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REPORT ON CERTAIN MATTERS CONNECTED WITH THE BUTLER'S GORGE - TARRALEAH HYDRO-ELECTRIC POWER SCHEME

1. INTRODUCTION

A report on certain matters connected with the Butler's Gorge - Tarraleah power scheme was furnished on 26/9/41. Subsequent to that report a further visit was made and the present report is the result of that visit. This report will furnish additional information on certain matters already reported on and also deal with other matters not discussed in the first report.

11. THE STORAGE BASIN

A dam is to be constructed across the Derwent River near the northern end of Butler's Gorge and portions of the valleys of the Derwent, Guelph, Rufus, and Navarre Rivers will be flooded. Although it was known that much of the storage basin and adjacent country was occupied by dolerite (diabase) no information was available as to the geological formations along the Rufus and Guelph rivers, and as some of the Lower Palaeozoic rocks (including limestones) might have extended northwards from the Gordon River, it was deemed advisable to make a reconnaissance trip to the storage basin.

The attached geological map shows the rocks present in the storage basin, sufficient of which was inspected to ensure that the conditions were not unfavourable. The hills along the eastern side of the basin are occupied by dolerite. Dolerite also occupies the hills to the south of the dam and extends along the western side of the storage in the Derwent. at least as far as north of the Navarre River (the storage of the Rufus and part of the Guelph is west of this diabase.

The storage basin along the Derwent River is occupied wholly by glacial and fluvio-glacial rocks. The storage along the Guelph and Rufus Rivers above their junction is also occupied by similar rocks. The surface is characterised in many places by large boulders of dolerite and the upper beds is apparently largely of a morainal nature. At lower levels the boulders are absent, and, where exposed, the beds are finer. Tillites are exposed in the bed and banks of the Navarre River. Tillites, sands and clays are exposed at places between the Derwent Bridge and Cynthia Bay.

At the southern end of the storage basin near the Rufus River sandstones and pebbly shales and sandstones form three small rocky knolls. Some are fossiliferous, and indicate that the rocks are of the Permo-Carboniferous system. Rocks of that age also occur along the West Coast road near the Navarre River.

To the east of Butler's Gorge, sandstones and grits occur over a width of 2 to 3 miles. They are largely covered by fluvio-glacial deposits but outcrop extensively around the Hydro-Electric Department's sand-pit. Outcrops occur in the Derwent River, 2½ miles east of Butler's Gorge and in the tributary creek entering the Derwent nearby. Exposures exist along the canal and in roadside quarries in that vicinity. In one of the quarries, carbonaceous beds occur. In the previous report (26/9/41) these rocks were referred to the Permo-Carboniferous system, but it is now considered that they are more likely to be of the Triassic system.

In similar country eslewhere in Tasmania, the open valleys are usually occupied by the soft sedimentary rocks of the Permo-Carboniferous and Triassic systems, and the hills and gorges by dolerite. It has already been shown that the open country of the Rufus River and that around the sand-pit are occupied by such soft sedimentary rocks. It is, therefore, possible that similar rocks may occur beneath the plains along the portion of the Derwent River to be occupied by the Storage basin, but there are no known exposures.

The above rocks and the geological structure are such that there will not be any leakage from the storage basin.

111 - THE DAM SITE.

GENERAL

Further field investigations have increased the belief that the dolerite forming Butler's Gorge is in the form of a dyke.

However, specimens of the dolerite and the analyses of the dolerite from the upper and lower quarries were submitted to Dr. A.B. Edwards, of the University of Melbourne. Dr.Edwards has in recent years made a study of the chemical and mineralogical composition of the Tasmanian dolerites with particular regard to their occurrence as sills, dykes, &c. From the chemical aspect, and less so from the mineralogical aspect, he considers that the dolerite in the vicinity of the two quarries is in the form of a sill, and that the bottom of the sill would be approximately 300 feet below the lower quarry.

The opinion of Dr. Edwards does not affect my view that the dolerite is probably a dyke, but in order to ensure that there is a minimum thickness of at least 200 feet of dolerite below the dam foundations, it is strongly recommended that at least one bore should be put down to a depth of 200 feet as suggested in my report of 26/9/41.

DETAILED

The dolerite in two places along the dam site was disscussed in detail on the ground.

On the western bank of the river, the foundations would, at one place, have weathered dolerite on the downstream side and it would have been extremely difficult and costly to have extended the foundations deep enough (owing to the slope of the hill being much the same as that of the wall) to encounter solid unweathered dolerite.

As most of the dam was on unweathered and only slightly jointed dolerite, it was obviously very desirable from the engineering view point to move the dam site a short distance upstream.

move

A somewhat similar situation existed on the eastern side of the river, but was not quite so serious a matter. This place was discussed in the report of 26/9/41. The decision to shift the dam a short distance upstream also overcame the difficulty at this place.

