

20. Preliminary examination of Pipers River dam sites 7, 7A, 10, 12

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Four dam sites were examined at the request of the Rivers and Water Supply Commission. Two sites (10, 12) stated to be better sites on economic and topographic grounds were also required to be examined seismically. All dam sites are on Pipers River. The overall geology may be seen on the Pipers River map sheet (Marshall et al. 1965).

SITE 7

Situated 800 m east of the Lower Turners Marsh-Pipers River road and 1.6 km north of Lower Turners Marsh is a topographically good site which would need foundations about 6-9 m, as indicated by badland erosion patterns of small tributary creeks. Exposures of slate are very rare. It is anticipated that unweathered slate would be at depths of up to 12 m beneath soil, sand and weathered slate.

SITE 7A

Located 1.2 km north-east of Malmarney Sugarloaf. At this point the river is flowing from west to east. Both abutments are capped with basalt and a wedge of talus is derived from the basalt on the northern abutment. The basalt overlies slate, siltstone and sandstone although there are few outcrops. The southern abutment, which has a long, low profile, is noteworthy for the absence of exposures and may also be expected to have a deeply weathered profile.

SITE 10

Located 1 km south of the bridge on Tunnel road. The eastern bank of the river at this point has a definite rib and sharp bend which clearly forms a possible abutment. The bank is very steep, is capped with basalt and most of the slope is covered by basalt talus. Slate and siltstone are exposed in the river bend and cuts in the bank near the river. The western bank has a much shallower slope, although a small, sharper knoll is present opposite the possible eastern abutment. The knoll benches out to the general slope about 15 m above the river. Above 18-21 m the slope steepens and the remainder of the bank is capped by basalt. Basalt talus and boulders are seen on most of the lower slopes.

West Abutment Knoll

Three seismic spreads were placed in the region of the knoll.

- (1) Survey line N-S, at an elevation of 15 m on the bench behind the steep rise of the knoll-abutment (AA, fig. 18). Three layers have been interpreted.

Layer 1: seismic velocity (v) = 450-900 m/s; thickness 4.5-11 m. Basalt boulders. The lower figure is regarded as more reliable and consistent with other data.

Layer 2: v = 1,400-1,600 m/s; thickness 1.5-2 m. Weathered slate.

Layer 3: v = 1,800-2,700 m/s; depth 7-12.5 m (probably 7-8 m). Slate.

- (2) Survey line SE-NW (BB, fig. 18). Two layers have been interpreted.

Layer 1: $v = 600-750$ m/s; thickness 2-4 m. Basalt boulders.

Layer 2: $v = 1,800-8,000$ m/s. Slate

(3) Survey line NE-SW (CC, fig. 18). Three layers have been interpreted.

Layer 1: $v = 300$ m/s; thickness c.3 m. Basalt boulders.

Layer 2: $v = 1,400-1,500$ m/s; thickness 7 m. Weathered slate.

Layer 3: $v = 2,600-2,700$ m/s; depth c.11 m. Slate.

To summarise it appears that the basalt seen at the surface within 45-60 m of the river is but a surface covering of very loose boulders. They overlie weathered and unweathered slate. Previous seismic investigations dealing with such rocks have shown that velocities of 1,800 m/s represent quite solid rock (e.g. Stevenson and Leaman, 1968). It is thus expected that rock with velocities of 2,700-3,000 m/s would make a good foundation. As these rocks are folded it will be necessary to establish the direction of folding and schistosity as these properties will significantly affect the real strength of the rock under load. It further appears that a deep cut, up to 10 m deep, will be necessary in order to have a reliable foundation.

East Abutment

Two seismic spreads were placed down the steep bank.

(1) Survey line E-W (DD, fig.18). Two layers are observed.

Layer 1: $v = 1,000-1,200$ m/s; probable thickness up to 12 m and regularly disposed down the slope.

Layer 2: $v = 6,000$ m/s; 3,000 m/s.

The first figure is obtained in downhill shooting and the latter in uphill shooting. It is likely that both figures are low due to some averaging effects. The higher velocity is due to the solid basalt underlying the talus on the upper half of the bank and the lower velocity is related to the slate and siltstone beneath the talus near the river. The lower shot point was in the river.

As far as can be determined in the difficult conditions prevailing on this slope the interface between basalt and slate beneath the talus is about 40 m up-slope from the river (height c.15-18 m).

