

REPORTS PREPARED FOR THE HYDRO-ELECTRIC DEPARTMENT  
ON THE DAM SITES FOR THE CONSERVATION OF WATER AT  
UPPER HUON AND MACQUARIE PLAINS

UR 1920-1922 / 180-185

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INTRODUCTION

The following reports are the results of recent investigations into the nature of the rock formations occurring in these areas. The main objectives of these examinations are to ascertain whether or not the valley-sides will form suitable retaining walls in connection with the construction of concrete dams to impound the waters of the rivers and their tributaries for the purpose of generating power for industrial uses. As these papers deal mainly with the dam sites, attention will be confined almost exclusively to the subject in hand, viz., the discussion of the relation of geological structure of the formations to the dam foundations.

THE HUON RIVER SITE

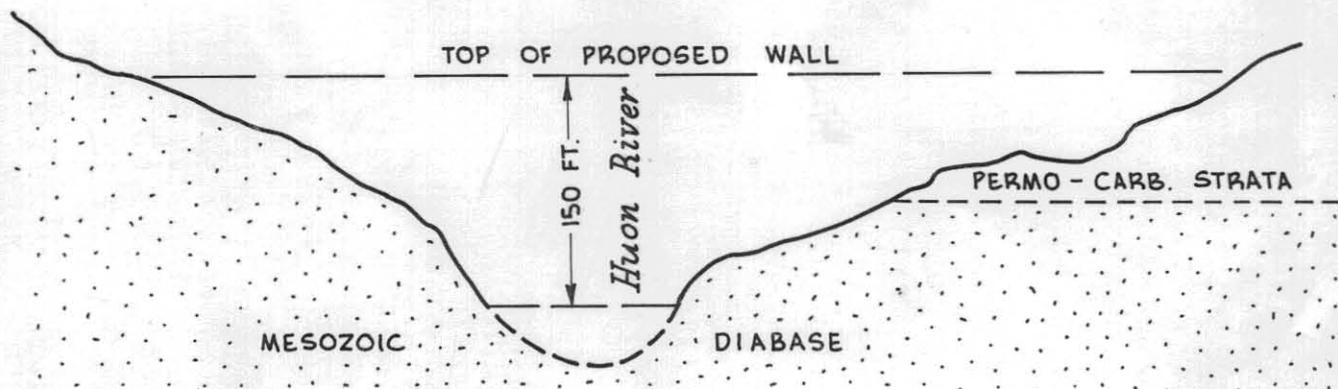
The site of this dam is a little over a mile below the confluence of the Arve and Huon Rivers, about 45 miles by water from the sea-coast. The contours of the valley in this area have been carefully surveyed at 10-foot intervals, and accurate plans and cross-sections have been prepared. Four places, within a length of 20 chains, have been selected for special consideration. At each of these places on both sides of the valley trial pits have been sunk at about 30 feet intervals from the 200 to the 350 feet contour in order to ascertain the depth of soil overlying the solid rock. Pits have been sunk also at intermediate points from which data of considerable value have been obtained. It is proposed to construct a wall at least 150 feet high for a smaller dam would provide neither sufficient "head" nor an adequate storage.

The general geology of the area is simple and the structural features are not difficult to decipher. Sedimentary rocks consisting of Permo-Carboniferous mudstones occupy the surface just above the dam site while igneous rocks prevail at the place selected for the construction works. An examination of the structure of these formations shows that the strata have been intruded by diabase. This basic intrusive has the form of an immense sill, many hundreds of feet thick, which dips in a south-westerly direction at a very gentle angle in conformity with the bedding planes of the Permo-Carboniferous sediments. The upper portion or hanging-wall of the sill is cut in the bed of the stream just above the No. 2 or most westerly site gradually rising in a north-easterly direction until at the No. 3 site, 20 chains downstream, it occupies the whole of the valley. This rock, on the hanging-wall of the sill, has suffered greatly from the effects of decomposing agencies.

