PRELIMINARY REPORT ON THE POSSIBILITY OF UNDERGROUND WATER SUPPLY AT GLENORCHY.

Following a request received from the Glenorchy Council, a geological examination has been made of part of the Glenorchy Municipality in order to determine the practicability of augmenting the municipal water supply from underground sources.

A full report is in preparation concerning the geological structure and stratigraphy of the area examined, which will be accompanied by geological maps. The purpose of this interim report is to present in advance the results of this investigation so far as they bear on the water supply problem.

The investigation was requested because a trial shaft sunk by Glenorchy Council in connection with its sewerage works, adjacent to Humphreys Rivulet below Grove Road struck the water table at a depth of 6 feet and found the rate of flow at 25 feet to be of the order of 50,000 gallons per day, this measurement being made at the peak of the 1945-46 drought. Chemical analysis showed the water to be of good quality.

As a result of the present investigation I report that a water bearing area exists forming the floor of the glen after which Glenorchy is named. This area whose boundary is shown on the attached plan is composed of gravels, sands and clays probably partly of lacustrine origin in Upper Tertiary times, and partly formed as an alluvial fan at the change in thalweg of Humphreys Rivulet. These sands are permanently saturated because Humphreys Rivulet has to keep them saturated before it can flow at all as a surface stream. This saturated zone forms a storage which can yield water long after the surface stream has ceased to flow.

There is no water bearing area further up wither the Humphreys Rivulet or Tolosa Creek Catchments, and the valleys of Islet and Faulkner's Rivulets are likewise unpromising. There is, however, another area at Moonah which might be capable of development in the same way as the area at Glenorchy proper. Of the two areas the Glenorchy one is the more attractive and should be developed first even if use of both is contemplated.

Possible Development by Shaft and Infiltration Gallery

Water may be drawn from this area either by (a) a grid of wells spaced across the underground storage area or (b) a single sump with laternal horizontal infiltration boreholes on the Ranney system or (c) a single sump with laternal horizontal infiltration galleries.

The first method necessitates a large number of shafts, for which resumption of many small areas of private property would be necessary. It would also necessitate an equal number of pumps to gather the water to a central pumping station where a multistage pump would inject it into the reticulation mains. The risk of pollution entering the basin down the several shafts would be high and would need extensive safeguards.

The second possibility would avoid several of the objections to the first but would not be as efficient as the third for this particular underground reservoir, because what is wanted is not so much radial gathering round the sump as a single inflitration channel across the full effective width of the underground flow channel. This is not a simple underground storage

basin into which the water flows, and cannot escape, so that effective pumping from one place can lower the water table and eventually drain the whole basin. It is really an underground valley filled with permiable material and the water is in constant movement down the valley and into the Derwent. If an infiltration gallery is dug across the bottom of the valley for an appreciable part of its width, all water passing down the underground valley has to pass across the infiltration gallery and if pumping is increased, all water in the system can be tapped allowing none to go to waste into the Derwent. If this is done it is reasonable to hope for a yield of probably not less than half a million gallons per day but it might well be three or four times this amount. The maximum yield is governed by the total rainfall of the Humphreys Rivulet and Tolosa Creek catchments which is of the order of 2,577,000,000 million gallons a year. Of this at least half is lost during excess run off in wet periods, and some is lost to evaporation. But it is reasonable to expect about 20% to pass through the underground storage channel with which we are dealing. This places an upper limit on the amount of water which could be hoped for as 1,400,000 gallons per day. This takes no account of the water stored in the basin and so long as the draw down does not exceed the average daily intake of approximately 1,400,000 gallons, a greater amount could be pumped during the summer months.

Optimum Location for Inflitration Gallery

The infiltration gallery should run transverse to the flow, that is, roughly at right angles to the surface course of the Humphreys Rivulet. Several factors bear on the question of where this gallery should be placed :-

(a) Catchment: The lower towards the Derwent the transverse gallery, the greater the catchment available. For all rain falling even on the glen itself finds its way into the underground pore spaces and augments the supply.

(b) Storage: The storage capacity of the pore spaces of the sands of the basin is of the order of 2,320 acre feet. The gallery should be kept as low as possible in order to use as much as possible of this storage. If the gallery were located high, say up towards Clydsdale Avenue, it would have less storage to meet drought periods.

(c) Drawback from Derwent: The gallery cannot be located too close to the Derwent because on heavy pumping salt water might be drawn from the Derwent. However, anywhere above a point about halfway between the railway line and Grove Road, there is no danger of this happening because the reduced level of the gallery would be well above the reduced level of the Derwent.

