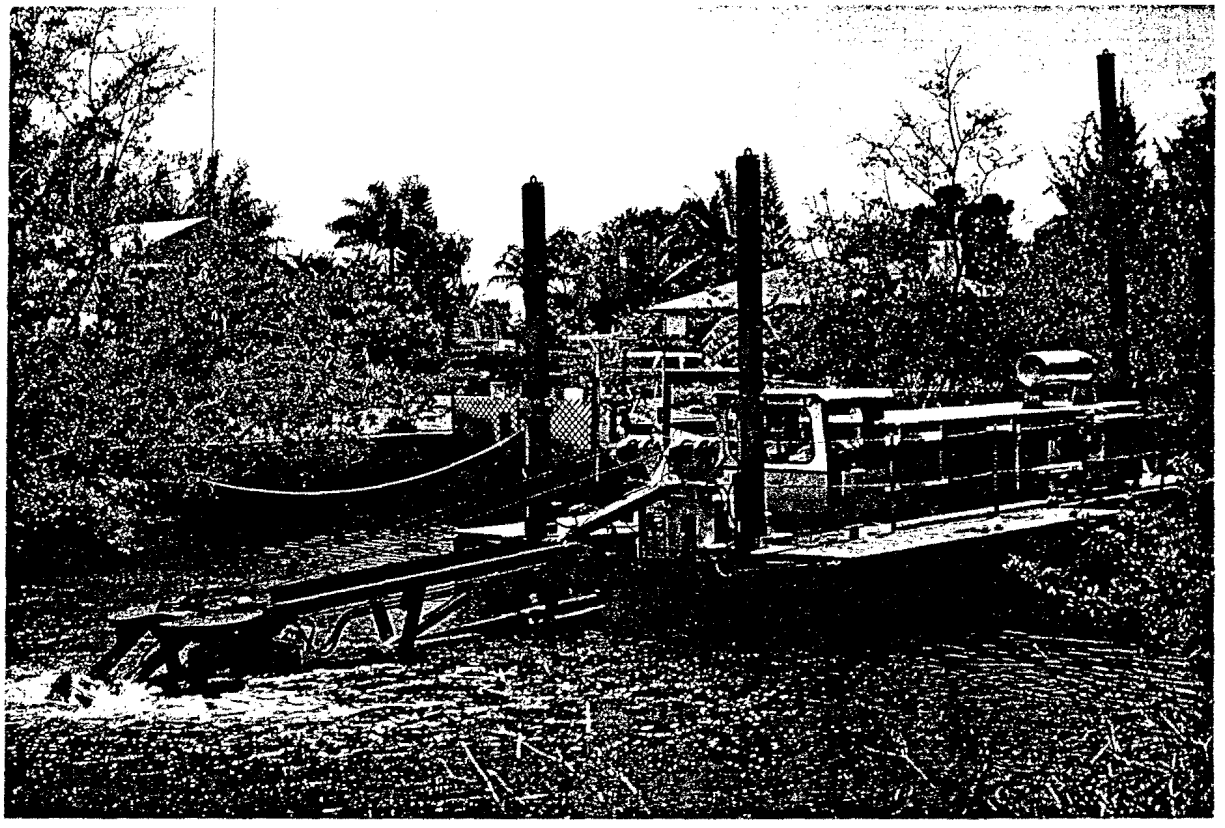
TECHNICAL DATA

	10 INCH	12 INCH
DREDGE PUMP:	**10×10-32**	**12×12-32**
MAIN PUMP POWER:		
Caterpillar	3406 TA	3408 TA
Continuous Rating	322 hp @	402 hp @
	1800 rpm	1800 rpm
Intermittent Rating	402 hp @	500 hp @
	2100 rpm	2100 rpm
MAIN PUMP DRIVE:		
	Tonan TM 729S	Tonan TM 828S
CUTTER:		
Basket w/replaceable edges	31" I.D.	34" I.D.
Rating	41 hp @ 34 rpm	52 hp @ 34 rpm
SWING WINCH:		
Pullmaster	M-6	H-8
Line Pull	6000 lb.	8000 lb.
SPUD WINCH:		
Pullmaster	PL-4	PL-4
Line Pull	4000 lb.	4000 lb.
LADDER RAM:		
Hydraulic Cylinder	6" bore	6" bore
	2½" rod	2½" rod
SERVICE WATER PUMP:	**2½×2-10**	**2½×2-10**
ELECTRIC SYSTEM:		
	24 volt	24 volt
GENERAL:		
Length of Hull	39'-6"	45'-0"
Length Overall	61'-0"	70'-0"
Beam	11'-10"	11'-10"
Hull Depth	4'-0"	4'-6"
Ladder Length	31'-0"	35'-0"
Dry Weight (approx.)	62,000 lb.	74,000 lb.
Fuel Oil Capacity	800 gals.	1000 gals.
Digging Depth, max.	28 ft.	31 ft.
Cutting width @ max. depth	58 ft.	65 ft.
Cutting width @ 1'-2" digging	82'-9"	97 ft.
Loads to Transport	one	one/two

