



62nd Canadian Geotechnical Conference, Halifax September 2009

“Lessons Learned” or “Projects Gone Wild”

Two lessons learned from the construction of the Mactaquac Dam in New Brunswick

“Wild project” 1: Unexpected serious difficulties with dumped glacial till cofferdam seals

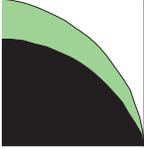
The original design called for 4H:1V slopes of the dumped till, as indicated in Figs. 1 to 3. The three cofferdams were all till-faced rockfill structures, constructed by end-dumping in water depths of up to 65 ft. Placing of till was started at the spur dyke cofferdam. Slips occurred after the placing of only 5,000 cu.yd. along a 450 ft length (Fig.1). The slips involved fine rock transition as well as glacial till. Soundings along several sections showed that the material had sloughed to the toe of the rockfill and formed underwater slopes as flat as 30H:1V. Subsequent dumping resulted in flat “slopes” extending as far as 500 ft from the centreline. Alternate layers of gravel, crushed rockfill and till did not improve this situation.

Dewatering of the spur dyke cofferdam could not be effected until a differential head was established, and this could be done only after the powerful dredge pump was added to all the other high-capacity pumps, creating a total pump capacity of about 6,400 litres per second (85,000 gal./min.).

Detailed descriptions of the construction of the three cofferdams shown in Figs. 1 to 3 may be found in the proceedings of the 30th Canadian Geotechnical Conference in a paper by Landva and Keenan (1977), pp. VI-1 to VI-58.

“Wild project” 2: Unexpected serious difficulties with boulder content during dredging excavation of dam foundation

Drill reports for the main dam and cofferdam foundations were issued by the Engineer in December 1963 and November 1964. Boreholes 100 – 105 had been drilled in September – October 1959, boreholes 201 – 230 in January – March 1961, boreholes 231 – 269 in January – March 1963, boreholes 270 – 271 in August 1963, and boreholes 275 – 279 in February – March 1964. Most of these boreholes are shown on the plan in Fig. 5. A recent review of these drill reports has shown that boulders were present in most of the boreholes, both in the alluvium immediately below the river bottom and in the till above the proposed dam foundation. However, the size of the boulders is not indicated nor is the amount of boulders present. On the other hand, in some of the drill reports the amount of boulders is described as “occasional”.



TerrAtlantic

Engineering Limited

515 Beaverbrook Court
Fredericton, New Brunswick, E3B 1X6

tel: (506) 460-8660 fax: (506) 460-8679

An excerpt from the dredging specifications is shown in Fig. 6. Again the amount of boulders is referred to as "occasional". The size of the boulders is not specifically stated, but the boulders referred to are described as being of a size that are "too large to be handled by the dredging equipment", the dredge having a cutter-suction head with a diameter of about 9 ft.

Before the dam area was dewatered, it was thought, as envisaged by the dredge specifications, that the dredge would leave a more or less undisturbed surface of stiff till partly covered with relatively large boulders too big to be picked up by the dredge. In reality, the dredging excavation left a substantial layer of remoulded till up to about 6 ft thick. The content of boulders in this disturbed till was not recorded. However, the size of the boulders that proved to cause problems with the dredging equipment was in the order of 8 to 12 inches. This size of boulders could be picked up by the suction of the dredge pump, but often these boulders damaged the pump impeller. The pump then had to be dismantled for repair, sometimes twice a day, and this of course caused delays.

The contractor submitted a sizeable claim for the cost of these difficulties. In today's dollars he was awarded a sum that has been estimated to be in the vicinity of 10 million dollars.

Fig. 1 - Section through the Mactaquac spur dyke cofferdam
 27 October to 7 December 1965

