## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>II. Experimental Studies</td>
<td>1</td>
</tr>
<tr>
<td>a. General Comments</td>
<td></td>
</tr>
<tr>
<td>III. Experimental Results</td>
<td>2</td>
</tr>
<tr>
<td>IV. Future Studies</td>
<td>3</td>
</tr>
<tr>
<td>a. General Comments</td>
<td>3</td>
</tr>
<tr>
<td>V. References</td>
<td></td>
</tr>
<tr>
<td>VI. Appendix</td>
<td></td>
</tr>
</tbody>
</table>
STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP

I. INTRODUCTION

The following report summarizes the studies performed during the months of December 1960 and January 1961, at the Hydraulics Division of Fritz Engineering Laboratory, under terms of Contract No. DA-36-109-CIVENG-59-112. Earlier work was described in Status Reports dated December 1958(1)*, February 1959(2), April 1959(3), June 1959(4), December 1959(6), February 1960(7), March 1960(9), April 1960(10), May 1960(11), June 1960(12), July 1960(13), August 1960(15), September 1960(16), October 1960(17), November 1960(18), December 1960(19), and a Project Report dated September 1959(5).

II. EXPERIMENTAL STUDIES

A. General Comments

No experimental tests were carried out during this period in view of the fact that tests with impellers No. TD-5 and TD-6 have been completed for silt-clay-water mixture concentrations between 1170 and 1380 grams per liter. It is planned to perform tests with water for the impellers No. TD-5 and TD-6 after completion of all tests with silt-clay-water mixtures for additional impellers. It would be

* Numbers in parentheses indicate References
impractical to replace the silt-clay-water mixture with water in the sump tank at this stage of the testing program.

III. EXPERIMENTAL RESULTS

Additional characteristic curves for the pump with impellers No. TD-5 and TD-6 have been prepared and are presented in the Appendix. The additional curves now complete the set of pump characteristics for the impellers No. TD-5 and TC-6.

Figure A-1 presents the head-flow and brake horse-power flow curves for impeller No. TD-5 and concentration of 1170 grams per liter, while Figure A-2 presents a similar set of curves for the impeller No. TD-6.

Figures A-3 to A-9 present the characteristic curves for silt-clay-water mixture concentration of 1170 grams per liter, while Figures A-10 to A-15 present the curves for concentration of 1320 grams per liter. The curves were plotted for two impellers, TD-5 and TD-6, on the same graphs for comparison reasons. The following pump speeds are presented:
### IV. FUTURE STUDIES

#### A. General Comments

The proposed extension of Phases II and III of the present study has been authorized, and two additional impellers were ordered:

1. An impeller with 22-1/2° exit angle, 45° entrance angle, and an involute vane shape. This impeller was designated as No. TD-7.

2. An impeller with a 35° exit angle, 45° entrance angle, and an involute vane shape. This impeller will be called No. TD-8.

It is expected that tests will get under way early in March.
APPENDIX

Figures A-1 to A-15
REFERENCES

(1) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=1 Lehigh University, December 1958

(2) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=2 Lehigh University, February 1959

(3) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=3 Lehigh University, April 1959

(4) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=4 Lehigh University, June 1959

(5) Herbich, J.B. CHARACTERISTICS OF A MODEL DREDGE PUMP Fritz Engineering Laboratory Project Report No. 31 Lehigh University, September 1959

(6) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=5 Lehigh University, December 1959

(7) Herbich, J.B. Weiss, W.L. Waddington, W.M. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M=6 Lehigh University, February 1960
References

(8) Weiss, W.L. SUGGESTED DESIGN CHANGES FOR A CENTRIFUGAL PUMP IMPELLER HANDLING DREDGED MUD
Fritz Engineering Laboratory
Special Report
Lehigh University, November 1959

(9) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory
Memorandum No. M-8
Lehigh University, March 1960

(10) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory
Memorandum No. M-9
Lehigh University, April 1960

(11) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory
Memorandum No. M-12
Lehigh University, May 1960

(12) Herbich, J.B. ANALYSIS OF HIGH-SPEED MOVIES OF A MODEL PUMP
Waddington, W.M. Fritz Engineering Laboratory
Memorandum No. M-11
Lehigh University, June 1960

(13) Herbich, J.B. Long, J.L. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory
Memorandum No. M-13
Lehigh University, July 1960

(14) Iversen, H.W. VOLUTE PRESSURE DISTRIBUTION, RADIAL FORCE ON THE IMPELLER, and VOLUTE MIXING LOSSES OF A RADIAL FLOW CENTRIFUGAL PUMP
Rolling, R.E. ASME Paper No. 59-Hyd-10
Carlson, J.J. Journal of Basic Engineering, 1959
References

(15) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M-14 Lehigh University, August 1960

(16) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M-15 Lehigh University, September 1960

(17) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M-17 Lehigh University, October 1960

(18) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M-19 Lehigh University, November 1960

(19) Herbich, J.B. STATUS REPORT OF RESEARCH PROJECT ON IMPROVING DESIGN OF A HOPPER DREDGE PUMP. Fritz Engineering Laboratory Memorandum No. M-20 Lehigh University, December 1960
Fig. A-1 - MODEL DREDGE PUMP CHARACTERISTICS
Impeller TD-5
Concentration: 1170 grams/liter
Fig. A-2 - MODEL DREDGE PUMP CHARACTERISTICS
Impeller TD-6
Concentration: 1170 grams/liter
Fig. A-3 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1170 grams/liter
Speed: 1150 rpm
Fig. A-4 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1177 grams/liter
Speed: 1300 rpm
Fig. A-5 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1175 grams/liter
Speed: 1440 rpm
Fig. A-6 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1173 grams/liter
Speed: 1550 rpm
**Fig. A-7 - MODEL DREDGE PUMP CHARACTERISTICS**

Impellers TD-5 and TD-6

Concentration: 1170 grams/liter

Speed: 1650 rpm
Fig. A-6 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1172 grams/liter
Speed: 1750 rpm
Fig. A-9 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1171 grams/liter
Speed: 1900 rpm
Flow GPM

Fig. A-10 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1150 rpm
Fig. A-11 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1300 rpm
Flow GPM

Fig. A-12 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1440 rpm
Fig. A-13 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1550 rpm
Fig. A-14 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1650 rpm
Fig. A-15 - MODEL DREDGE PUMP CHARACTERISTICS
Impellers TD-5 and TD-6
Concentration: 1320 grams/liter
Speed: 1750 rpm