



Investigation of a proposed dam site at Nubeena

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Abstract

A possible dam site to supply water to Nubeena is situated on the contact between Jurassic dolerite and Triassic sandstone and shale. The boundary between these rocks may be a fault contact. A seismic survey showed that there was 2–4 m of soil and loose material under the storage area and the proposed dam wall. At lower levels, material on the western side of the storage should be largely rippable while that under the eastern side may not be. Leakage is possible from the storage area if unweathered bedrock or a fault is exposed. Sufficient clay to form a core for the dam and a blanket in the storage area has not been located to date. Further subsurface work is required at the dam site and to locate clay deposits.

INTRODUCTION

The Municipality of Tasman is planning to introduce a reticulated water supply to Nubeena, and requested that the geology of the area around a proposed dam site just east of the town be examined. The proposed site is to the south of Tip Road (fig. 1). The site is situated below a saddle, and requires a wall of considerable height to impound the required water (initially 75–100 ML).

GEOLOGY

The dam site is on the eastern contact between a northeast-trending body of dolerite about 500 m wide and Triassic aged sandstone and siltstone. The general geology of the area is shown in Figure 1.

The sedimentary rocks and the dolerite at the dam site are weathered to variable depths, as indicated by the test pits dug prior to this survey. The form of the contact between the dolerite and Triassic sediments is not known but a lack of obvious baking of the sedimentary rocks, and an absence of very fine-grained dolerite, suggests that the contact is a fault line.

SEISMIC SURVEY

As it was proposed to excavate quite deeply in the storage area to produce material to form the embankment, a seismic survey was undertaken to determine the approximate depth of material that could be easily obtained. As well, it is important to know the depth to relatively unweathered bedrock under the dam wall, as a cut-off to such material would almost certainly be required. A seismic spread would aid in determining this depth.

Five seismic spreads, each of 12 geophones and with a 7.5 m geophone spacing, were fired in the dam site area. Spreads 1, 2, 3 and 4 were situated in the storage area, while Spread 5 was placed along the dam-wall alignment.

The interpreted profiles under the spreads are shown on Figure 2. Under each spread there appears to be 2–4 m of soil and loose material (seismic velocities of 275–375 m/s). Under Spreads 2, 3 and 4 the surface material is underlain by material with a seismic velocity of 2000–2400 m/s. This probably represents weathered rock (Triassic sediments under Spread 2 and part of Spread 4, and dolerite under Spread 3 and part of Spread 4). Material with these velocities should be rippable.

At deeper levels under Spread 3 material with a velocity of 4000 m/s was indicated, at depths ranging from 14–18 m with questionable depths outside this range under both ends of the spread. Rock with this velocity is probably unweathered dolerite.

The minimum depth to material with seismic velocities of 3000 m/s under Spreads 2 and 4, and most of Spread 3, is ten metres. Sandstone or dolerite with this velocity would be difficult to rip.

Spread 1 is underlain by material with an interpreted velocity of 3330 metres/second. This probably represents relatively unweathered Triassic sediments, which would be difficult to rip.

Spread 5 is underlain by relatively high velocity material at depth; this material may be partly sandstone and partly dolerite, or all dolerite.

The western end of Spread 5 and the southern end of Spread 3 have extremely low velocity material near the surface. This may indicate loose dry sand.

CONCLUSIONS FROM SEISMIC SURVEY

Removal of the material to make the storage will probably expose fresh rock, which may have moderate permeability. If this is the case, the storage area would need sealing with clay. The higher velocity material under Spread 1 may be difficult to rip.

The material under the proposed dam wall needs to be examined. This could be done by drilling with an auger drill and/or digging pits with a backhoe. The western end is of particular concern.

SOURCE OF CLAY

Clay will be needed to provide a core for the dam, and may be needed to seal the storage area.