THE ABOVE BRAND NAMES ARE SUBJECT TO AVAILABILITY OR EQUAL SUBSTITUTION

BARRACUDA CUTTERHEAD DREDGE

8″ (20.3cm); 10″ (25.4cm); 12″ (30.5cm)



This versatile dredge is capable of swinging the cutterhead from side to side and advancing forward without the aid of swing cables and a remote achoring system.

The unit can easily be converted to a dredge using a conventional anchoring system.

The Barracuda can be transported on one truck from job to job for reduced mobilization and demobilization cost.

The Barracuda is capable of digging to a depth of 18″.

The dredge is portable and the fabricated hull is an all-steel welded, single-piece construction with side stability tanks. The dredge is complete with the spuds, two digging and one walking.

General Machinery:

Swing Winches - Hydraulic Planetary
Spud Winches - Hydraulic Planetary
Cutterhead - Basket type with replaceable edges
Cutterhead Motor - Hydraulic motor
Cutter Reduction - Gear box
Main Engine - Caterpillar or equal

Engine Cooling - Keel cooling
Electrical - D.C. System
Dredge Pump - Pekor or equal
Service Pump - Peerless

BARRACUDA
SWINGING LADDER DREDGE
TECHNICAL DATA

	8 INCH	10 INCH	12 INCH
DREDGE PUMP:	**8×8-25**	**10×10-32**	**12×12-32**
MAIN PUMP POWER:			
Caterpillar	3306 TA	3406 TA	3408 TA
Continuous Rating	260 hp @	322 hp @	402 hp @
	2000 rpm	1800 rpm	1800 rpm
Intermittent Rating	300 hp @	402 hp @	500 hp @
	2200 rpm	2100 rpm	2100 rpm
MAIN PUMP DRIVE:			
	Tonan TM 729S/Equal	Tonan TM 729S/Equal	Tonan TM 828S/Equal
CUTTER:			
Basket w/replaceable edges	25" I.D.	31" I.D.	34" I.D.
Rating	25 hp @ 34 rpm	41 hp @ 34 rpm	52 hp @ 34 rpm
SWING WINCH:			
Pullmaster	PL-4	M-6	H-8
Line Pull	4000 lb.	6000 lb.	8000 lb.
SPUD WINCH:			
Pullmaster	PL-2	PL-4	PL-4
Line Pull	2200 lb.	4000 lb.	4000 lb.
LADDER RAM:	**4" bore**	**5" bore**	**6" bore**
Hydraulic Cylinder (2)	1¾" rod	2" rod	2½" rod
WALKING SPUD KICK RAM:	**4" bore**	**4" bore**	**4" bore**
Hydraulic Cylinder	2" rod	2" rod	2" rod
SERVICE WATER PUMP:	**2½×2-10**	**2½×2-10**	**2½×2-10**
ELECTRIC SYSTEM:			
	12 volt	24 volt	24 volt
GENERAL:			
Length of Hull	35'-0"	40'	40'
Length Overall	54'-9"	65'	66'
Beam with side tanks	17'-8"	17'-8"	17'-8"
Hull Depth	4'-0"	4'-0"	4'-6"
Ladder Length	20'-0"	25'	25'
Dry Weight (approx.)	50,000 lb.	72,000 lb.	83,000 lb.
Fuel Oil Capacity	800 gals.	900 gals.	1000 gals.
Digging Depth, max.	13'-6"	18'	18'
Cutting width @ max. depth	14'-2"	19'	19'
Cutting width @ surface	20'-0"	26'	26'
Loads to Transport	one	one	one/two