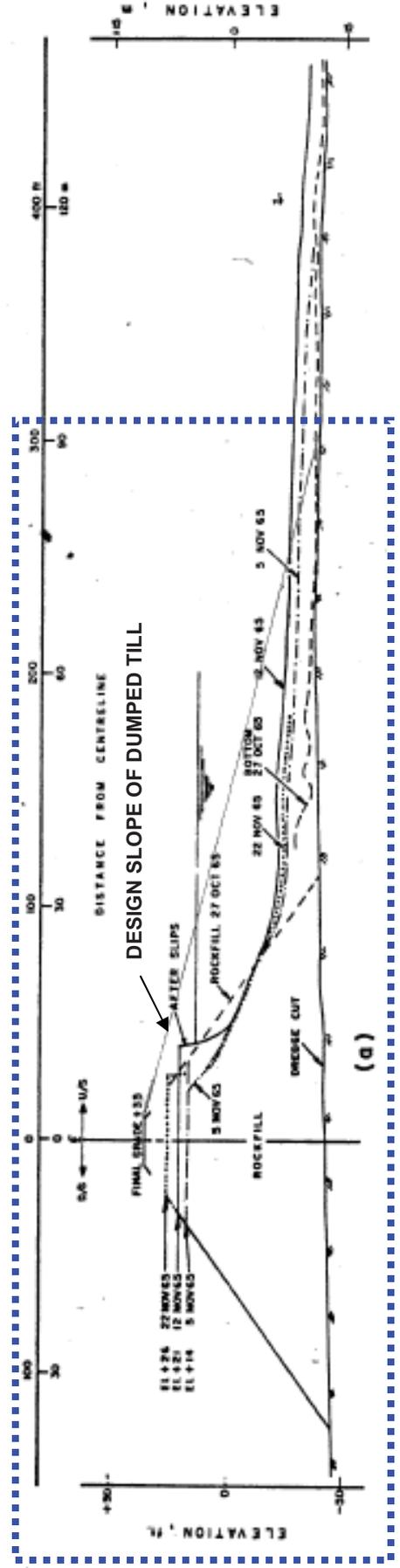
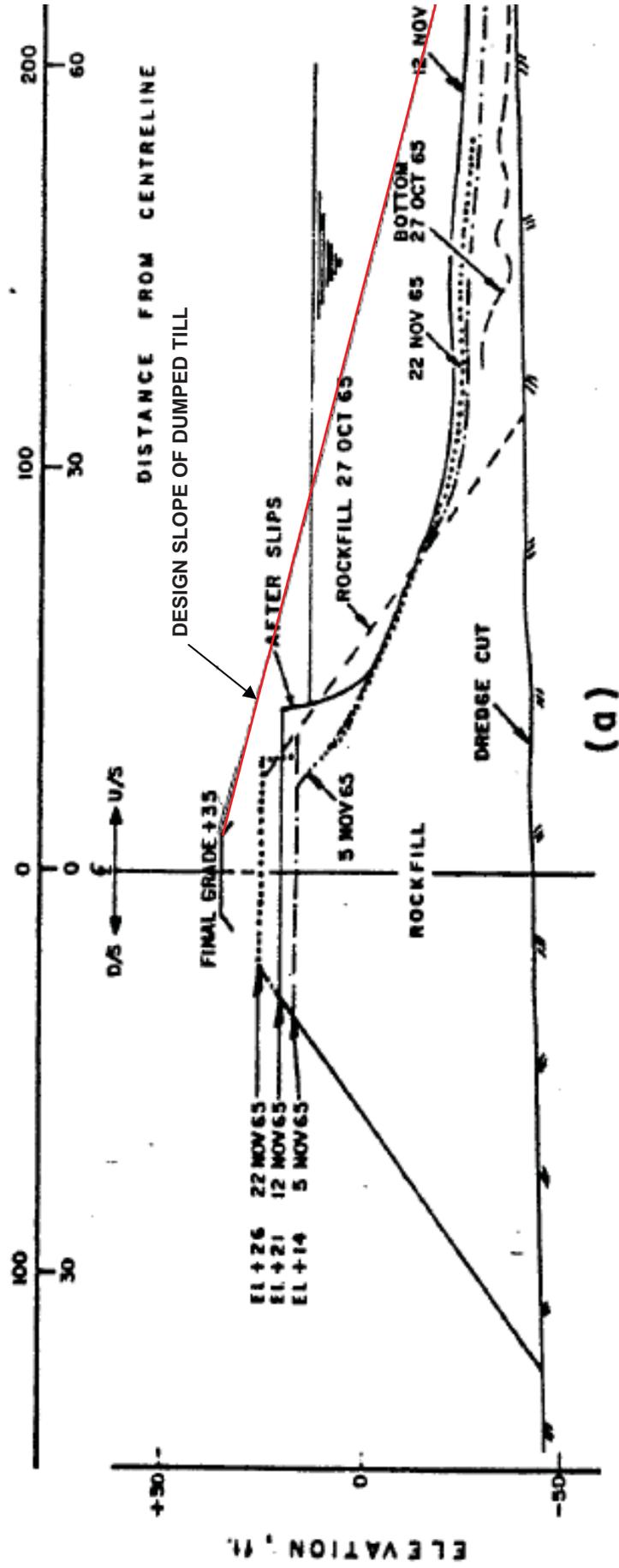


