WESHS (25 May 83) 1st Ind
SUBJECT: Time and Cost Estimate for Hydraulic Model Tests of the Proposed Butterfly Valve Gated Structure, New Orleans Outfall Canals, Hurricane Protection

DA, Waterways Experiment Station, Corps of Engineers, PO Box 631, Vicksburg, MS 39180 24 JUN '83

TO: Commander, US Army Engineer District, New Orleans, ATTN: LMNED-H, PO Box 60267, New Orleans, LA 70160

1. A meeting was held 9 June 1983 at the Waterways Experiment Station (WES) between representatives from the New Orleans District and WES to discuss details of the proposed model studies. The WES concurs that a model study would be beneficial in providing design and operating guidance for the proposed Butterfly Valve Gated Structure. The study would define for various valve openings the magnitude, frequency, and direction of the average and maximum trunnion torques reacting dynamically to the hydraulic forces imposed by wave action and flow conditions. A comprehensive model constructed to a scale of 1:20 would be capable of simultaneously simulating various anticipated wave conditions and head differentials at the structure. The comprehensive model would simulate sufficient Lake Pontchartrain shoreline and lake area to reproduce the wave climate at the mouth of the canal and sufficient length of the canal (about 3000 ft) to permit investigation of flow and wave characteristics at the structure and measurement of hydraulic forces.

2. Design and construction of the comprehensive model could be accomplished in four months for a cost of $241,000. Operation including minor revisions would cost $21,000 per month and four months should be allowed for tests. Preparation of data and a final report would cost an additional $15,000 and normally requires eight months after completion of all tests. The total cost for the general model study would be $340,000 and design guidance would be available in about seven months.

3. If some of the essential forces in the comprehensive model are too small to allow adequate measurement for design details, a section model could be used to measure these hydraulic forces. A 1:10-scale section model would be recommended to simulate one valve, a portion of two adjacent valves, and about 300 ft of the approach and 300 ft of the exit area. Design and construction of the section model could be accomplished in about four months for a cost of $144,000. Operation, including preparation of data and minor revisions, would cost $21,000 per month and three months should be allowed for tests. Test results would be published as a part of the final report for the comprehensive model. The total cost for the section model would be $207,000 should it be required.

4. Summarizing, it is estimated that the proposed 1:20-scale comprehensive model study would cost $340,000 and the 1:10-scale section model study, if required, would cost $207,000. Final results could be available in seven

4

LMVD Comments
on
Lake Pontchartrain, Louisiana and Vicinity
Hurricane Protection Project-Model Study,
Request for Authorization

a. Para 1. In this paragraph the District discusses possible remedial measures which will be detailed in a subsequent General Design Memorandum. The details in this study should include a comparison of the planned operational procedures for the gates, allowable pumping times, detail cost estimates, etc., between the vertically pinned gate and the other alternatives.

b. Para 4.

(1) The plan for floodgates at the lake end of the canals, Plan 3, should cover various type gates. One type recommended to be included in the study is a control structure with lift gates that have flap valves built in. Under existing conditions, it appears that as the lake level rises, the pump discharge must be reduced to prevent overtopping of the levees. At the time the proposed lake end gates will be closed, the pumping rate may be reduced significantly. The flap gates should allow an acceptable rate of flow into the lake after the lift gates are closed.

(2) In addition to the plans under consideration, an additional alternative to plan 1 should be considered. This alternative would consist of lining the channel using a reinforced concrete U-framed conduit, without gates at the lake end. The U-shaped reinforced concrete channel would be designed to contain the maximum surge within the outfall canal. A sketch of the scheme is attached for your information. The principal problem in constructing such a conduit is the care of water during construction. NOD needs to consider this alternative.

c. Para 6. Design parameters must be defined prior to initiation of any WES model testing program. For this model, it must include the pump capacities, water surface profiles for the outfall canal up to the levee overtopping stage, stages when pumping will be stopped, design stages on the gate, and wind and wave data. This information, which must be developed by the District, should be submitted to this office for review prior to initiation of a model testing program.

d. Para 7.