A possible source of clay for the construction of the dam had previously been located to the south-east of the dam site (fig. 1). A test pit in this area had indicated considerable depths of clayey material which had been tested as being suitable for the core of the dam. The area

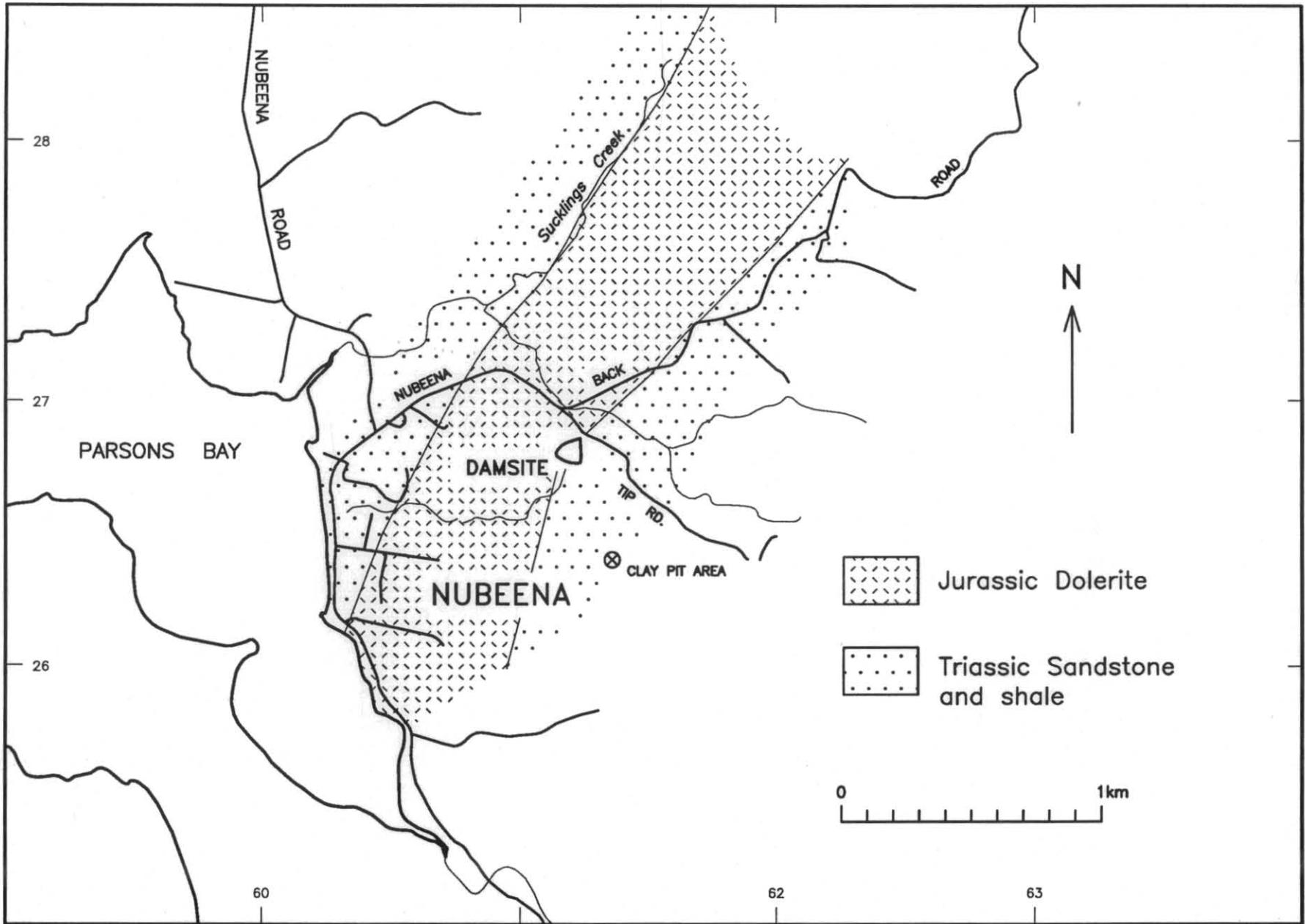


Figure 1. Location of dam site and clay pit areas, Nubeena.

5 cm

is underlain by Triassic rocks, and perhaps in this location there is more shale interbedded with the sandstone.

A series of six auger holes was drilled around this test pit. The logs of these holes are given in Appendix 1. Most of the holes, even those close to the test pit, encountered much less clayey material. As the material remaining around the test pit had a different moisture content than that produced from the auger holes, some sizing analyses were undertaken (Table 1). The amount of sand, as opposed to clay and silt-size material, was determined approximately by wet sieving, i.e. the samples were separated using a 63 µm sieve.