THE ABOVE BRAND NAMES ARE SUBJECT TO AVAILABILITY OR EQUAL SUBSTITUTION

6

Innovative Material Systems Inc. "Versi-Dredge"

INNOVATIVE MATERIAL SYSTEMS

DREDGES, PUMPS & PUMPING SYSTEMS

VOLUME 2, ISSUE 1

CASE HISTORY

VERSI-DREDGE® Clears Channels for Luna Pier Harbor Club

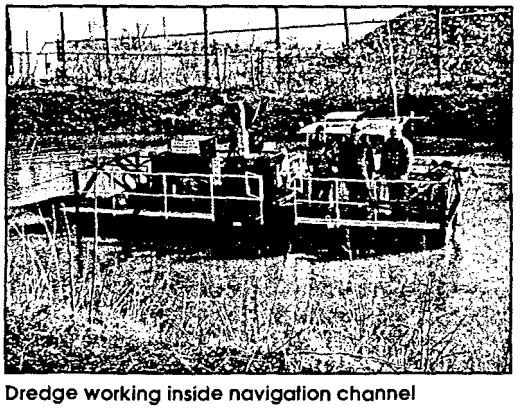
BACKGROUND

It had always been Al Towsley's dream to build a marina on his 23 acres of Michigan soybean fields. The property seemed ideal. It was located one hour south of Detroit and had an adjacent canal to Lake Erie. In 1985, with the help of his nephews, construction began. Today, the Luna Pier Harbor Club is a 392-slip, privately owned marina. According to Mel Briskey, Towsley's nephew and one of the current owners, the marina will expand on 8.3 acres of recently purchased land.

PROBLEM

From the start, keeping Luna Pier's channel to Lake Erie clear proved to be a major problem for the developers. Sand rolling along the western basin of the lake would settle in the club's channel, making it impassable for boaters. Private dredging contractors, utilizing mechanical and larger basket cutterhead dredges, were often called on to keep the channel open.

The contractors hired to remove the settled sand were also asked to remove 2 feet of virgin clay. It was hoped that by removing the clay layer the channel would take more time to fill in, thus extending the time between required dredgings. According to Briskey, "The real problem was that they weren't doing a real good job. They didn't take any time at all. They were leaving hills out there, and they couldn't even cut that hard, blue clay. The channel would fill up again in about three months time. And we were having trouble with our boaters complaining."



Dredge working inside navigation channel

SOLUTION

Last April, the owners of the marina decided to purchase a Model 4010 VERSI-DREDGE,® manufactured by IMS, and do the work themselves. Walleye season had just begun, and Luna Pier's boaters wanted clear access to the lake.

Dean Wickoren, IMS director of new product development, and Jim Saucerman, customer service technician, were on hand for the customary machine start-up and new operator training session. The session lasted two days and allowed IMS further evaluation of its recently introduced high-pressure dredge pump. The pump easily removed the sand, clay and zebra

(continued on page 2)

LETTER FROM THE PRESIDENT

Not so long ago, the two-man crosscut saw was the tool of choice in the logging industry. With advances in technology, specifically the introduction of the chain saw, logging has changed a great deal.

Switching to the chain saw made economic sense. Chain saws were small enough to be carried to a job site by a single individual. In addition, they needed only one operator. Finally, chain saws offered consumers more power and production at a relatively low cost.

James F. Horton

Innovative Material Systems is dedicated to developing products that have the same impact on our marketplace as the chain saw had on its. Particularly, we look to improve upon the status quo by producing technology that is more portable, more powerful and more resource-efficient than current products.

I encourage you to read this newsletter and learn more about our small dredge and submersible pump product lines. Welcome to our company, I hope you enjoy *"Systems."*

INSIDE SYSTEMS

ASK THE EXPERT

Designing a Spoil Area

Q What can be done about spoil?

A Finding space to store spoil even temporarily may be the most difficult problem a designer faces on a dredging project. IMS can't *find* space for you, but we *can* make suggestions that will help utilize available space.

The ideal location for a spoil area is immediately adjacent to the impoundment being dredged on either a perfectly level site or, at most, with a slight slope away from the inlet. It should be large enough for long-term storage of the slurry that will be pumped in clearing the impoundment. If the ideal site exists, the designer of a small project may simply estimate the total volume that will have to be pumped to clear the dredge site and build a spoil area to hold more than that.