Fig.2 - Section through the Mactaquac upstream cofferdam 1965

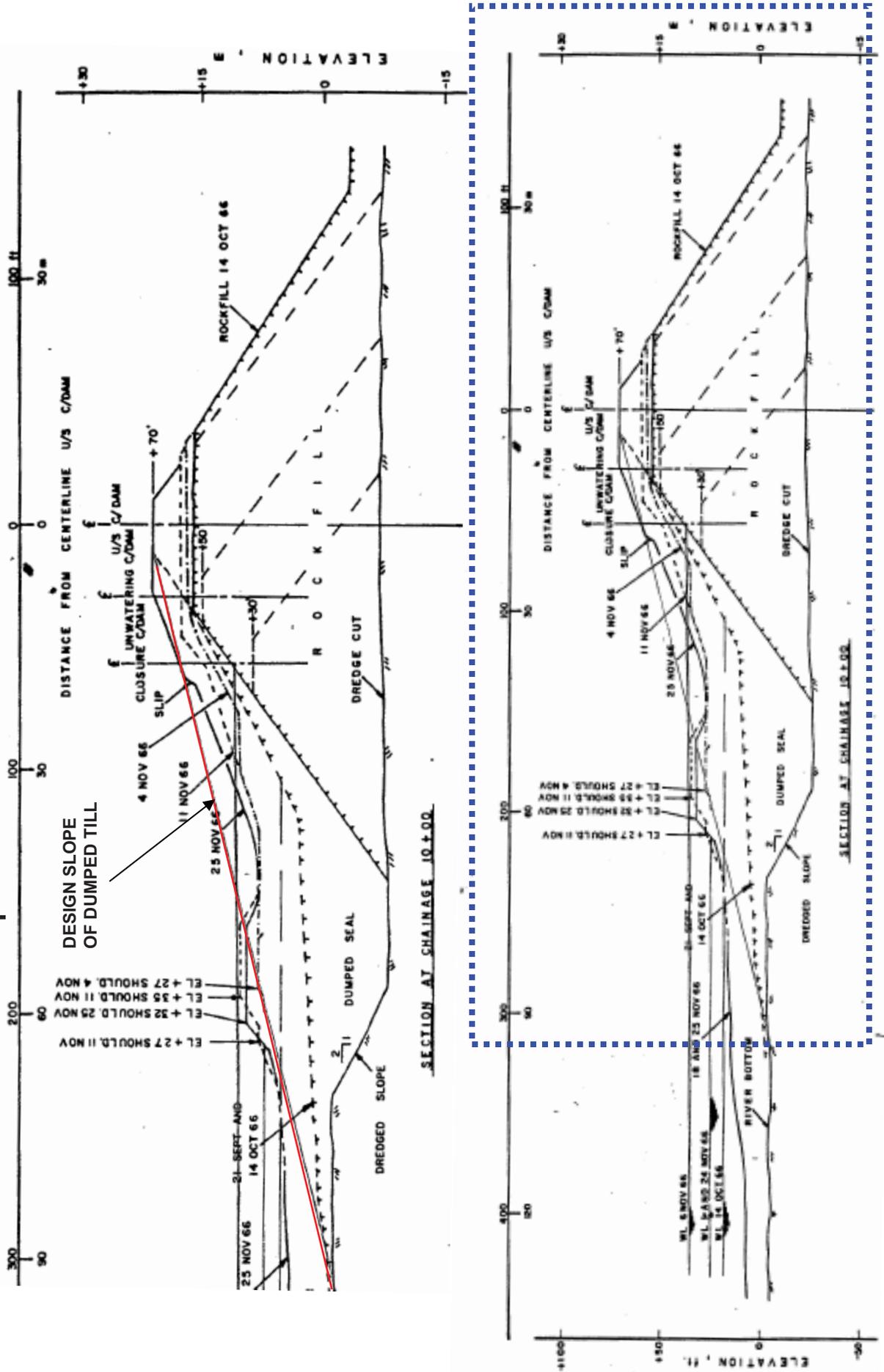


Fig.3 - Section through