(d) Contamination: Risk of contamination by town pollution decreases as the site is moved back up the valley. The question of pollution will be discussed later.

(e) Length of Gallery: necessary becomes less as the site is moved up the glen, and the valley becomes more restricted with probably a steeper bottom transverse profile. Since length of gallery is the heaviest factor in cost, this is important.

(f) Availability of Land: This is an important consideration in the case of a built up area like Glenorchy, where resumption would be very costly, legally difficult, and undesirable.

The following areas are at present available to the Council :-

(1) An allottment between Tolosa Street and Terry Street.

(2) The reserve in Eady Street. (This is too near the margin to be suitable for a shaft site.)

(3) A large vacant area opposite Glenorchy Station, at present used as a playing field and for grazing.

(4) The Esplanade at the mouth of Humphreys Rivulet. (This is considered too close to the Derwent for heavy drawdown).

(5) The reserve along the railway line could probably be made available for this purpose.

Considering all the above factors, the most suitable site for an infiltration gallery seems to be along the railway line with a sump possibly situated on the area owned by the Council opposite Glenorchy Station.

Works Necessary

It would be necessary to sink five or six shafts about six foot square and about 200 feet apart to bedrock 25 feet deep along the railway reserve and connect these up by a drive on the average gradient between the bottom of the shafts. If the first shaft were located near where the railway line crosses Humphreys Rivulet, then one on each side of it 200 feet away, the sites of remaining two shafts could be determined according to the direction of fall of the bottom profile, so that the final line of shafts would be roughly symmetrically arranged across the deepest part of the drift. This would avoid the necessity of a preliminary line of test bores. The lowest shaft would then become the final pumping sump and the others filled in when the driving was completed, and packed for the upper ten feet with puddled clay to seal them off as possible conduits for polluting surface waters to the gallery.

Owing to the unconsolidated nature of the material the drive would have to be supported all the way by timbering with close sets and close lagging. Pipes with open joints could then be laid along the gallery and the remaining space packed with gravel. Large capacity pumps would be necessary to keep the water down while work was in progress. If driving were commenced from the deepest shaft, the final multi-stage pump could be installed as soon as this shaft and the driving from it were completed and the water pumped into the main to its full capacity to yield. This would assist in lowering the general level of the water table and reduce the amount of pumping from the next shaft when driving work was still going on. This would also have the advantage that some idea of the total yield would be known while work was going on and the total length of the infiltration gallery reduced or increased according to current need. If the work were stopped in this way, the capacity of the scheme could be increased at a later date by sinking an extra shaft and extending the gallery.

Owing to the unconsolidated nature of the drift and its saturation with water the work would need to be carried out by men well experienced in this type of work. Such men are often hard to get but some of the men recently laid off at Briseis have been accustomed to driving through the unconsolidated tin bearing drifts of that area and are fully competent to do this work.

Estimated Cost

Final estimates would need to be made by an experienced engineer after full details are worked out. However, a preliminary estimate of the order of magnitude is necessary at this stage. It is estimated that at least 1,200 feet of driving will be necessary with timbering, laying of pipes and packing. This might be expected to cost up to £5,000.

A multistage submersible pump capable of lifting a million gallons of water a day to the head of the present mains

may be estimated at £1,000, and the pipe connections, electric connections and housing may add another £1,000. The whole scheme might therefore be expected to cost something like £7,000, of which more than half would be labour costs in sinking and driving.

Contamination

The possibility of contamination by polluted surface waters needs careful consideration and should be referred also to the Director of Public Health.

However, provided precautions are taken to protect the main sump from contamination by surface waters, and the auxiliary shafts are properly sealed with puddled clay for their upper ten feet to prevent surface waters getting direct access to the infiltration gallery, the danger of contamination is low. If the gallery is twenty feet below the surface, all water reaching it must be filtered through at least 20 feet of sand and clay. However, the drift is stratified with some layers more clayey than others, which means that the direction of movement of the underground water, would be mainly horizontal parallel to the more porous layers. Hence the path of the surface waters towards the gallery would be always considerably longer than 20 feet and the filtration would probably be sufficiently thorough to remove all harmful organisms from the water. Bacteriological tests should be made after prolonged pumping from the existing shaft near Grove Road, but care would need to be taken to ensure that the tests were not vitiated by surface water running directly into the shaft from the surface.

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