On larger projects, available space and money may take precedence. This forces the designer to adapt the site to his needs and sometimes, to tailor the entire dredging project to the spoil area design constraints. A series of tests can be run to assist the designer, and IMS can help our customers in the running and interpretation of these tests. Some of the considerations in spoil area design are:

- How many cubic yards of material are to be dredged? Add at least 10 percent to this figure for design purposes. As mentioned above, on small projects and where space is available, this is the spoil area design. Build it to hold the calculated volume and dredge.
- How much slurry will have to be pumped to dredge this amount of material? In other words, how much material will have to be handled to do the job?
- Will the material settle out of the slurry? How fast? If a settling test shows that the material will settle out of the slurry *and* decanting of water is permitted, the volume of the spoil area can be reduced by the amount of water that can be decanted. Settling will only occur in a quiescent setting. Will there be long periods (overnight) when no material is being pumped to the spoil area? The settling test should be limited to this length of time.
- How rapidly will the material dry to the point where it can be removed or pushed out of the way? This depends not only upon the material but upon the climate. Drying is enhanced by turning the material. This can only be done when fresh slurry is not being added.
- If settling and decanting appear viable, the material dries readily, and equipment is available to assist in the drying process, consider the construction of multiple cells. The cells are sized to contain several days production and are used alternately. While a cell is in service, the others are being decanted and dried, and the material is removed or pushed aside.

Q What steps must be taken to construct a spoil area?

A There is no foolproof recipe for designing and building a spoil area. In designing the spoil area, the designer should avoid being merely hopeful. Apply what is known about the material realistically. Test results are always suspect because it's usually impossible to be certain that the samples are truly representative of the entire site. Be conservative! Few things are more frustrating than having a full spoil area with a third of the site yet to be dredged.

A FEW SUGGESTIONS

- Know as much as possible about the behavior of the material.
- Build the area as large as available space and money permit.
- Be prepared to *operate* the spoil area. That is, use all options such as decanting and drying that are economically feasible. ◆

VERSI-DREDGE® Clears Channels

(continued from page 1)

mussel shells to a spoils area 2,900 feet away at a elevation of 20 feet. Production rates often exceed 100 cubic yards an hour.

Since walleye season, Briskey says, the small dredge has been used to do a more thorough job on the 1,800-foot-long by 30-foot-wide channel, as well as 500 feet of problematic lake area. "It has done a tremendous job," he says. "We've cut through the blue clay – none of the others have ever done that."

RESULTS

The boaters are very pleased with the changes, according to Briskey. "The biggest problem has always been the navigable waters off the channel mouth, and we have that well corrected now."

While other marinas in the area are about 40 percent occupied, Luna Pier's rate is up from last year to about 85 percent, Briskey says. The new dredge, he believes, is giving the club an advantage over the competition.

In fact, while some of Briskey's neighbors were initially skeptical of Luna Pier's new dredge, they are now believers. Several have come by to watch the VERSI-DREDGE® run and have even asked Briskey to contract his services. "They have been very impressed with it. And they should be. We have been very satisfied, and we know that the dredge will pay for itself," he says.

Luna Pier's owners are still undecided as to whether they will take the competitors up and contract the dredge, he adds. "We have put the cost into running our marina, and we are trying our level best to do a good job on our own property!"

For further information on the Luna Pier Harbor Club, please contact Mel or Mike Briskey at 313/848-8777.

* Registered Trademark of IMS, Inc., Olathe, Kansas. ◆

3

PUMP TALK

Digester Cleaning Package

Anaerobic digesters require periodic cleaning. This is particularly true in plants without grit and grease removal systems and/or facilities for screening trash.

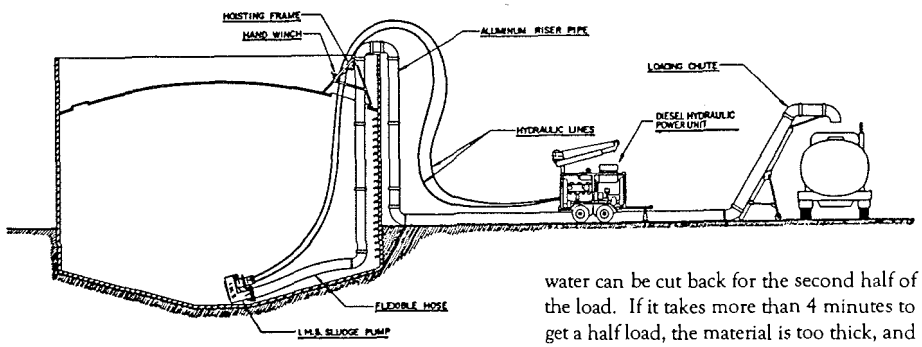
Grease, trash and grit often accumulate to the point where the digester will not function because it can no longer be mixed and heated. This loss of mixing can result in the buildup of sludge and solids so thick that the tank cannot be drained or pumped down using existing plant equipment.