the Mactaquac downstream cofferdam 1965

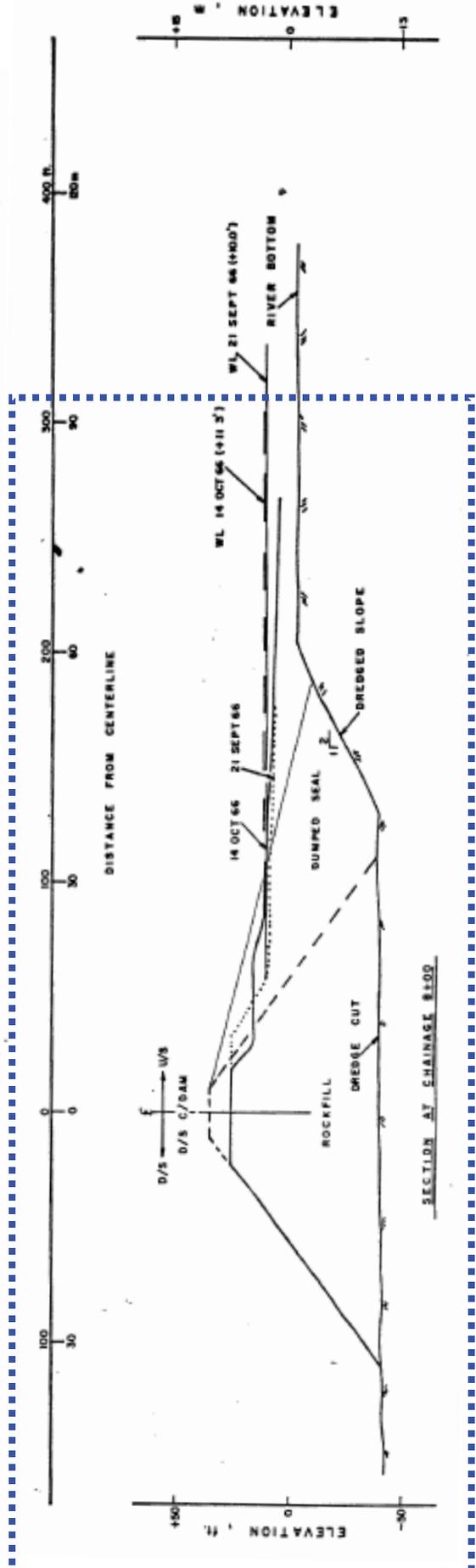
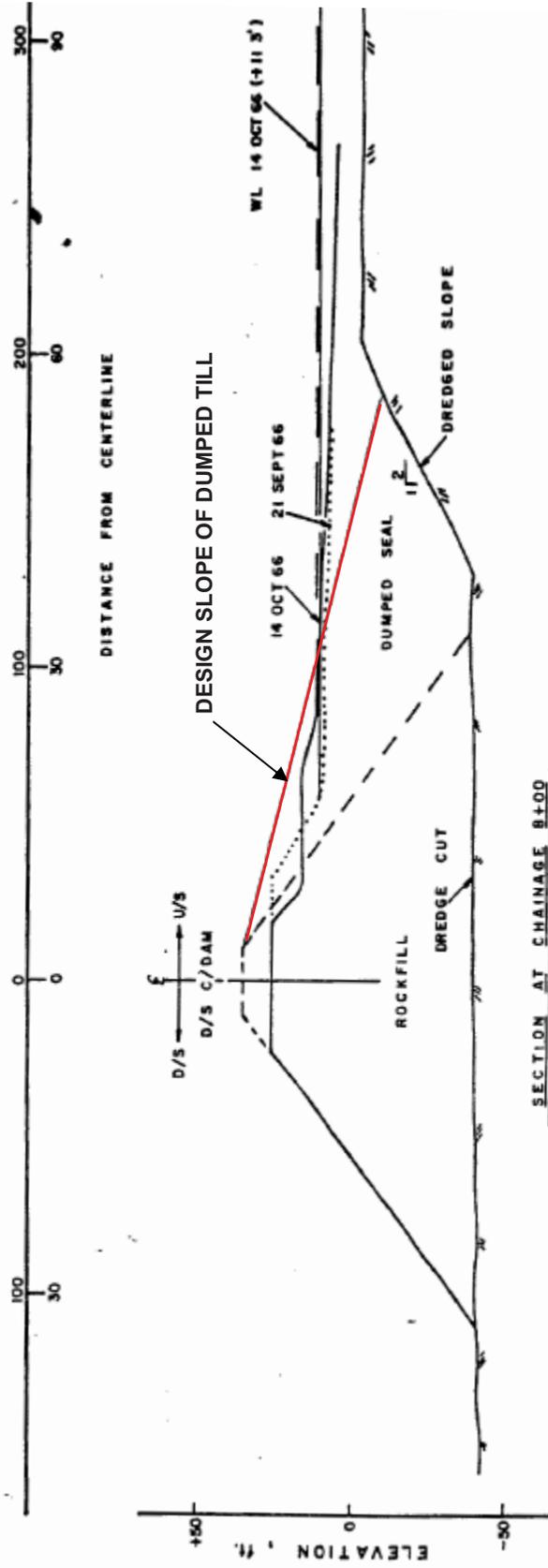


