

1977/10. Site stability investigation for a proposed storage tank at Bell Bay.

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In response to a request from the Port of Launceston Authority, an investigation was made of a site at Bell Bay, where it is proposed to build a 600-tonne butane storage sphere (fig. 1).

Topographically, the Bell Bay area comprises a broad almost flat terrace about 40 m a.s.l. which slopes gently south at 2-5° to a distinct escarpment immediately behind the wharf installations. The proposed storage site [DQ882460] is aligned east-west on this gently sloping surface 3-20 m from the edge of the escarpment. The Port of Launceston Authority therefore requested an assessment of site stability because the actual location of the storage tank is relatively inflexible, and is fixed by an adjacent road and railway reserve.

The site was visited on 15 February 1977. The geology of the general area was studied, and seismic and magnetometer surveys were made.

GEOLOGY

The Bell Bay area is underlain by a sequence of interbedded Tertiary sediments and basalt. Parts of this sequence are exposed in the prominent escarpment at the rear of the Bell Bay wharves, and in adjacent railway cuttings and quarries, where up to 20 m of basalt is interbedded with unconsolidated sand, clay and quartz gravel. The basalt shows great lateral and vertical variation in its degree of weathering and fracturing. Its base and upper surface show considerable relief, so that its overall thickness is also variable.

Although the general geology near the proposed storage tank is clear, the detailed relationships between the basalt, its weathering products and adjacent sediments are unknown. The site and surrounding area is covered with a veneer of unconsolidated Tertiary(?) sand, sandy clay, clay, iron-stone gravel, quartz gravel and minor lateritic patches. Exposures in the nearby escarpment show that these sediments are at the most about 3-4 m thick and overlie partly weathered and strongly fractured Tertiary basalt. The basalt is 10-20 m thick, and overlies unconsolidated white, grey and yellow-brown sandy clay which is exposed in the railway cutting on the escarpment.

GEOPHYSICAL WORK

Seismic survey

Five seismic spreads, with a geophone interval of 3 m were fired in an attempt to assess the range of foundation conditions at the site. Each was designed to indicate the depth to the basalt (if present), and to gain an indication of the degree of weathering of this material. The location of the spreads is shown in Figure 1, and the results of each are summarised in Table 1.

As expected, the survey indicated a variable depth of unconsolidated sediments, and showed that the underlying basalt is variably weathered. Rippable material is present well below the intended excavation depths, and no problems will be encountered during the initial stages of construction of the storage sphere.

Seismic velocities at the site group naturally into three ranges.