Digesters are usually cleaned by pumping out through the manways in the cover. The material is pumped to sludge beds, lagoons or presses. If pumping direct to disposal is impossible, material may be pumped into a truck for hauling. This can be the most expensive item on a cleaning job.

IMS offers a complete digester cleaning package, including: a diesel/hydraulic or electro/hydraulic power unit, a hydraulically driven sludge pump with slurry gate, a 200-foot pair of hydraulic hoses, riser pipe assembly, a 100-foot discharge hose, a pump hoisting frame with winch, and a truck loading chute.

The usual procedure in setting up a project is as follows:

- Set up the power unit in an area where it can be easily refueled (if diesel) and serviced.
- Lower the pump through the large access manhole above the ladder, forcing it through the sludge if necessary. Sometimes it can be "jetted" into the sludge with a fire hose.
- Attach the riser as the pump is lowered.
- When the pump is as deep as possible, connect the discharge hose to the riser pipe, and the pipeline to the process or the truck loading chute.
- If the sludge is being trucked, set up the loading chute, if possible, so that trucks can drive in, load and leave without turning around.
- Begin pumping.



The thin, easiest to pump material will naturally be pumped out first. As the pump works its way down assisted by the slurry gate, the thicker sludge will form an angle of repose, and the pump finally will be at the bottom of a "cone" of the more solid sludge. At this point, a fire hose should be used to loosen the sludge, causing it to tumble or flow to the pump.

When the center (or low spot if not the center) of the digester floor becomes visible, the pump is moved there and reconnected to the riser pipe with a section of the flexible discharge hose. The sludge left clinging to the digester floor and walls is then "blasted" off with the fire hose and washed to the pump.

The amount of water used to flush the digester can be critical. If the sludge is pumped out too wet, a drying bed or press could be flooded or the number of truckloads required to haul might increase greatly. If the material is pumped too dry, the press might not handle it or it may not drain from the trucks.

When pumping to trucks, the amount of solids pumped can often be controlled well enough to avoid disaster by simply timing the loading. For instance, with an 8-inch system, thin sludge will pump at 1,000 g.p.m. and a thick sludge at 400 to 500 g.p.m. A 6,000-gallon truck will load in 6 to 15 minutes.

If it is determined that a sludge that can be handled is produced when the pump is discharging 750 g.p.m., the truck will load in 8 minutes. Time the loading until the truck is half full. If it takes less than 4 minutes, the sludge is too thin and the water can be cut back for the second half of the load. If it takes more than 4 minutes to get a half load, the material is too thick, and the water should be increased for the second half of the load.

One of the greatest problems normally encountered in digester cleaning is the so-called "ragball." These masses of rags, plastic and string are formed in the rolling action induced by the digester mixer. Many of them are too large to pass through a pump or pipe and are not welcome in a tank truck or pond. Unfortunately, they may have to be lifted out and disposed of separately.

Sand and grit can pose a similar problem. Although they can be pumped out of the digester, they may not drain from a tank truck and often are not wanted by a downstream process. If there are large amounts of grit, it may be necessary to pump out the sludge and handle the grit separately from the sludge.

The digester cleaning packages are available with 6-inch and 8-inch pumps. The 6-inch pump package, provided with 8-inch riser pipe, hose and loading chute, will handle 80 percent of jobs. The 8-inch pump package, which includes 10-inch pipe, hose and loading chute, will handle nearly all jobs.

Stay Tuned ...

In our next newsletter, "Pump Talk" will discuss sewer bypass systems.

EMPLOYEE PROFILE


Barbara Smith

During her four-year career with IMS, Barbara Smith has worn many hats. As our receptionist, she is the first person to speak to customers, and therefore is the first impression they receive of our company. Her highly visible position, combined with her knowledge of IMS, our products, and our staff, makes her a valuable resource for customers and prospects.