Fig.4 - Glacial till from the Mactaquac borrow pit

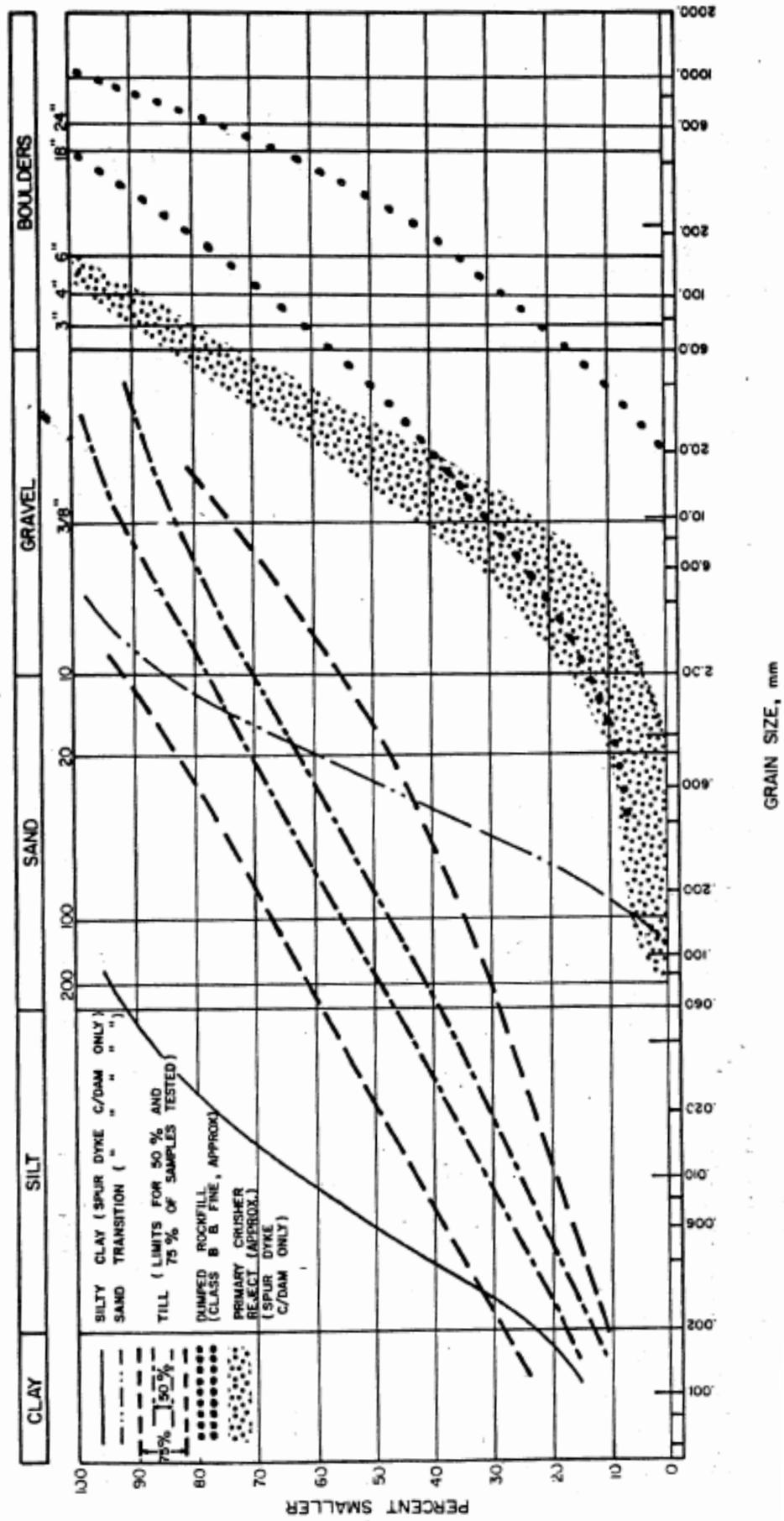


Fig.5 - Location of boreholes for
Mactaquac main dam foundation

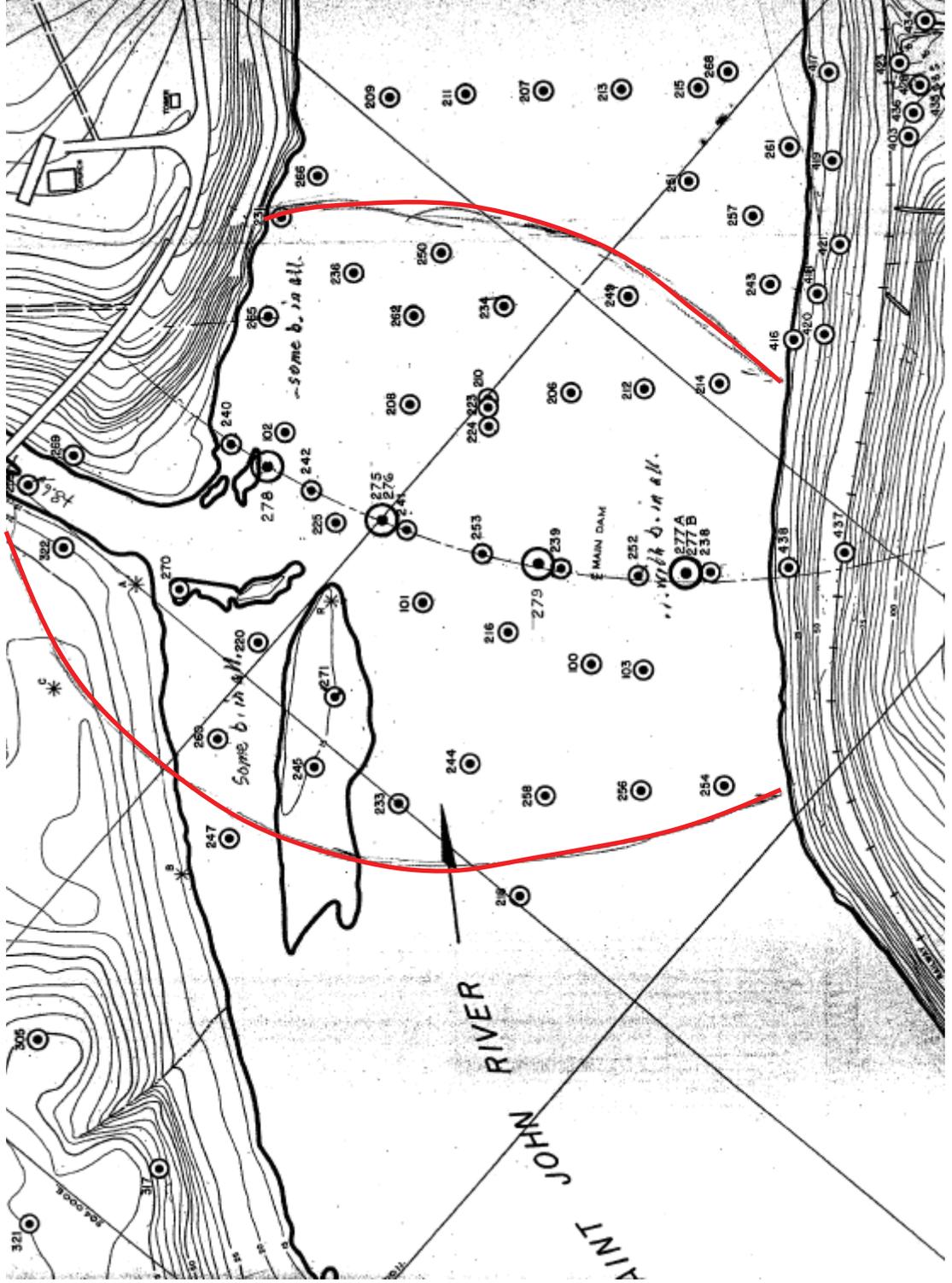


Fig.6 - Excerpt from Mactaquac dredging specifications

(4.B2) repair or replace any damaged to the approval of the Engineer, and tional expense to the Commission.

Occasional boulders may be encountered in the dredging which may be too large to be handled by the dredging equipment. Such boulders may be left on the dredged surface in the areas beneath the proposed rockfill cofferdams. Should the quantity of such boulders be so large that, in the opinion of the Engineer, it is necessary to remove them, all work associated with the removal of the boulders shall be done by the Contractor and payment shall be made as provided for under the Clause entitled - Alterations; Extra Work and Deductions, in the General Conditions.

Excavation in any area not stipulated in these specifications will not be tolerated, and