



Division of Mines and Mineral Resources — Report 1991/29

Geological investigation of a proposed inlet tunnel bypass at Ridgeway Reservoir

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Introduction

A geological investigation for a proposed inlet tunnel bypass at Ridgeway Reservoir, South Hobart, was carried out by the Division of Mines and Mineral Resources at the request of the Hobart Regional Water Board.

The investigation of the 215 m long section (523800 mE, 5248400 mN) (fig. 1) sought to provide basic information on the nature and ease of excavation of subsurface materials likely to be encountered along the route to a depth of 1.5-2.5 metres.

The investigation involved site mapping followed by a seismic refraction survey at one location on the route.

Site geology

The Hobart 1:50 000 scale geological map sheet (Leaman, 1972) indicates that the proposed inlet tunnel bypass is underlain by Jurassic dolerite. The current site investigation has confirmed this to be the situation.

As there was little bedrock outcrop along the actual route, the geological mapping was based on surface soil information and exposures observed in roadway cuttings.

The surface soil is typically sandy clay (CH) with cobbles and boulders of dolerite float. Exposures noted in roadside cuttings, both along the route and in adjacent areas, indicates a shallow soil profile in this region which grades down to a variably weathered dolerite rock mass. The soil profile, where exposed, was generally of the order of about one metre thick. The underlying bedrock was typically extremely to moderately weathered with remnant kernels or core stones of slightly weathered dolerite to a depth generally below the required excavation specifications.

Geophysics

Survey details

The seismic refraction survey consisted of a single spread along the gravel road section between 66 and 80

metres. This was considered to represent a typical section along the proposed route and the results should therefore give an indication of the likely variation in the excavation conditions expected.

A Nimbus 12-channel seismograph was used, with a spread length of 24.0 m with 2.0 m geophone spacings. Shots were fired from both ends. Calculations were by the critical distance, intercept time, and where appropriate, the reciprocal time methods.

Results

It is stressed that in any investigation employing geophysical methods, the results are an interpretation (based largely on experience) of the physical properties measured. No amount of investigative work at this preliminary survey level can accurately predict the extremes or rapid variability of materials (both laterally and vertically) that may exist over short distances.

Contractors should view the results as a guide only to conditions anticipated along the route. A series of trial excavations should preferably be undertaken to test the validity of the information inferred from the geophysical results. This would also enable contractors to assess the capability and suitability of their machinery for varying rock conditions.

The seismic refraction survey results presented in Table 1 indicate low to moderate velocities representing soil and weathered rock conditions to well below the required excavation depth. The velocity plot is typically symmetrical but has stepped segments, indicating that variable conditions can be anticipated across the site. This stepping effect is considered to represent variations in the weathering characteristics of the rock mass.

Excavation conditions

The mapping, together with the geophysical survey results, indicates the probability of varying conditions along the route. The majority of the materials that will be encountered during excavation to around 1.5-2.0 m