She also is regarded highly by co-workers. "Barbara has a very helpful attitude and possesses an appropriate sense of urgency when dealing with our customers," says IMS President Jim Horton. "We have complete confidence in her ability to handle simultaneous projects in addition to helping customers when they call."

Barbara also is administrative assistant to Jim, and handles a range of office functions, including travel arrangements, invoices and ordering office supplies.

Despite her importance to IMS, Barbara emphasizes her greatest accomplishment has been raising a daughter by herself. Gabriella, now a 17-year-old high school honor student, has high aspirations like her mother, who is attending college at night. "You're never too old to learn something new," Barbara says.

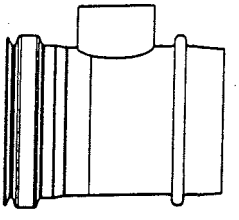
Not only is Barbara a dedicated mother and a hardworking employee in pursuit of a college degree, she also sells Mary Kay cosmetics and is a zealous dancer. In fact, she ballroom dances three times a week and considers dancing to be her ultimate stress-reliever: "It's about the same price as a therapist. So I do it for myself!" she says.

An intriguing past has contributed to Barbara's zest for life. She lived in Germany for 20 years and England two years before moving to the United States in 1965. While she misses the delicious foods of Germany and England's traditional tea time, she loves the wide open spaces of America.

"I would like to resume my travels one day, and the Far East will probably be my first stop," she says. Until then, IMS appreciates Barbara's many contributions to our growing business.

IMS: Your Single Source for Accessories

In addition to its dredge and pump line, IMS carries a full range of discharge line accessories. These items range from routine valves (check valves, shut-off valves, etc.), to made-to-order adapters, to discharge hose and pipe. IMS is a distribution source for dredging and pumping products from manufacturers such as Goodyear (discharge hose), Phillips Petroleum (discharge pipe), and Gheen (quick disconnect fittings). If you have a need, chances are IMS has the answer. For further information on our line of parts and accessories, please call: 800/800-4010



Environmental Fact

Americans, including U.S. businesses, use about 90 billion gallons of groundwater every day; 14 percent is drinking water. Contamination of this water comes from dangerous chemicals that end up in unmonitored pits and lagoons. The EPA has found 98 percent of these dump sites within a mile of underground drinking water, and 93 percent of them threatened groundwater supplies.

IMS
INNOVATIVE MATERIAL SYSTEMS, INC
Dredges, Pumps & Pumping Systems

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Oceaneering Technologies "TCCD"

A New Device for the Retrieval of Contaminated Marine Sediments
The Total Containment Clamshell Dredge

Oceaneering International, Inc. is currently developing a new underwater excavation device that has been specifically designed for contaminated sediment retrieval. The patent pending Total Containment Clamshell Dredge (TCCD) is designed to precision dredge "hot" zones while minimizing all possibilities of spreading the contamination. Two primary objectives were set during the TCCD design. The first objective was that disturbed sediments would not be able to escape the system. The second was that the volume of associated water be kept to an absolute minimum.

Total containment is accomplished by incorporating a hyperbaric soil receiving chamber. This is an air void that provides space for the incoming sediments. This void eliminates the displacement of an equal volume of contaminated water. It also minimizes the volume of associated water captured with each "bite" of sediment. Leakage containment is assured by operating in a negative pressure differential mode. Essentially, the pressure within the system is adjusted to be less than the ambient water pressure during system operation. This results in leakage into the apparatus rather than outward.

Total containment is further assured by active silt curtains. Hard curtains that seal against the sides of the clamshell buckets are lowered to close off the gap between them during closure. This prevents disturbed soil from extruding out of the system.

A working prototype of the TCCD is currently in factory testing with operational field testing scheduled in the early spring of 1996. The TCCD will be produced in three sizes to accommodate a variety of applications and is designed to use a vessel of opportunity as a floating base which provides the flexibility to bid projects in any market area.

With the TCCD, Oceaneering International will continue to be a leading international participant in the field of underwater contaminated sediments operations.

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The objective of the present task was to compile the latest available information on equipment, procedures, and monitoring techniques for dredging contaminated sediments. A readily available published document offering technical information collected under this project will benefit the U.S. Army Corps of Engineers and others involved in dredging of contaminated sediments.

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