Table 1. *Sizing analyses of materials.*

Hole No.	Depth (m)	percent sand	percent clay+silt
Test pit	residue on surface	27	73
1	1-3.4	30	70
1	3.4-5.2	42	58
2	3.1-4.6	63	37
4	0-1.5	59	41
4	1.5-3.4	56	34
4	3.4-4.6	45	55
6	0-1.5	29	71
6	1.5-3.4	36	64
6	3.4-4.6	47	53

Only samples in which it was obvious that the clay and silt content was fairly high were tested, and samples which visually had a high sand content were not selected.

The distribution of material with a high clay and silt content is very irregular, and only Holes 1 and 6 indicated useful depths of material similar to the test pit. Further investigation into clay resources would be required to establish reserves.

CONCLUSIONS

Excavation of the storage area of the proposed dam will probably expose unweathered Triassic aged rocks, and possibly dolerite at some locations. These rocks could allow significant seepage, and would need covering with a blanket of clay.

If the contact between the two rock types (dolerite and Triassic sediments) is a fault line, considerable loss through seepage is possible. This reinforces the need for the clay blanket.

Investigation of the depth and nature of the material under the dam wall (particularly on the western side) needs to be undertaken.

Sufficient clay reserves for the dam construction have not been established, and further work is required to locate these reserves.

[16 August 1989]

