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15. Geological investigation of the Quamby Brook No. 11 dam site

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An investigation of the proposed Quamby Brook dam site (No. 11) was made on 26 and 27 July 1969 at the request of the Rivers and Water Supply Commission. The dam site is located one mile upstream from the Ostmaston Road bridge where the Quamby Brook flows through a narrow gorge cut in a high NW-SE ridge known locally as Black Jacks Ridge.

TOPOGRAPHY

The south-eastern abutment of the dam is situated on a low knoll at the northern end of a flat-topped NNW-SSE spur, 40 ft high, extending approximately 400 yd from the main ridge. This spur, where it is crossed by the Quamby Brook Road, would form a natural spillway for the proposed dam.

The north-western abutment is situated on a steep valley side 300 ft high forming the north-western wall of the gorge (fig. 21).

The area to be flooded upstream from the dam is a wide alluvial basin around the confluence of Eden Rivulet, Elmers Creek and three other unnamed streams with the Quamby Brook (fig. 20).

The narrow gorge, natural spillway and extensive flat reservoir area make the site an attractive one from the topographic point of view.

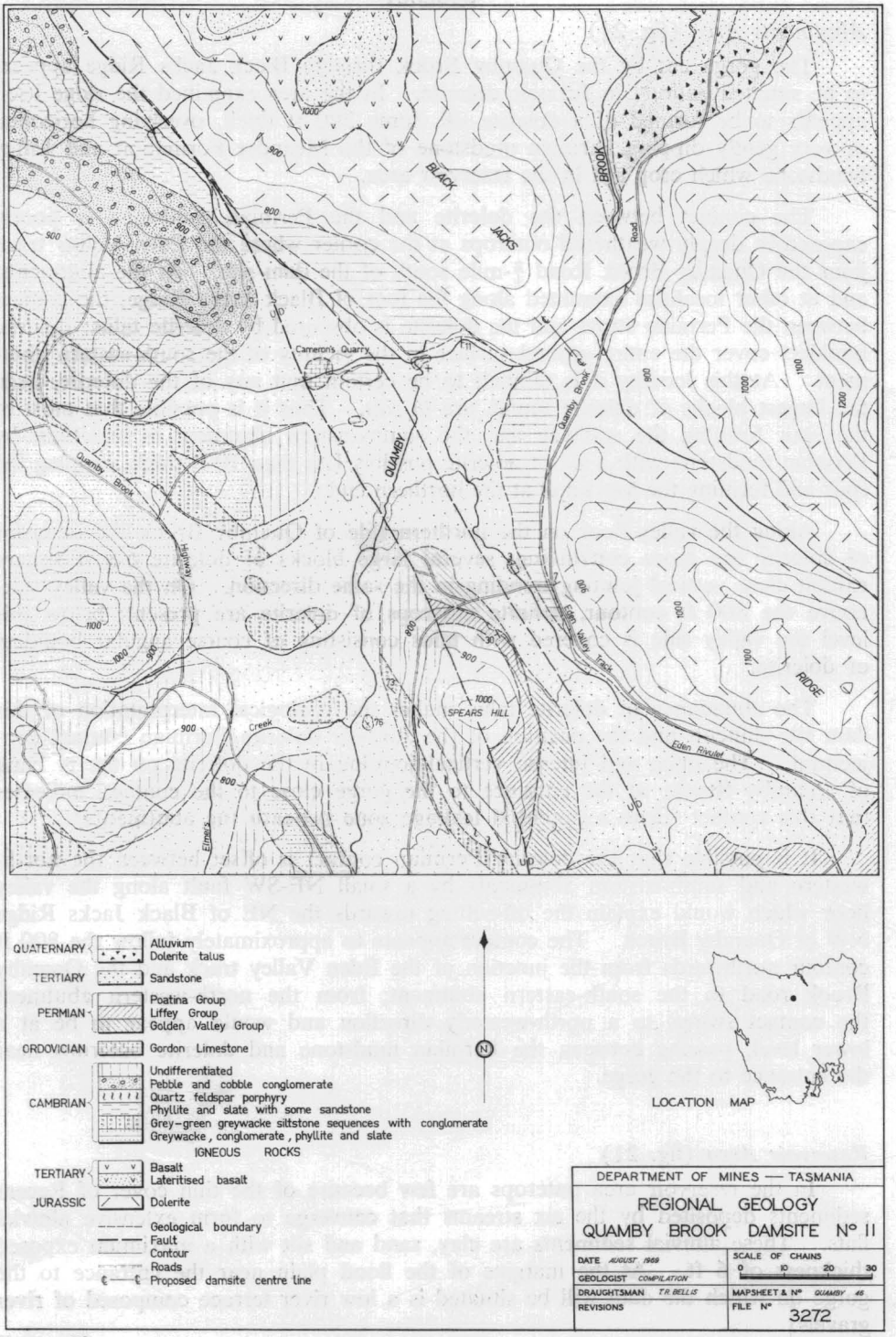

FIGURE 20

5 cm

Abutments Area (fig. 21)

The gorge cut by the Quamby Brook through Black Jacks Ridge appears to be situated entirely in Jurassic dolerite. In the area examined the ridge itself appears to be formed of a dolerite sill, some 300 ft thick, overlying horizontal or very gently dipping Permian mudstone of the Meander Formation and Liffey Sandstone which crop out in the reservoir area.

The contact between the dolerite and the Permian mudstone is poorly exposed in deeply weathered outcrops at the corner where the Eden Valley track joins the Quamby Brook Road $\frac{3}{4}$-mile south of the dam site. At the abutments, and at other localities examined along the foot of Black Jacks Ridge, the contact between the Permian strata and the dolerite is obscured by dolerite talus: dolerite boulders cover the entire ground surface in the vicinity of the south-eastern abutment. At this locality it