Cited in their order of succession from West to East the four possible sites are numbered 2, 4, 1 and 3.

No. 2 Site - Diabase shows strongly on the south side, but is weak on the North, where it is overlain by mudstones. The hill slopes on both sides are very gentle and because of this and the presence of soft mudstone the site is quite unsuitable.

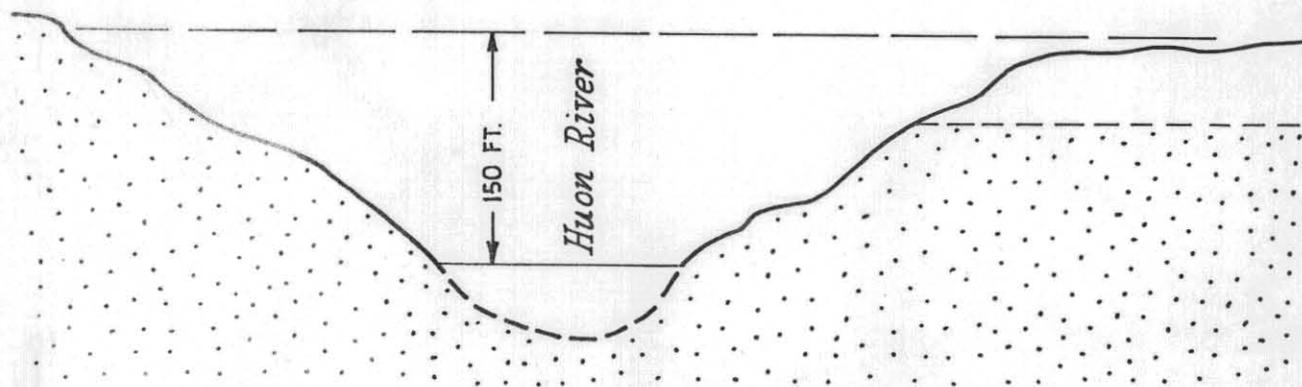
## CROSS SECTION N°2 SITE



No. 4 Site - On the South side massive diabase rises at a high angle from the river bed to a height of 200 feet; on the north like conditions prevail up to the 270 feet contour or 70 feet above waters-edge. Thence the rock is covered with a considerable depth of clayey soil and subsoil which increases as the summit of the hill is approached. Pits sunk on this line up the hill side show unequal weathering of the underlying diabase. From the 300 to the 350 feet contour there is a heavy mantle of soil from 20 to 70 feet deep. Above the 350 feet contour the surface rises very gently suggesting a complete rock decomposition. Further indications of the continuance of these conditions is evidenced by the tremendous sizes and heights of the eucalyptus trees hereabouts.