The advantage of having unweathered dolerite on the downstream side of the foundations at all places will offset the slightly increased expenditure on the excavations. The value of the excavations has not been totally lost because it was through that the unsatisfactory nature of the rock at two places was ascertained, and further the existing faces will facilitate the additional excavation which has been made.

1V SANDSTONE

It is proposed to crush pebbly sandstones and grits for use in the concrete for the dam. The mapping has shown that there is a large area (about 4 square miles) of sandstone country, but that as far as can be seen, the pebbly beds are restricted to the vicinity of the sand-pit. Such beds are the result of deposition under conditions of strong water currents and are likely to be erratic in distribution and of no great lateral extent. A small area has been exposed already by the development work being conducted, and no better procedure can be adopted than to continue to follow the beds by similar developmental work.

In general, the beds dip to the east, with variations between north-east and south-east; the amount of the dip is about 10° to 15°. At the western end of the sand-pit the dip is much steeper (up to 30°), but it becomes less towards the eastern end of the pit. The dips should be considered when following the beds to open up a quarry face.

V - THE LAND SLIPS NEAR DRAIN 85 ON CANAL

Since the previous visit and report, there had been no further movement in these slips. In the drainage adit, a drive has been driven to the south-east along the joint plane which the water was issuing. The face of the drive was in slightly weathered dolerite from which only a small amount of water was issuing at the level of the floor. It was stated that the large inflow of water had come from a length of only 12 feet of the joint.

The drive had, therefore, achieved its objective in draining the water-bearing part of the joint and it was advised that the work in the drive should be stopped. At the same time it was advised that, because the slip was almost certainly confined to the canal spoil-bank, the soil, sub-soil and the weathered dolerite, drainage, should be attempted at a higher level, and either in, or at the level of the top of, the weathered dolerite. By picking up as much drainage at that level as possible, the possibility of further slips would be reduced as much as possible. It should also be the aim of such works to pick up the water enteringthe adit at as high a level as possible not only for the above reasons, but also to avoid any possible stoppage of the flow by the filling (with soil, &c.) of the joint above the adit level.

V1 - SLIPS NEAR TARRALEAH PIPE-LINE

The lower part of the pipe-line to the Tarraleah power station is laid down the western side of the gorge of of the Nive River and has a steep slope. The gorge has a depth of approximately 900 feet. The upper part (about 550 feet) is occupied by basalt and the lower part (350 feet) by dolerite (diabase). The basalt filled the valley of the pre-basaltic Nive River, and overlies the dolerite with a generally horizontal junction, the contact being in the vicinity of anchore U to T.

On such a steep slope, falls of rock and slips of the surface soil, sub-soil and loose rocks are likely to occur. The slips, in particular, are usually caused by the satuation of the lower layers with water. It is, therefore, necessary to control the sub-surface drainage in order to reduce the possibility of land slips.

Small slips, areas of crumbly, and cracks have developed on the north side of the pipe-line near anchors U and T and between the 1360 and 1480 contours. West of this area, there is a slight basin-shaped depression (Contours 1490 and 1510), which suggests a former land slip or fall of rock from the cliffs. To the west of this basin cliffs of basalt rise almost vertically for a short distance. This disturbed area is situated at, and near, the bottom of the basalt. The reason is that from the bottom layers of basalt and the junction of the basalt and dolerite, a greater quantity of underground water is likely to issue (and tend to saturate the soil, &c.) than from any other places down the side of the gorge.

The objective of methods of prevention should be to pick up the underground water as near its source as possible and also at as many places on the bedrock as possible within the threatened area. Deep trenches should be dug so that they reach the bedrock (whether it be basalt or dolerite) and quickly remove the water. If the depth of material above the bedrock becomes too great for trenches, then either the trenches should be continued as adits or else a number of trenches should be dug at short intervals up the slope of the hill so as to reach bedrock at a number of places. The positions of the drainage trenches should be those already selected by the Hydro-Electric Department along the shallow depressions revealed by the detailed contour survey. The most important of these are that passing near anchor T and the triple-headed one passing near anchor V. It would be advantageous in the cases of the depression near anchor V, to start the work near the heads, because if the whole of the water can be picked up there, it can be piped or conducted away in concrete drains and drains need to be dug lower down. If water still issues from the excavations along the pipe-line the trenching should be continued until the whole of the flow is controlled. The trenching along the depression near anchor T should be commenced near that anchor. The trenching in the depression west of anchor V should be continued sufficiently far to the west to pick up the junction between the basalt and the dolerite. The trenching in the depression near the anchor T and the triple-headed one near anchor V should be continued sufficiently far to the west to reach the bottom of the cliffs of basalt which occur in that direction. All drainage water should be led away in drains or pipes which will prevent any of it soaking into the ground.

As the depressions are already marked on the plan (5907) of the Hydro-Electric Department, no further plan will be attached to this report. It should be noted, however, that the depressions are marked on that plan as far west as contours between 1460 and 1490, but that the drains should be continued to the west, as recommended above, and to a contour possibly as high as 1530 or 1540.

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