is difficult to be certain that any of the dolerite, even the largest blocks of dolerite found, are *in situ*. Thus it is possible that most of the spur forming the spillway and the south-eastern abutment is underlain by Permian mudstone with a sill of dolerite possibly less than 10 ft thick, capping the spur and forming the low knoll at the northern end.

Along the valley floor on the northern side of Quamby Brook the outcrops of dolerite are more convincing; several large blocks of dolerite 6-8 ft square exhibit close vertical jointing trending in the same direction. On the valley side, above the 800 ft contour, definite outcrops of dolerite are present; below this level the valley side is covered with talus consisting of coarse angular boulders of dolerite.

The abundance of dolerite talus makes the geological interpretation of this dam site difficult and the position of the Jurassic dolerite/Permian contact conjectural. The open and intense vertical jointing in the dolerite on the N bank of Quamby Brook, at the entrance to the gorge close to the contact, indicates that this contact forms a potential leakage zone beneath the abutments.

It is possible that the dolerite/Permian contact is offset between the north-western and south-eastern abutments by a small NE-SW fault along the valley floor which would explain the off-setting towards the NE of Black Jacks Ridge NW of Quamby Brook. The contact appears to approximately follow the 800 ft contour northwards from the junction of the Eden Valley track and the Quamby Brook road to the south-eastern abutment; from the north-western abutment the contact swings to a north-westerly direction and would appear to be at a lower level, passing between the Permian mudstone and dolerite outcrops near the entrance to the gorge.

Reservoir Area (fig. 21)

In the reservoir area outcrops are few because of the thin cover of Recent sediments deposited by the six streams that converge to form extensive alluvial flats. These alluvial sediments are clay, sand and silt with a maximum exposed thickness of 6 ft. At the margins of the flood plain near the entrance to the gorge on which the dam will be situated is a low river terrace composed of river gravels.