## CROSS-SECTION - NO. 4 SITE

## CROSS SECTION N°4 SITE

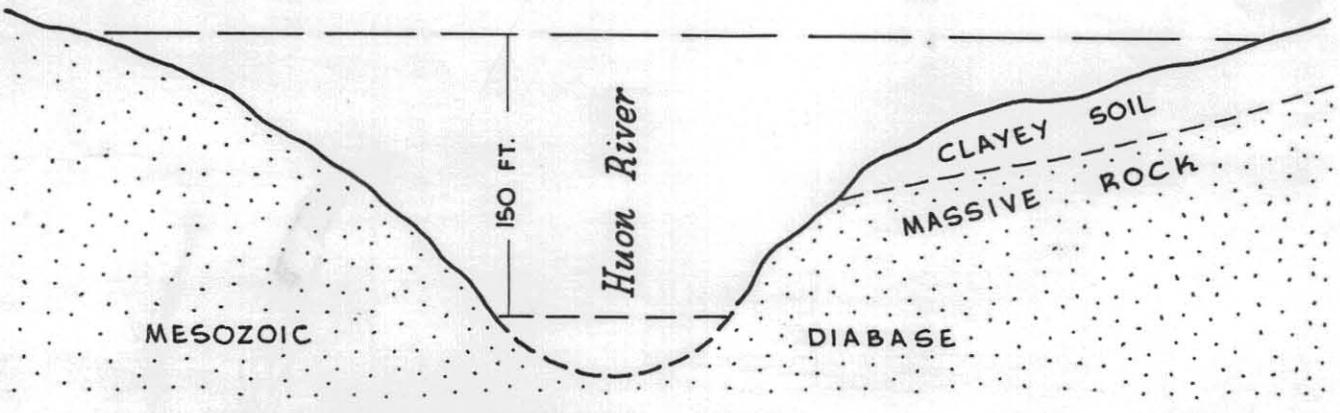


No. 1 Site - Like the preceding, presents no engineering difficulties on the south side of the river. Up to the 300 feet contour line massive diabase is met within a few feet of the surface, but from this point the soil cover increases rapidly. No. 2 pit sunk on the 320 feet contour is 42 feet deep. The top soil consists of ochreous felspathic material and the subsoil is a light yellowish decomposition-product of diabase only slightly argillaceous. At the bottom of the pit rock decomposition has not been so complete.

The material consists of rounded boulders of diabase set in a clayey matrix. No. 1 pit on the 340-foot contour is down 66 feet in soft clay. The particles in the clay do not cohere strongly but are easily detachable by pressure of the fingers. Material of this kind tends to slide when it becomes water-soaked, the whole mass slaking and flowing readily. The ground rises so bently northward that an immediate improvement in the conditions is not anticipated in that direction.

CROSS-SECTION - NO. 1 SITE

CROSS SECTION N°1 SITE

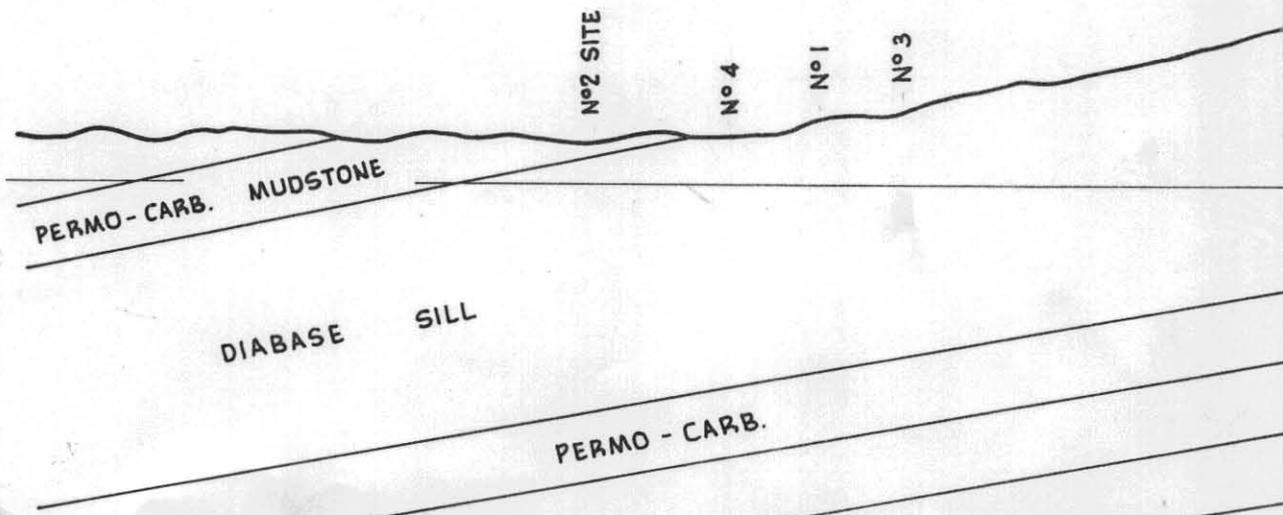


Sites Nos. 4 and 1 are similar in many respects, with certain advantages in favour of the latter. In both, the very great depth of soil on the north side precludes the possibility of either being selected as the length of wall required outweighs any other advantages they possess over other sites. It is considered, however, that the surface of the undecomposed rock above the steep incline rises in conformity with the gentle slopes of the hill. Generally, the angle of inclination of the surface is indicative of the degree of decomposition the rock has undergone.