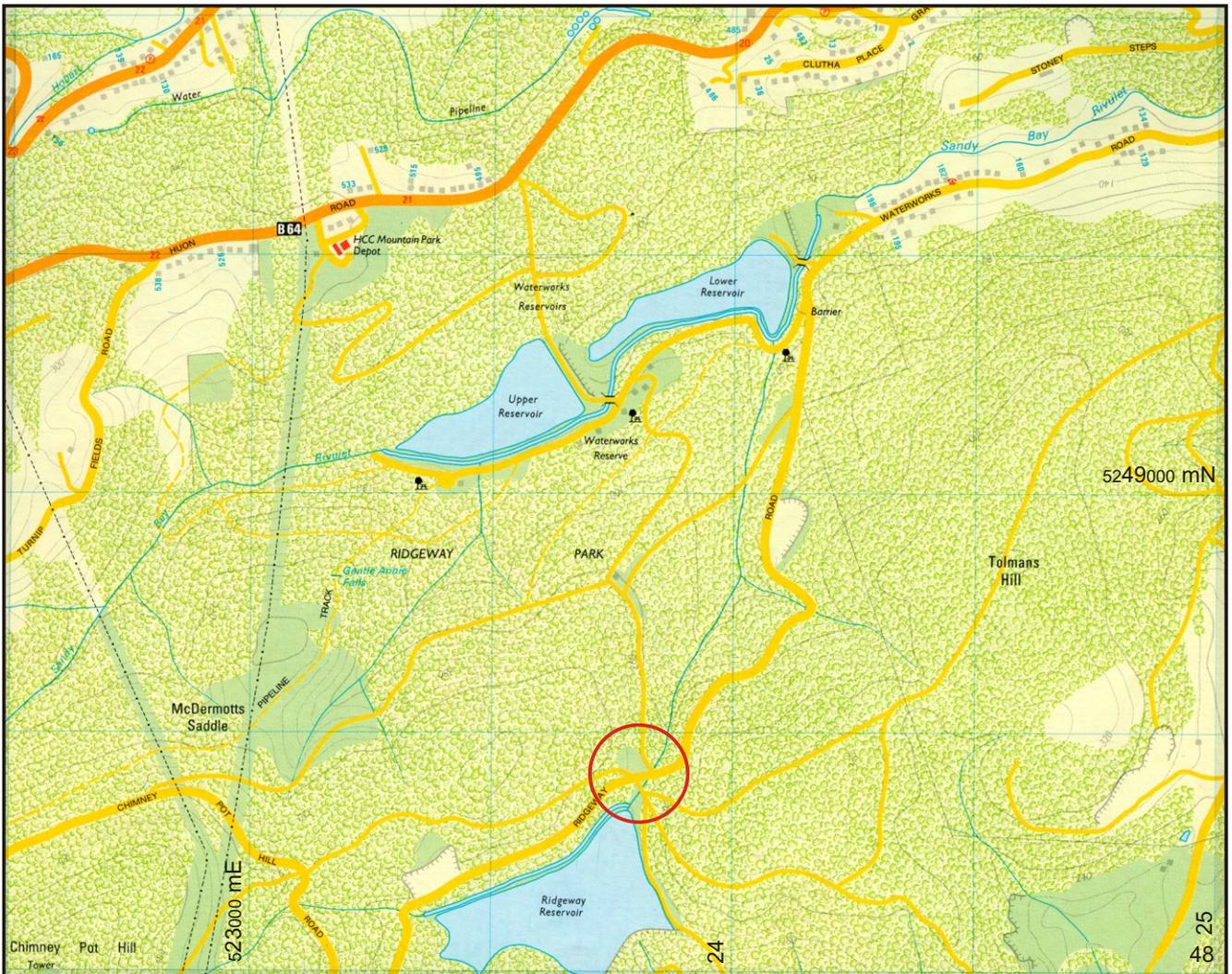


Figure 1
Location of investigation area.

depth are likely to be soil and weathered materials of the parent bedrock, although isolated sections of slightly weathered to fresh hard bedrock could be encountered.

The dolerite is likely to have highly variable weathering characteristics which result in rapid changes in the nature and strength of the rock mass over short distances.

The rippability guide chart (fig. 2) relates the excavation capability of heavy machinery (D9 or similar) to seismic velocities over a range of rock types. Velocities in excess of about 2500 m/s for dolerite are considered to represent material that may require blasting. Velocities approaching these values were not recorded and are below the general excavation limit (refer Table 1).

It is the weathering, strength and joint (defect) characteristics of the rock mass that will ultimately determine the ease of excavation of those areas of bedrock encountered along route. The roadside cuttings along and adjacent to the proposed pipeline route, where the soil/rock profile can be observed, combined with the seismic refraction survey results

suggest that the vast majority of hard rock conditions should be below the excavation depth.

It is considered that the use of explosives should not be necessary. The general attitude and spacing of the major joint sets observed suggests that sections may require a rock breaker to loosen the material.

Summary

A variably weathered dolerite rock mass will be encountered during the excavation phase of the project. The materials are likely to be highly to moderately weathered. Hydraulic rock breakers may well be required along some sections, although the use of explosives is not anticipated.

It is recommended that contractors take time to view the numerous exposures along the route and follow up with a series of trial excavations to confirm and, if necessary, modify the above findings and predictions.