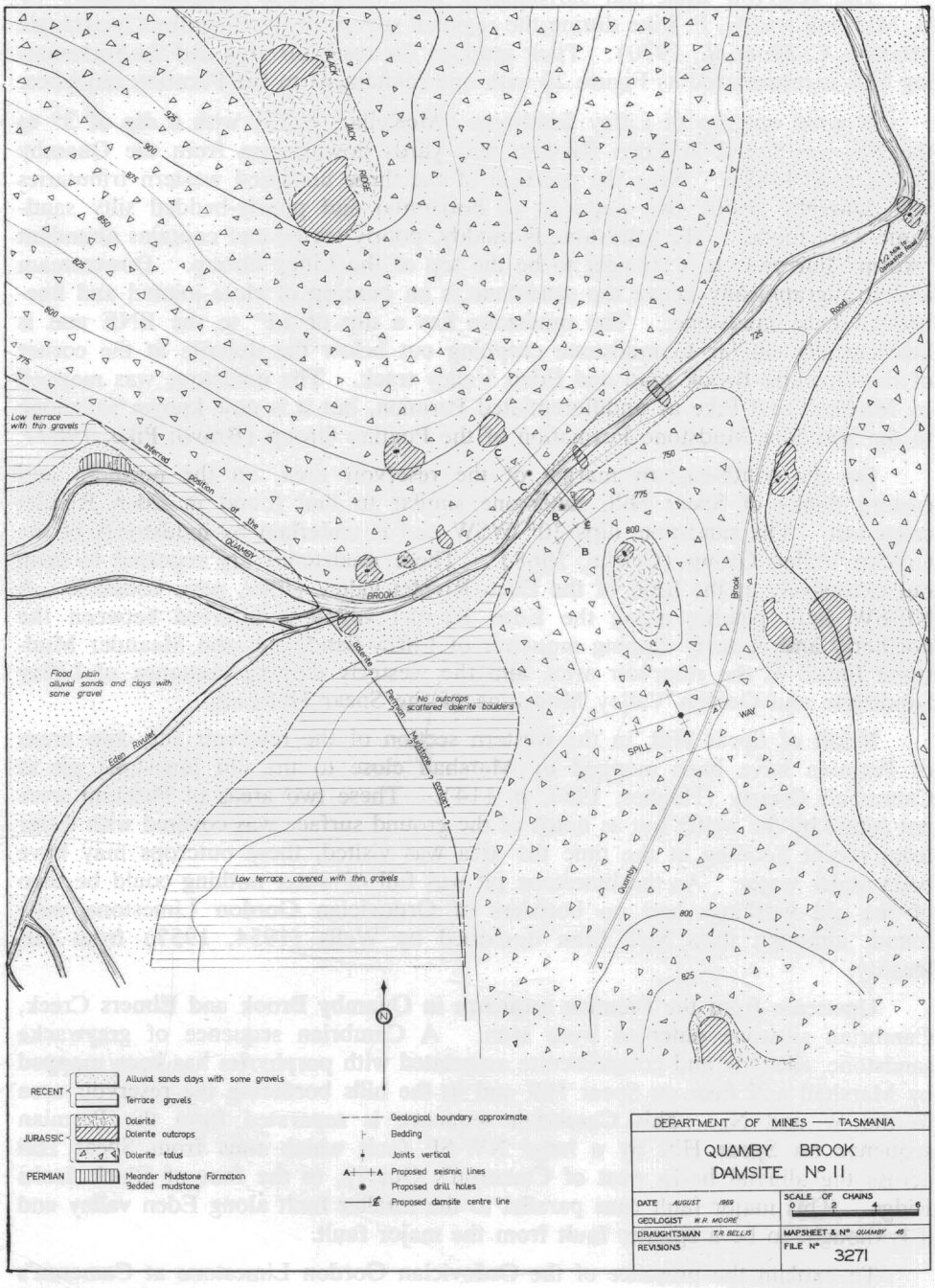

FIGURE 21

5 cm

The reservoir area and surrounding hills have been mapped recently by B. Marshall and G. P. Pike during the regional survey of the Quamby Quadrangle (Barton, C. M. *et al.*, 1970). Their map for the reservoir area and the surrounding hills is reproduced as Figure 20 with one refinement to the Permian sequence.