(2) Survey line E-W (EE, fig.18). Interpretation of this traverse was more complicated.

Layer 1: $v = 750-900$ m/s is much more irregular, varying from an estimated 9-14 m. It appears to be thickest about 45 m upslope from the river. This layer is probably talus.

Layer 2: $v = 6,000$ m/s; 2,500 m/s. Similar comments apply as for DD above, although the basalt may extend lower on the hill. Alternatively the variable thickness of the overlying talus may confuse any interpretation. It is possible that the velocity deficiency about 45 m upslope from the river (20 m vertically) may be due to Tertiary sediments beneath the basalt.

Thus it appears that the river has cut through the basalt to the underlying slate/siltstone sequence; with basalt talus on its banks. The base

of the basalt appears to be about 18-20 m above the present level of the river.

Drilling is recommended to verify these conclusions and to sample the foundation rocks.

Four holes are suggested along the centreline. One to be placed on a bench behind the W abutment knoll to establish a correlation between the seismic velocities of the metasediments and their condition. A further hole to be located near the river to assess the conditions in the critical zone as far as dam loading is concerned. Two holes on the E abutment are required to check the level of the basalt and the presence of any permeable sediments beneath the basalt. The state of weathering of the upper surface of the slate/siltstone will also need to be determined as such a zone might provide leakage paths. A further two holes are suggested near river level 20-24 m on either side of the centreline. All holes should be drilled to a depth of 20-24 m.

SITE 12

Site 12 straddles the river between alternating spurs about 1.6 km north of the bridge on the Bridport Road. As a result of the topographic form of the valley at this point two possible centrelines have been considered (fig. 18). The only rock exposures seen in the vicinity of the site are of closely jointed, slightly scoriaceous basalt. Outcrops occur on all three abutments and in the river between them.

Common Western Abutment

Spread AA suggests that metasediments may occur at shallow depth (perhaps about 4.5 m, $v = 1,800-2,700$ m/s). Some of the results reflect basalt at the surface ($v = 9,000$ m/s): it is by no means certain that such sediments occur in depth. Irregular basalt outcrops, weathering and thin alluvial cover in the valley floor make the interpretation of the seismic results difficult and sediments may not be encountered at such a shallow depth.

Spread BB results suggest basalt at a depth of about 2.5 m with boulder and alluvial cover (300-600 m/s compared with 4,000-4,500 m/s). Only about 1.5 m of basalt has been penetrated. Its thickness is indeterminable.

Spread CC presents a three layer situation.

Layer 1: 300-450 m/s; thickness about 1 m. Soil.

Layer 2: $v = 1,500-2,000$ m/s; thickness less than 0.6 m. Broken basalt.

Layer 3: $v = 3,200-3,600$ m/s; depth c.2 m. Moderately solid basalt.

Eastern Abutments

Three N-S spreads were used to cover these abutments and check on the presence of basalt in the dip between them.

Spread DD showed velocities in the range of 2,300-6,000 m/s, suggesting zones of fractured and massive basalt. No depth estimates are possible.

Spread EE showed that a thin cover (less than 1 m) of material with velocity 2,000 m/s (fractured basalt?) overlies solid basalt (4,000-7,000 m/s).

Spread FF showed that fairly solid basalt was present near the surface (3,000-5,500 m/s) with no detectable overlying layers.

With the possible exception of spread AA, surface basalt has been proved over the entire site. It is likely that more than one flow is present, as suggested by the springs near EE, and the presence of inter-basaltic sediments has been neither confirmed nor disproved. It is possible that all the basalt cropping out on the site is near the base of one flow in which case sub-basaltic sediments or metasediments might be encountered at shallow depth. Considerable drilling of the entire site would be necessary before a satisfactory assessment could be made. However, two preliminary holes are suggested (fig. 18) which would provide a control for the seismic work already done and allow further recommendations for future drilling. Holes should be 20 m deep.

REFERENCES

- MARSHALL, B.; BARTON, C.M.; JENNINGS, D.J.; NAQVI, I.H. 1965. Geological atlas 1 mile series. Zone 7 Sheet 31 (8315N). Pipers River. Department of Mines, Tasmania.
- STEVENSON, P.C.; LEAMAN, D.E. 1968. Report on the geological and geophysical work on the North Eastern Outlet Road, Bell Bay to Bridport. Tech.Rep. Dep.Mines Tasm. 12:108-113.

