

## 23. Geological observations and seismic survey, Department of Mines site, Mornington.

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The Department of Mines site is an elongate block of land adjacent to the Eastern Outlet Road at Mornington [EN32355] and abutting the planned road interchange with the Bellerive by-pass. The northern side of the property is bounded by the route of the old Sorell railway, now a private access road.

The development, as conceived in Scheme 2, involves a five-storey building and two elongate single storey buildings. All construction is planned for the western end of the property.

## GEOLOGY

The geology of the property is indicated in Figure 79 which also shows the general location and the siting of the buildings. In general only three materials occur at the site.

*Loam.* There is up to 40 cm of grey podsolic loam which is generally non humic. The average thickness is estimated at 10-25 cm.

*Gravel.* There is a variable thickness of partly cemented gravel-talus. The material is composed almost entirely of locally derived fragments of Permian siltstone and sandstone. Although the material is derived from the adjacent steep slopes there is some evidence of water working and rounding with traces of bedding, lensing and imbrication. The deposit may be related to fluvial inter-glacial stages.

The fragments range in size from 2-30 cm with a median value of about 5 cm. Cementing is normally argillaceous although some layers are distinctly sandy, well compacted and firmly cemented. In such cases, the material is quite massive and hard. The proportion of gravel fragments varies rapidly within the deposit from about 10% to 90%. An additional complication is the water-bearing properties of the material. Some parts are highly permeable while others are not. This results in many small springs and seepages, piping and a very irregular water table with small swamps. Much evidence of piping can be seen in the region of the proposed main building and along the drains bordering the Eastern Outlet Road.

*Siltstone and sandstone.* A siltstone-sandstone sequence (Malbina Formation) with occasional fossiliferous bands forms the main bedrock of the area. The unit is highly fractured but not significantly weathered.

## SEISMIC SURVEY

The seismic survey, which was undertaken to provide an estimate of the gravel thickness and distribution, encountered numerous difficulties both in operation and interpretation. The gravel made efficient shot setting awkward and holes were often too shallow. As the degree of compaction and cementation of the gravel was highly variable the time-distance graphs were complicated by relatively high velocity shallow depth refractors with definite suggestions of consolidated 'hidden layers'. In addition there is a measure of velocity overlap between gravel and fractured bedrock and also a steep slope in the gravel-bedrock interface (especially in the area of the main building) which make interpretation very uncertain. This is a most difficult combination of materials (see also Moore, 1973) and some confirmatory drilling will be essential.

Seismic velocities recorded were:

<i>Material</i>	<i>Seismic velocity (m/s)</i>
Soil	300- 700
Gravel	1000-2000
Fractured bedrock	1000-3000
Bedrock	3000-5000

Seismic spreads were fired in the region of the proposed main building and the ore dressing - pilot plant - core store building.

In the area of main building definite bedrock (seismic velocity 3000-4200 m/s) occurs at depths ranging from 3-7 m. The interface is very irregular but appears deepest towards the south side of the proposed building. It may be coincidental that a small swampy depression occurs nearby. This could imply either lower velocity distortion of the interpretation or a more permeable, deeper, water path. This section of the site should be drilled. At least one other hole should be placed in this region, preferably on the north-eastern corner of the site so as to confirm the general interpretation and demonstrate whether the interpreted interface represents the gravel/rock interface or a fractured rock/rock interface.

In the region of the core store building site the thickness of the gravel ranges from 2.5-6.5 m. The interface is again very irregular and its exact nature should be confirmed by at least one drill hole. At the western end of the proposed building the thickness of gravel is estimated at 6.5 m and at the eastern end, 5.5 m. The average thickness is about 5m with a localised thin cover zone about half way along the site from the western end.

Since vibrating machinery will be installed in buildings on the site a check was also made of the 'natural' frequencies indicated or transferred by the gravels. Frequencies of 80-100 Hz or multiples thereof could be expected to induce resonance and must be avoided. Such frequencies are surprisingly high for a material with a relatively low transfer velocity.

Footings for the main building should be placed on bedrock (positively identified by excavation). This will be necessary because of variable strength, cohesion and compaction of the gravel and the ever present risk of the removal of fine material by the piping process which could result in the undermining of the foundations unless these are rock founded. Two to four drill holes at the locations suggested are advisable so as to confirm the form and depth to bedrock indicated in Figure 79.

#### REFERENCE

MOORE, W.R. 1973. Seismic survey on gravel deposits along the Eastern Outlet Road, Hobart. *Unpubl.Rep.Dep.Mines Tasm.* 1973/7.

[10 April 1975]

#### DRILLING

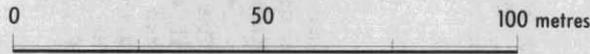
Four holes were subsequently drilled to evaluate the reliability of the seismic survey (fig. 79).

WEST PORTION , DEPARTMENT OF MINES SITE ,  
MORNINGTON  
SCHEME 2 LAYOUT

D.E. LEAMAN  
1975

Note: Contours indicate approximate depth in metres to firm bedrock.  
Bedrock seismic velocities (m/s) are also indicated.

