REPORT ON THE DAM SITE AT GREAT LAKE

General Geological Conditions of Dam Site

The rock composing the whole of the dam site is diabase. This is an intrusive igneous rock which has cooled at considerable distance beneath the surface. Its thickness is, in the locality of the Great Lake, in the vicinity of six to seven hundred feet. It is much jointed, these being the fractures resulting from the contraction taking place during the cooling of the igneous mass. This fracturing often results in polygonal columns, but in the vicinity of the dam site the fractures are very irregular and the rock is broken up in irregular shaped masses. Some of these fractures are filled with zeolite which is a white mineral.

The dam site occupies, with the exception of the eastern and western ends, the bottom of the original Great Lake which was much larger than the present lake, and extended southwards until tapped by the back cutting of the Shannon River which has proceeded as far as the hard bar on which the present dam has been built. Geological evidence is sufficient to show that there never has been any other stream flowing out of the present outlet of the Great Lake than that at present in existence, and this is flowing in about the same channel as it always has flowed.

The actual condition of the diabase rock near the surface of the dam site is solely the result of the action of surface agencies decomposing the rock and the extent to which this decomposition has proceeded downwards. The intesity of the fracturing of the rock has presented conditions which have enabled this decomposition to proceed some distance downwards. This decomposition would have taken place mainly while the present dam site was under the water of the original lake. The Shannon River has worn away the greater part of this decomposition product with the result that the bed of the river and the immediate vicinity thereof is solid rock a few feet below the surface. Further up the slope, however, and approximately coinciding with the original shore of the lake the decomposition has proceeded deeper, and in addition the decomposition products have not been removed by the scour of the river. One of the special results of the decomposition in the vicinity is that of the decomposition of the zeolite. The waters percolating downwards have converted this mineral into a soft, greasy clay which now fills the original fractures and offers a very dangerous slippery surface. These fractures are mainly vertical but some occur at an angle of 50° from the horizontal.

Necessary Conditions for Dam Foundations

Under the circumstances existing, therefore, it is obvious that the dam construction should only be started on the solid rock, and excavations should be carried to such an extent downwards as will ensure that the intense decomposition zone is passed through. To attain this result is simply a question of continuing excavations downwards until this surface feature is passed through. There need be no fear whatever that such decomposition will increase downwards as it is not due to causes which have risen up from below, but only to agencies which have descended from the surface, and therefore the amount of decomposition will gradually decrease with increase in depth. On the evidence available I am of the opinion that in no part of the dam site is decomposition sufficient to render the rock unfitted for foundations to a greater depth than approximately 30 feet.

Result of Present Excavations for Foundations

Arch 0 W Not yet at the bottom of clay seams, but will reach solid rock within 2 feet.

Buttress 0 W On solid rock in the south at 4 feet. Not through clay at northern end, but solid rock should be met a few feet below.

Buttress 3 W On solid rock varying from 5 feet below surface at north end to 6 feet below surface at south end.

Arch 3 W On solid rock on the west side. East side not excavated.

Buttress 4 W On solid rock varying from 5 feet at north end to 6 feet at south end,

Arch 4 W On solid rock varying from 5 feet at north end to 8 feet at south end.

Arch 5 W On solid rock varying from 6 feet at east end to 4 feet at west end.

Buttress 6 W On solid rock at 10 feet at both north and south ends with a depression 14 feet deep towards the southern end. This depression is a seam of clay about a foot wide in the bottom, but the conditions are satisfactory for foundations.

Arch 6 W On solid rock at 5 feet from surface at east end, deepening to 7 ft. 6 inches in the centre. The west end is filled with the fall which took place on the occasion of the recent accident.

Buttress 7 W Solid rock at 10 feet from the surface at the extreme northern end, excavation then sinks suddenly to a depth of 16 feet which extends for the rest of the length of the buttress. The bottom of this excavation is still in soft decomposed rock with a number of slippery clay heads formed by the decomposition of the zeolite. The conditions here are unsuitable for the foundations of the dam. I would advise the widening and deepening of this excavation with the object of reaching the more solid rock. It would also be advisable to extend the excavations southwards in order to ensure that the southern end of the buttress is solid rock foundations to avoid the possibility of shearing southwards as the present southern end has many of the slippery heads.

Arch 7 W Solid rock at 14 feet from the surface on the east end deepening to 16 feet in the centre, and shallowing to 10 feet at the west end.

Buttress 8 W Solid rock varying from 6 feet on the north end to 10 feet on the south end.

Arch 8 W Solid rock at 10 feet on the east end, shallowing to 6 feet in the centre, sinking to 10 feet a short distance westwards and shallowing again on the west end to 7 feet.

Arch 1 E Solid rock at 8 feet.

Buttress 1 E Unfinished at north end, but solid rock not far below. At the south end solid rock nearly to the surface.

Arch 2 E Solid rock at 5 feet.

Buttress 3 E Solid rock at 5 feet.

Buttress 4 E This excavation is 9 feet 6 inches deep. It is in a clay which can be dug with a shovel practically to the bottom. This clay has been thought to be a bed of an old outlet of the lake, but I can quite definitely say that this is not so as the clay represents the decomposition product of the diabase which is in the original composition of the diabase and has only had removed from it the soluble constituents. It is in fact decomposed diabase in situ. To reach solid rock for foundation, therefore, this excavation will have to be deepened when the rock may be expected to become gradually harder, but in this case also I do not think that solid rock will be deeper than 30 feet from the surface. In a test hole to the east of this buttress similar material occurs, but the bottom which is about 9 feet from the surface shows the rock to be less decomposed than the bottom of the excavation of the Buttress 4 E. A few feet further east solid rock occurs practically at the surface.

Conclusion

The two localities therefore in which the foundations have been demonstrated to be unsuitable with the present amount of excavation are Buttresses 7 W and 4 E which are approximately at the original shores of the lake. The solidity and safety of the rock mass will increase progressively downwards, and in both these cases excavations should be continued until sufficient solidity and undecomposed character of the rock are attained.

L. Hills

GOVERNMENT GEOLOGIST

Launceston,

19th February, 1921.