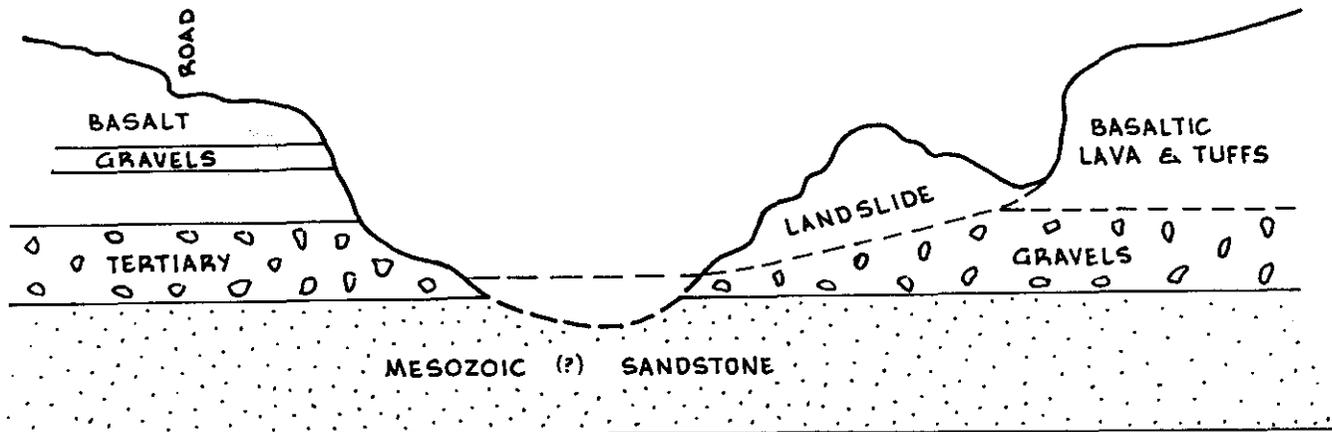
At No. 3 site on both sides massive diabase outcrops strongly for 200 feet above the level of the river. It is obvious that this site would be selected if the conditions were similar in other respects. The difficulty presented here is that the width of the river is much shallower, and massive rock crops out in mid-stream providing splendid facilities for construction. Moreover, immediately below there is an ideal site for a power station. Doubtless these advantages will receive careful consideration in the final discussion on the several sites.

CROSS-SECTION - DIABASE SILL

CROSS SECTION DIABASE SILL



since that time, has cut through the basalt cover and is now deeply entrenched in the gravels of its old channel. In quite recent time the disintegration and removal of portion of the underlying Tertiary gravels by the action of the stream in contact with them has undermined the basalt cover and the weakness thus induced has led to the displacement of enormous masses of material from the valley sides. This material slipped on its bed of shingle down to the river edge leaving in its wake basaltic debris and showing high escarpments which mark its original position on the side of the valley. On the south-east side these land-slides are of minor magnitude only and in places splendid sections of the undisplaced formations are exposed for examination. Here the basalt is found resting on 20-30 feet of well-rounded boulders (2 to 8 inches in diameter) consisting largely of quartzitic rock with interstitial material of the same kind. It is considered that the basal sandstone rock is fully 20 feet below the present river bed. In confirmation of this it has been observed that in the construction of the concrete piers for the railway bridge, 20 chains downstream, piles have been utilised in penetrating the deep wash. Furthermore, at a point 30 chains south of the railway station where the river is flowing rapidly the old gravel formation is exposed to a depth of 30 feet. At this spot on the south-east bank the old terraces are gradually slipping towards the river and the encroachment has proceeded so far up-hill as to threaten the safety of the railway.