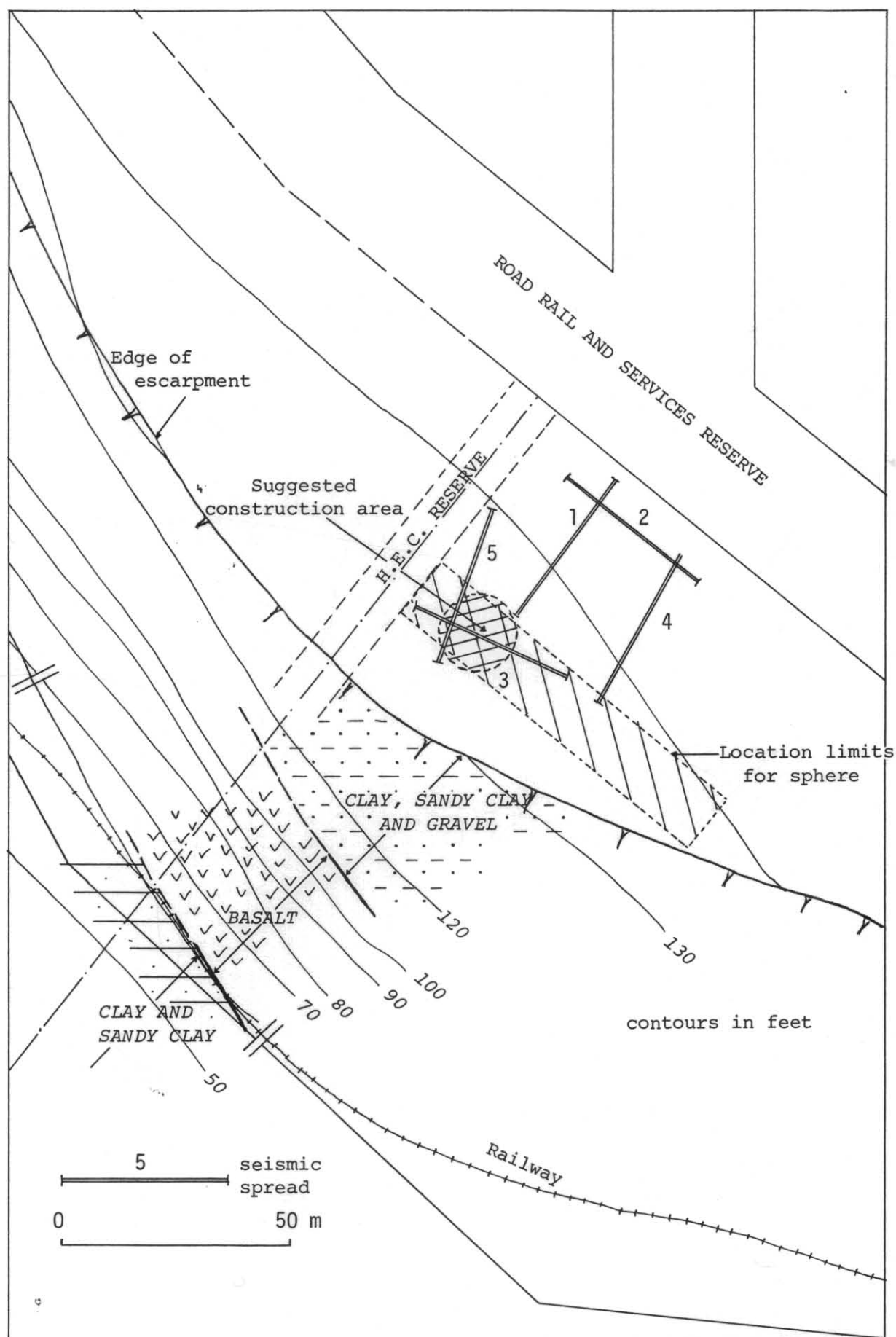


Figure 1. Site plan, showing geology, position of seismic spreads and the location limits and suggested construction area for butane storage tank, Bell Bay.

Although not in themselves definitive of the nature of the various rock types, they are consistent with velocities expected from the materials exposed in the nearby escarpment, and have accordingly been interpreted as:

<i>Seismic velocity (m/s)</i>	<i>Interpretation</i>
375-550	Dry, unconsolidated sediments.
675-1660	Deeply weathered and strongly fractured basalt.
1850-3800	Weathered - fresh basalt.

Table 1. SUMMARY OF SEISMIC SURVEY

Spread No.	Layer	Seismic velocity (m/s)	Layer thickness (m)	Interpretation
1	1	400	1-2.7	Dry, unconsolidated sediments.
	2	1200	6-8	Strongly weathered, fractured basalt.
	3	3230	-	Relatively fresh basalt.
2	1	530	4-5	Dry unconsolidated sediments.
	2	1050	8	Strongly weathered, fractured basalt.
	3	3800	-	Relatively fresh basalt.
3	1	500	4-6	Dry, unconsolidated sediments.
	2	c2000	?	Weathered basalt? Results inconclusive.
4	1	375	1-1.5	Dry, unconsolidated sediments.
	2	675	3-5	Dry sediments or very weathered basalt.
	3	1850		Weathered basalt
5	1	450	5-6	Dry unconsolidated sediments.
	2	1660		Weathered basalt.

Notes on the seismic spreads

Spread 1. Except at the south-west end, where they approach the surface, the unconsolidated sediments are relatively uniform in thickness (up to 3 m). An intermediate zone of very weathered basalt extends to depths ranging from 7 m (at the south-west end) to 9 m (at the south-east end). The material is rippable to this depth. The upper surface of the underlying harder basalt slopes gently down to the north-east.

Spread 2. The materials are rippable to at least 10 m. The underlying basalt is relatively fresh, with a gently undulating upper surface of slight relief.

Spread 3. The results are inconclusive but are suggestive of a variable and stepped basalt bedrock underlying unconsolidated sediments at depths ranging from 4 m (at the eastern end) to 6 m (at the western end). The materials are rippable to 6 m.

Spread 4. A thin (1-2 m) veneer of unconsolidated dry sediments overlies either damp sediments or very weathered basalt. No solid basalt occurs within 6-7 m of the surface. All materials are rippable.

Spread 5. There are apparently only two refracting layers. Unconsolidated sediments about 5 m thick and of uniform thickness, overlie strongly weathered basalt; all materials are rippable.

Magnetometer traverses

Two magnetometer traverses were conducted along seismic Spreads 1 and 4 in an attempt to locate major discontinuities between sediments and basalt, and within the basalt. Resulting curves of magnetic intensity show smooth profiles with only minor changes in relative values. Such findings are consistent with the seismic results and indicate no abrupt changes in basalt geology over the traverses.

CONCLUSIONS

There does not appear to be a risk of instability at the proposed site. The tank should be built as far from the edge of the escarpment as possible. This area is outlined on the accompanying map (fig. 1).

[3 March 1977]