⊙ Drill hole



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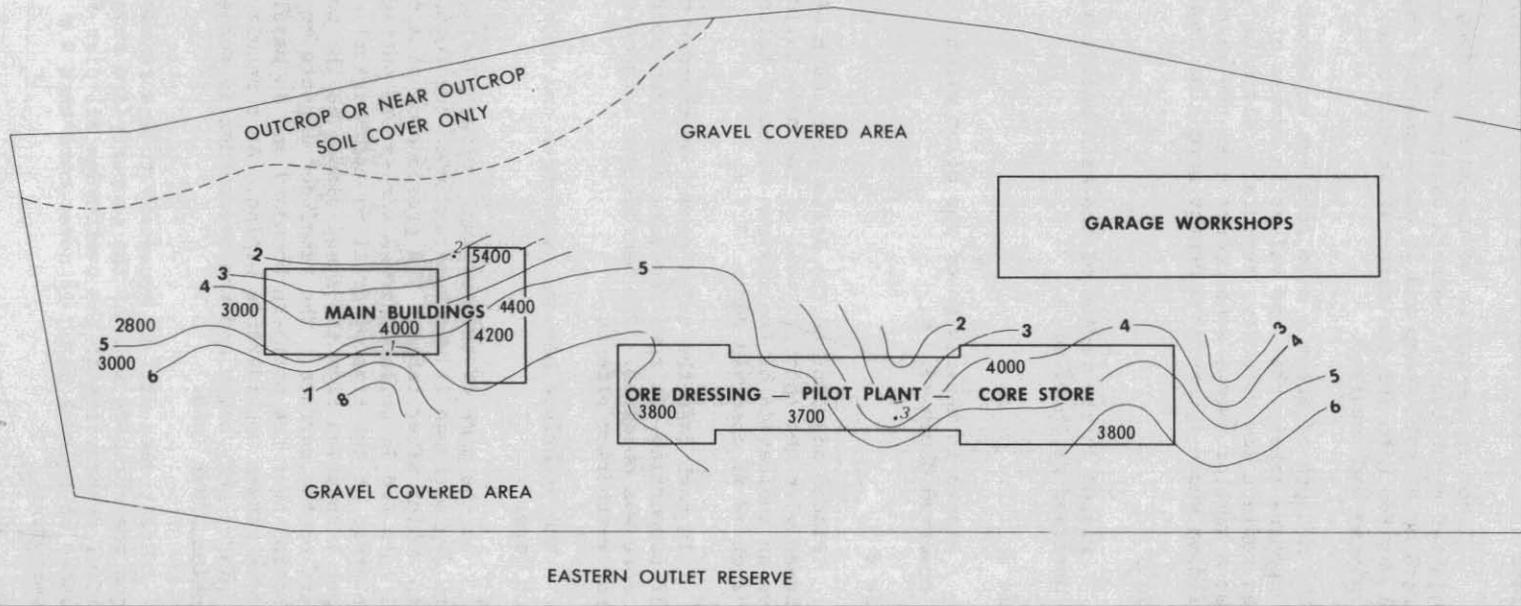
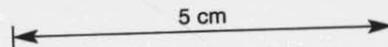


Figure 79.



#### Hole 1

Placed in the region of the main building where the seismic results suggested a substantial bedrock depression. The particular region is also marked by a small swamp and it was suspected that the velocity presumed overall was too high for the material in this zone. This would be especially so if piping had occurred.

A depth of about 6 m to rock was expected but only 3.7 m was recorded. It appears likely that the values in excess of 5 m as shown in the original plan reflect low velocity, texturally disturbed material. It is significant that a similar swampy zone occurs near the eastern end of the core store building where interpreted depths were also high.

#### Hole 2

Placed in the region of the main building. Expected depth to rock 2 m; observed depth ~3 m.

#### Hole 3

Placed in the region of the pilot plant. Expected depth to rock 3.5 m; observed depth ~3.5 m.

#### Hole 4

Placed adjacent to the drain just south of the property boundary and aligned with the southern wall of the main building this hole was used to give an indication of the maximum depth of talus materials. Expected depth to rock >8 m; observed depth ~7.7 m.

In each case the talus/gravel overburden was easily drilled and was self supporting but core recovery was often poor. There were zones where no core was obtained. The bedrock was in good condition and showed only minor weathering effects.

The interface between overburden and rock was found to be abrupt in each case.

At the time of the original surveys (late summer) the property was very dry although it was apparent that two regions were generally swampy with a high water table. The presence of piping features was also noted in all cuts and in collapse zones across the surface. All these features were confirmed at the time of drilling (mid-winter). The property is subject to sheet inundation from the steep slopes to the north and much of this runoff stays on the surface. The remainder appears to pass into the rock/talus junction near the northern boundary and in passing through the variable overburden causes considerable piping. As a result the property is very wet, in places very boggy and the overburden is subject to collapse and compaction under load.

Great care will be necessary to ensure adequate drainage, and drains along the northern side of the property are suggested. As a result of the partial destruction of the overburden all pier footings should be properly founded on bedrock which is never more than 4 m deep in the area marked for development.

[31 July 1975]