It will be seen from the foregoing that the banks on both sides of the river are unstable. Moreover, the sandstones may prove to be too soft to serve as a base for the concrete wall. Specimens of this rock obtained from the banks of the stream a few miles away are softer than concrete.

The route of the proposed water-race follows the valley of the river practically the whole way to the site for the power-station. It passes over old river terraces consisting of unconsolidated alluvial material, and in places over fractured basalt consisting of volcanic ash and vesicular rock. Allowing for a very slow rate of flow the loss from leakage would be considerable, and the angle of repose of the wet alluvium is so small that constant attention would be necessary to keep the race in repair. It is probable that the carrying capacity of the race would be so impaired as to make the whole scheme impracticable.

The only alternative position which may be conceived possible under the unusual conditions prevailing appears to be that between Nos. 3 and 1 sites. Here, it will be noticed, the contours are closer showing a steeper sideling and indicating a closer approach of rock to the surface. It may be advisable to test this ground before arriving at a definite decision in regard to the others.

After very careful deliberation the conclusion has been arrived at that No. 3 site is the only safe and practicable one, and that the facilities for construction will offset to a large extent the greater quantity of material required in the building of the wall compared with that required at the No. 4 which is the choice of the other three. The need for the exercise of every precaution in the selection of site is not only to insure the safety of the dam and thereby save expense for it is often very costly to patch up defective foundations after the work is started, but chiefly to safeguard the lives of those resident in the valley below.

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 MACQUARIE PLAINS SITE  
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This is situate in the Derwent River Valley about  $\frac{1}{2}$  mile northward from Macquarie Plains Settlement. The purpose of the dam is not for storage but as a means for the elevation of the waters of the river sufficient to provide a fall of at least 70 feet to the power-turbines. The scheme includes the construction of a conduit from the dam site to a point 4 miles down the valley selected as the site for the power station.

The scope of this examination includes the dam site and the route of the high-level water-race connecting the dam to the power-station.

The formations involved in the geology of the area under review consist of Tertiary basalt, pre-basaltic Tertiary river gravels and Lower Mesozoic (?) sandstones. The latter are not exposed here but crop out in the bed of the river a few miles down-stream. They form the base upon which the Tertiary gravels and the later basaltic lava sheets were laid down. The geological history as it concerns us in this examination commences with the events which took place during the Tertiary period. Here we find evidences, in the deep beds of river gravels and drift, of an old Tertiary stream, of similar capacity to the Derwent which had reached the base level of erosion. The actual thickness of these beds has not been determined but they are at least 20 feet and probably much greater. During the late Tertiary volcanic eruptions broke forth in the neighbourhood resulting in the accumulation of deep deposits of basaltic lavas and tuffs. The long continued emission of basalt involved much disturbance of the drainage system. The old river channel was choked, and the deep lead was completely buried. That these emissions were intermittent is shown by the alternate layers of ash and lava and by the recurrence of alluvial material between successive lava flows. Following these events an uplift of the land took place and an era of intense erosion supervened. The river,

Porous volcanics such as tuffs and agglomerates could be rendered impervious by grouting, and perhaps these difficulties might be overcome without adding largely to the cost, but this work is only of secondary importance compared with the larger dam structure upon which the success of the enterprise directly depends. At the point under investigation the original channel is so completely buried under the basaltic ejectamenta that it is difficult to determine the thickness of the gravels except by means of pits. It is essential that the foundations shall not only be solid but also watertight in order to prevent the flow of water around the ends of the dam or underneath it, and in this connection the greatest care has been taken to ascertain the tightness and continuity of the bed-rock and the stability and perviousness of the wall-rock. It is considered that under considerable water-pressure the tendency of the volcanic rock to slide on the gravel-beds will be greatly increased thereby jeopardising the whole structure of the dam and also the lives and properties of the settlers in the valley below. This latter consideration has influenced the writer in arriving at the conclusion that the site is unsuitable for the purpose in view.

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Launceston,

12th April, 1920.