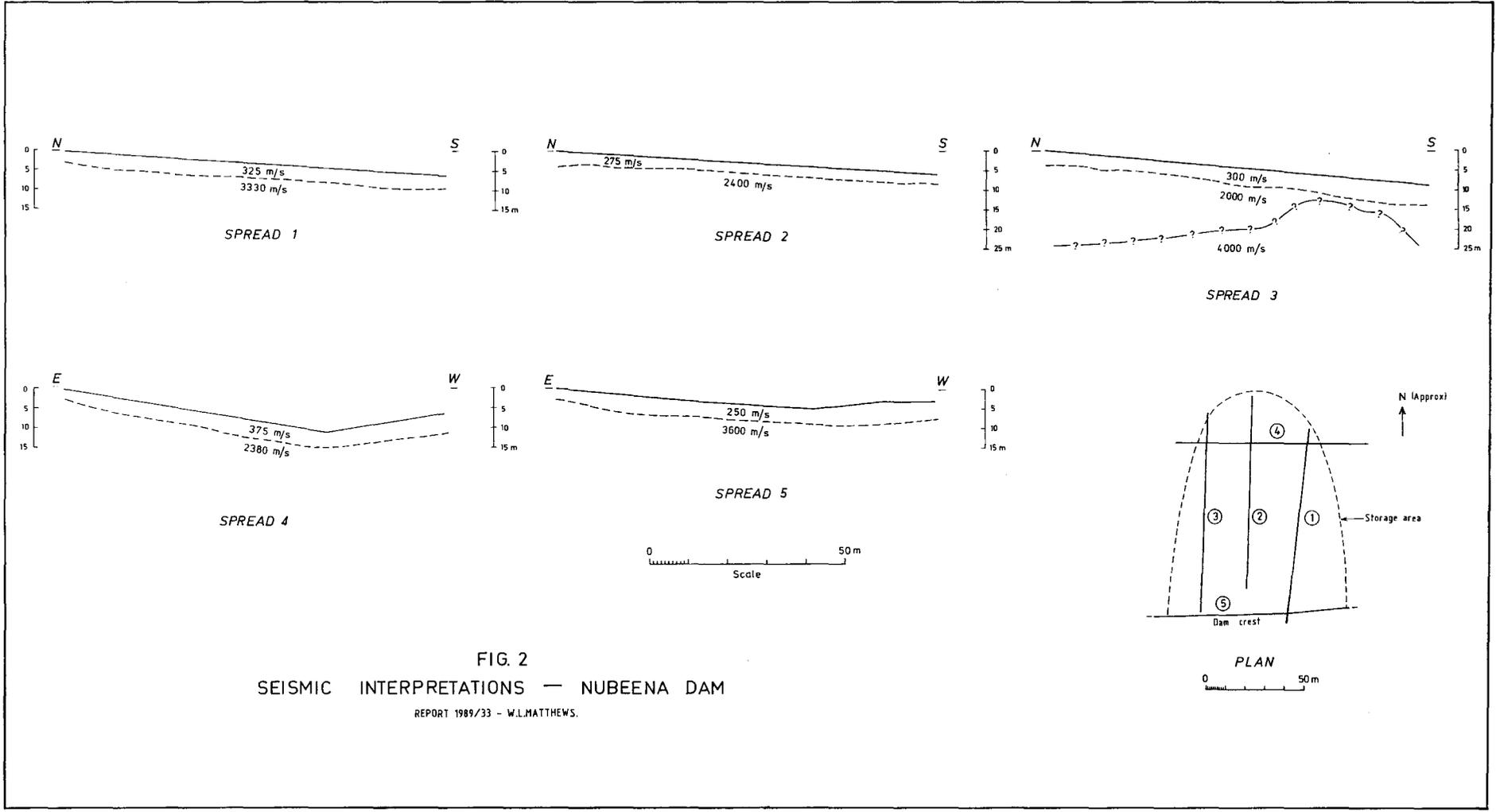


FIG. 2
SEISMIC INTERPRETATIONS — NUBEENA DAM
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APPENDIX 1

Logs of auger holes in proposed clay pit area

Hole 1

<i>Depth (m)</i>	<i>Description</i>
0-0.5	grey sand
0.5-0.9	clayey sand
0.9-2.4	yellow-brown sandy clay
2.4-3.0	lighter coloured sandy clay, sand content increasing a little.
3.0-3.4	yellow-brown sandy clay
3.4-4.6	clayey sand, yellowish fawn
4.6-5.2	fawn coloured sand with some clay sand content increasing with depth.

Hole 2

<i>Depth (m)</i>	<i>Description</i>
0-1.4	light grey sand
1.4-1.5	grey sand, a little clay
1.5-2.0	brown sand, sandstone fragments
2.0-3.1	grey-brown and grey clayey sand, some clay-rich layers
3.1-3.4	yellow sand, a little clay
3.4-3.8	fawn coloured clayey sand
3.8-4.7	brown clayey sand
4.7-5.2	light fawn coloured sand, a little clay

Hole 3

<i>Depth (m)</i>	<i>Description</i>
0-0.3	grey sandy soil
0.3-1.5	light grey sand
1.5-3.1	brown organic-rich sand
3.1-3.4	cream coloured sand, a little clay

Hole 4

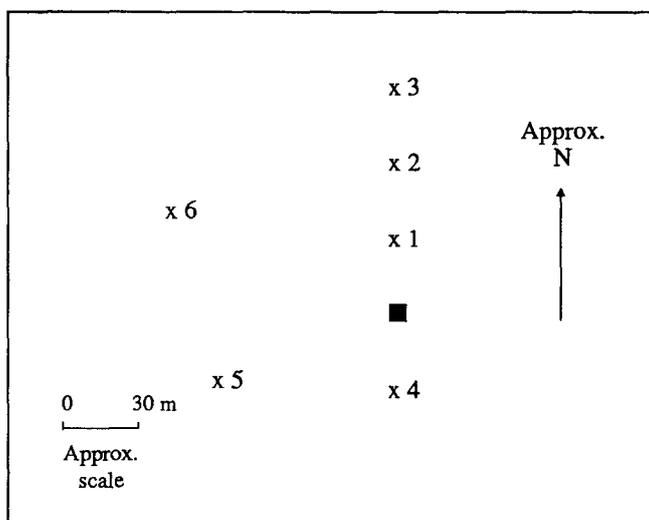
<i>Depth (m)</i>	<i>Description</i>
0.5-1.5	brown sand, a little clay
1.5-2.1	brown and grey clayey sand
2.1-3.4	brown clayey sand
3.4-3.8	as above but harder, some pebbles
3.8-5.2	light brown clayey sand (+ dolerite pebble?)

Hole 5

<i>Depth (m)</i>	<i>Description</i>
0-2.4	grey quartz sand
2.4-3.4	brown-grey clayey sand
3.4-5.2	light brown clayey sand

Hole 6

<i>Depth (m)</i>	<i>Description</i>
0-0.3	grey sand
0.3-1.5	grey and brown clay
1.5-2.4	brown clay
2.4-4.9	light brown clayey sand
4.9-5.2	light cream coloured sand



Sketch plan of auger hole locations - clay pit area.