A good outcrop of Liffey Sandstone (McKellar, 1957) with a dip of 3° to the NE was found in Eden Rivulet, 500 yards downstream from the Quamby Brook road bridge. Near the junction of the three unnamed western tributaries with Quamby Brook two outcrops of horizontal and poorly-bedded silty sandstone were found. The sandstone is muddy, poorly sorted and contains abundant ' worm ' burrows: it is thought to be the top of the Liffey Group. Downstream and stratigraphically above the sandstone is an outcrop of close-jointed and fine-bedded hard mudstone. The mudstone has a dip of 11° to the ENE and is lithologically similar to mudstone cropping out below the dolerite at the corner of the Quamby Brook road and Eden Valley track. The mudstone was mapped by Marshall and Pike as undifferentiated Permian, but it is now known to belong to the Meander Mudstone Formation of the Poatina Group (Bravo; Pike, 1969).

On the south-eastern margin of the reservoir area, on the northern and eastern flanks of Spear Hill, sandstone similar to that found in Eden Rivulet crops out. The sandstone dips 30° WSW and is underlain by mudstones of the Golden Valley Group (Clarke, 1968). These mudstones are reported to crop out extensively at the head of the Eden Rivulet valley (Pike, pers. comm.). A NE-SW fault passing along the Eden Rivulet valley is inferred between the northerly and easterly dipping sequence of Liffey Sandstone and Meander Mudstone found in the reservoir area, and the westerly dipping sequence of Liffey Sandstone and Golden Valley Mudstone of the Spear Hill area.

North of Spear Hill, in the western section of the reservoir site, two areas of Permian have been mapped by Marshall close to the old limestone pit at Cameron's Quarry (Hughes, 1957, p. 114). These two areas of Permian were not found by the writer but as much of the ground surface was covered with water from recent flooding at the time the area was visited, these outcrops may have been under water. As the limestone pit was full of water nothing could be seen of the old workings and no boulders of Ordovician Gordon Limestone were found, although they have been described by Wells (1954, 1957) from this locality.

Upstream from the Permian sequence in Quamby Brook and Elmers Creek, Cambrian siltstone outcrops were seen. A Cambrian sequence of greywacke sandstone, siltstone and conglomerate associated with porphyries has been mapped by Marshall and Pike on Spear Hill and in the hills bordering the reservoir area to the W and N. This Cambrian sequence is separated from the Permian sequence on Spear Hill by a large NW-SE fault which runs from Spear Hill across the alluvial basin west of Cameron's Quarry, to the foot of Black Jacks Ridge. This major fault runs parallel to the smaller fault along Eden valley and it is thought to be a splinter fault from the major fault.

To explain the presence of the Ordovician Gordon Limestone at Cameron's Quarry, Wells (1957) depicts a small splinter fault swinging around the quarry. If the Gordon Limestone was mined from this quarry to the reported depth ot 60-100 feet, then Marshall and Pike accept that this outcrop represents a pre-Permian basement high on which the Golden Valley Group of Lower Permian

age has been deposited unconformably: this explanation would appear more likely than the postulated faulting as a considerable variation in the pre-Permian basement topography is known from the adjoining Golden Valley area (Clarke, 1968).

RECOMMENDATIONS

No serious water loss is anticipated along the two NW-SE faults that cross the reservoir area because of the shallow depth of water in the proposed reservoir at these localities. The presence of soluble rocks such as limestone in any proposed reservoir is an undesirable feature and although Cameron's Quarry will only be covered by shallow water the presence and thickness of any limestone should be confirmed by drilling at least one borehole at this locality.

On the abutments three seismic spreads are recommended in order to confirm the thickness of dolerite particularly at the south-eastern abutment and at the spillway area. The results of the seismic investigation will require confirmation by three drill holes at the abutment and at the spillway area (fig. 21).

MATERIALS

Abundant supplies of dolerite for a rock fill dam are available at the site either from the dolerite boulders from the extensive talus deposits or from the dolerite outcrop above the north-western abutment.

Alluvial clays 4-5 ft thick crop out at several places on the stream banks but may be restricted in extent.

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