(1) The first sentence presents an impossible situation in that a scheme must be developed for keeping hurricane surges out of the drainage canal while preserving for the SWBNO the option to pump at all times. The underlying problem is the inability of the canal levees to retain hurricane waters to the level expected to be generated against the south bank of Lake Pontchartrain. Under the proposed concept of a gated structure in the lake end of the drainage canal and the existing return levees, closure of the gates is guaranteed with the occurrence of a critical hurricane. If the gates are closed, it is then a foregone conclusion that pumping will have to stop at some point, or overtopping

Incl 5

of the existing return levees and floodwalls will occur with flooding along the canals into the protected area. We understand, however, from discussions with personnel of your office that in reality the SWBNO is planning to continue pumping until the water level in the canals reaches the top of the existing return levees and floodwalls. Such a plan of operation will, however, be dependent on the stability and integrity of the existing return levees and floodwalls with canal stages at the top of protection. The stability and integrity of the return levees and floodwalls under such a loading condition should be investigated as part of any plan which contemplates such an operational procedure.

(2) The argument NOD presented has not been convincing from the standpoint that a significant increase in pumping time will result if the vertically pinned gate is selected over a vertical lift, sector or other standard gate. Once the lake rises to the elevation that the canals will overtop, then the gates will have to be closed and remain closed regardless of the type gate.

(3) This paragraph leads you to believe that the local sponsors might be anticipating credit for the work being done on the 17th St. Canal and that the District presently doubts that the locals' new levees will meet our standards. The District will be remiss if it does not impress locals with the fact that not only will credit not be allowed for this work, if deficient, but the Corps will still have to construct a gate in this canal and that the locals will be expected to cost share the structure cost.

(4) The data presented by the District thus far are inadequate to determine that a significant increase in pumping time will be gained if a vertical pinned gate is used instead of a conventional type gate. Also, if the vertical pinned gate or the conventional gate is required to operate in an oscillatory fashion with the period of the operating cycle being of short duration and/or the gates are subjected to significant impact during closing, this office will require NOD to evaluate the dynamic (structural) performance of the gate and the resulting hydraulic surges within the channel. This will be in addition to determining hydrodynamic forces as presently proposed. This office questions whether a valve could endure operating in an oscillatory manner for extended periods without fatigue effects. It would seem that automatic operations should be achieved by switches which are automatically actuated by "still water" head measurement.

e. Para 8. It appears that there is no compelling reason to invest from $340,000 to $547,000 and 1 1/2 years in model studies of butterfly control valves, considering that the first cost of this solution is indicated to be $5 million greater than the vertical roller gate solution, and assuming that the two solutions are equally viable from an engineering standpoint. It is implied that the butterfly valves have some measurable advantage over the roller gates, but no tangible engineering or economic data are presented to substantiate this fact. NOD should furnish additional supporting documentation to include an economic analysis reasonably demonstrating that the butterfly valve solution would provide greater net benefits than the roller gate solution.

d. Cost Table, Incl 2.

(1) A comparison of the cost for Plan 3a and 3b shows that the

vertically pinned gates cost an additional $5,000,000. Further detailed studies may show that a type gate other than the vertical pinned gate will meet the needs for closure of the canal. If this is the case and local interests still insist on having the vertically pinned gate, it appears they would be responsible for the additional cost.

(2) Under Plan 4 the basis for setting the pumping capacity for the supplemental pump at 80 percent nominal capacity should be substantiated. It is doubtful that the local pumps are presently operated at 80 percent nominal capacity when the lake stage reaches the level at which the proposed gravity drainage structure would be closed. A smaller supplemental pump capacity could reduce the cost of Plan 4 to the extent that this plan is competitive with the others investigated. This assumes the pumps have been added to offset loss of gravity drainage due to early closure of the gravity structure.