Reference

LEAMAN, D. E. 1972. *Geological Atlas 1:50 000 series. Sheet 82 (8312S). Hobart.* Department of Mines, Tasmania.

[18 November 1991]

Table 1
Seismic refraction survey results

Rock type	Velocity (m/s)	Layer depth (m)	Geological interpretation
Dolerite	V ₁ 500-650	0.4-0.6	Topsoil profile
	V ₂ 900-1000	1.5-2.1	Compacted clay/EW-HW dolerite
	V ₃ 1100-1350	7.7-8.5*	HW-MW dolerite, some core stones

* Minimum depth based on an assumed 2500 m/s (V₄) layer

EW = extremely weathered, HW = highly weathered, MW = moderately weathered, SW = slightly weathered, FR = fresh.

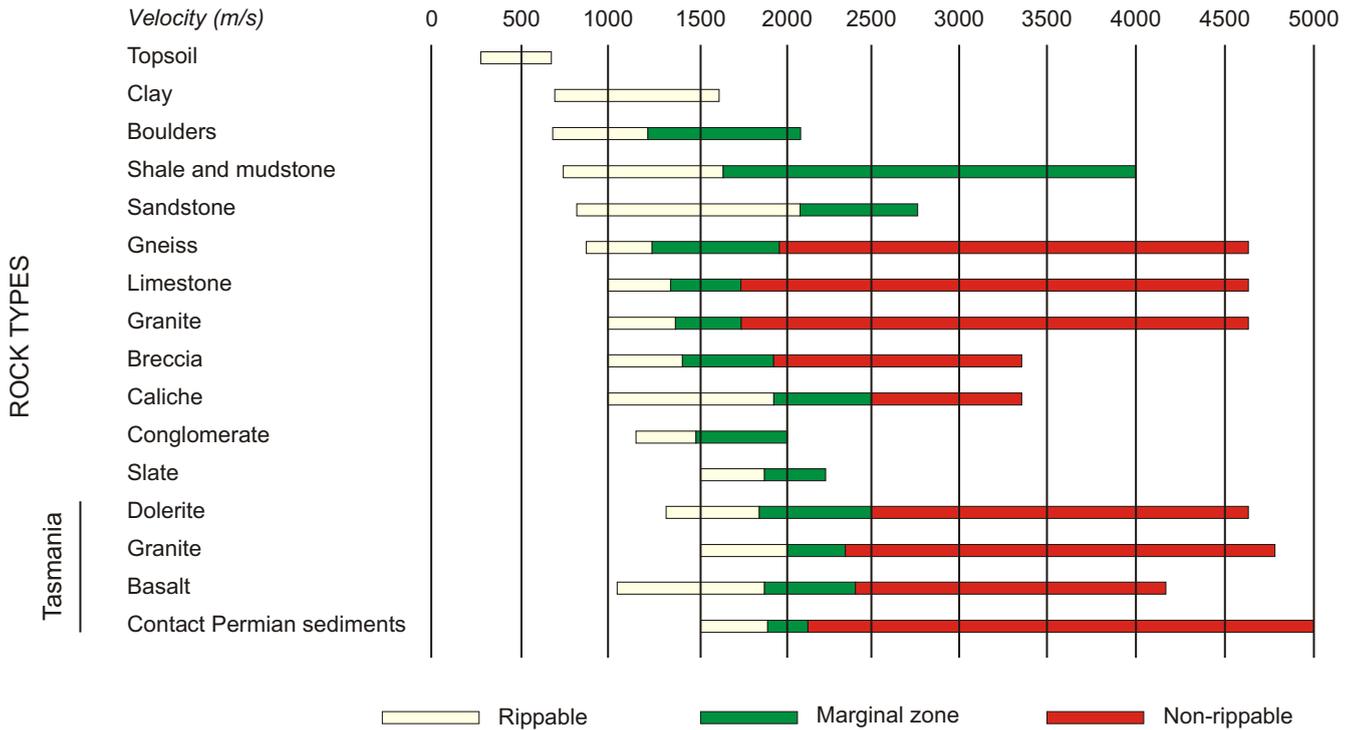


Figure 2
Guide to rippability (adapted from Soil Test Inc.).