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Proposed subdivision at Windermere

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A subdivision has been proposed at Windermere, on Windermere Farm owned by R.H. Harris (fig. 1). In accordance with landslip legislation doubful risk properties must be closely examined in order that a recommendation for subdivision may be made. The property is located west of the Windermere to Swan Bay road at Windermere. The land slopes gently to the Tamar River but does have two distinct benches within the boundaries of the property.

Apart from a few small clay outcrops beneath basalt talus along the river banks and some gravel rich soils at the eastern side of the property the slopes are covered by basalt soils and talus. No definite basalt outcrops have been recognised on the property.

PART 1. SEISMIC SURVEY

A seismic survey was undertaken to determine whether in fact basalt was present; how much talus was involved and if the main materials present were Tertiary clay and sand.

SURVEY DETAILS

Spreads were located at the northern edge of the property on the high points in order to locate the basalt source. The distinct step to the high areas is suggestive of a basalt-clay situation. Other spreads were located on the benches between the river and the high points. All spreads were 170 m long with shot points at 15m.

RESULTS

Detailed below are typical velocity profiles, and thicknesses in each zone of the property.

High level areas (20% of the area):

V_0 = 400-750 m/s	;	t = 3-5 m
V_1 = 1100 m/s	;	t = 0-6 m
V_2 = 1600-1650 m/s	;	t >30. m

Slope change at back of bench:

V_0 = 450 m/s	;	t = 4-6 m
V_1 = 1450 m/s	;	t = 3-4 m
V_2 = 1500 m/s	;	t = 12-13 m
V_3 = 1800-1900 m/s	;	t >30 m

Wide bench to river (70% of the area):

V_0 = 400-600 m/s	;	t = 3-5 m
V_1 = 1500-1700 m/s (1650 m/s)	;	t >30 m

Velocities in the range 400-750 m/s represent soil and talus. The thickness of this material appears to be very uniform with the exception of slope areas. It is likely that this low velocity layer may also include weathered clay. Several holes dug for shot points revealed clay at less than

2 m depth.

Velocities in the range 1100-1500 m/s represent weathered Tertiary sediments. Significant weathering profiles were only recorded uphill of the bench areas. Even so there are wide variations in thickness.

The velocity of 1650 m/s was most commonly recorded across the property and is considered to represent consolidated Tertiary clay. A higher velocity was recorded in one small area but is unexplained.

An apparent high velocity layer (3000 m/s) was suggested from one series of geophones at the group of trees high on the slope near the boundary fence between the two sections of the property. As results in spreads to south-east, south-west and north-west do not reveal any such layer it is concluded that these geophones were located on an outcrop, or near outcrop, of basalt, resulting in early velocity arrivals. The width of the outcrop is about 30 m.

CONCLUSIONS

There is virtually no outcropping basalt within the property area and the source of the 3-5 m thickness of talus must be still further upslope. The predominant material present is Tertiary clay. No basalt is interbedded within at least 30 m of the surface.

PART 2. LAND STABILITY

The seismic survey of Part 1 has shown that no basalt rock exists in the area, and that it consists of 3-5 m of basalt talus overlying sedimentary Tertiary clay.

Six trial pits were excavated and examined on 30 May 1972 in the positions shown in Figure 1. The sections seen in the pits are described below:

Pit 1

Material	*Thickness (ft)*
Top soil	1
Talus of hard angular basalt boulders in basalt clay matrix, became hard to dig at 6½ ft.	

Pit 2

Material	*Thickness (ft)*
Top soil	-
Weathered basalt talus with some hard boulders, became too hard to dig at 10 ft.	

Pit 3

Material	*Thickness (ft)*
Top soil	1
Talus of weathered basalt, mainly clay with a few basalt boulders at 11ft.	

Pit 4

Material	*Thickness (ft)*
Top soil	1
Brown plastic clay	2
Deeply weathered basalt with occasional boulders to 9 ft 6 inches where difficult to dig.	

Pit 5

Material	*Thickness (ft)*
Top soil	1
Brown sandy clay	2
Weathered basalt talus becoming too hard to dig at 8½ ft.	

Pit 6

Material	*Thickness (ft)*
Top soil	1
Brown sand	3
Weathered basalt talus passing into fresh basalt rubble at 8½ ft.	

None of the pits was deep enough to reach the Tertiary clay, but there is no doubt that these are present because:

(1) They outcrop along the Tamar shore below this area.

(2) Their presence was detected by the seismic survey.

(3) They are known to be present from regional mapping.

Because of the presence of the clay, the subdivision cannot be said to be without risks from landslips, but these are to some extent reduced by the presence of the basalt talus. The talus, when weathered, is itself a slip liable material but is much less so than the clay.

The liability to slip can be expressed in terms of the angle at which slopes are known to be 'reasonably stable'. This last expression implies that the slope is not subjected to unusual stresses of loading or moisture or both. The basalt talus in these terms is stable to about 16-20° and the clays are stable to about 7-11°.

The steepest slopes in the area are at the positions of Pit 1, 12°, Pit 2, 10° and Pit 5, 14°, and it will be seen that these angles lie between the estimates for basalt talus and sediments given above.

It is recommended therefore:

(*a*) that houses are not built on slopes greater than 10° or in any position less than 100 ft uphill of any slope of 10°;

(*b*) that stormwater and septic tank drainage, if any, is carried away to river level in pipes so constructed as to be flexible and not subject to leakage when in tension;

(*c*) that roads are constructed as far as possible to avoid the steeper slopes or areas immediately uphill or downhill of them;

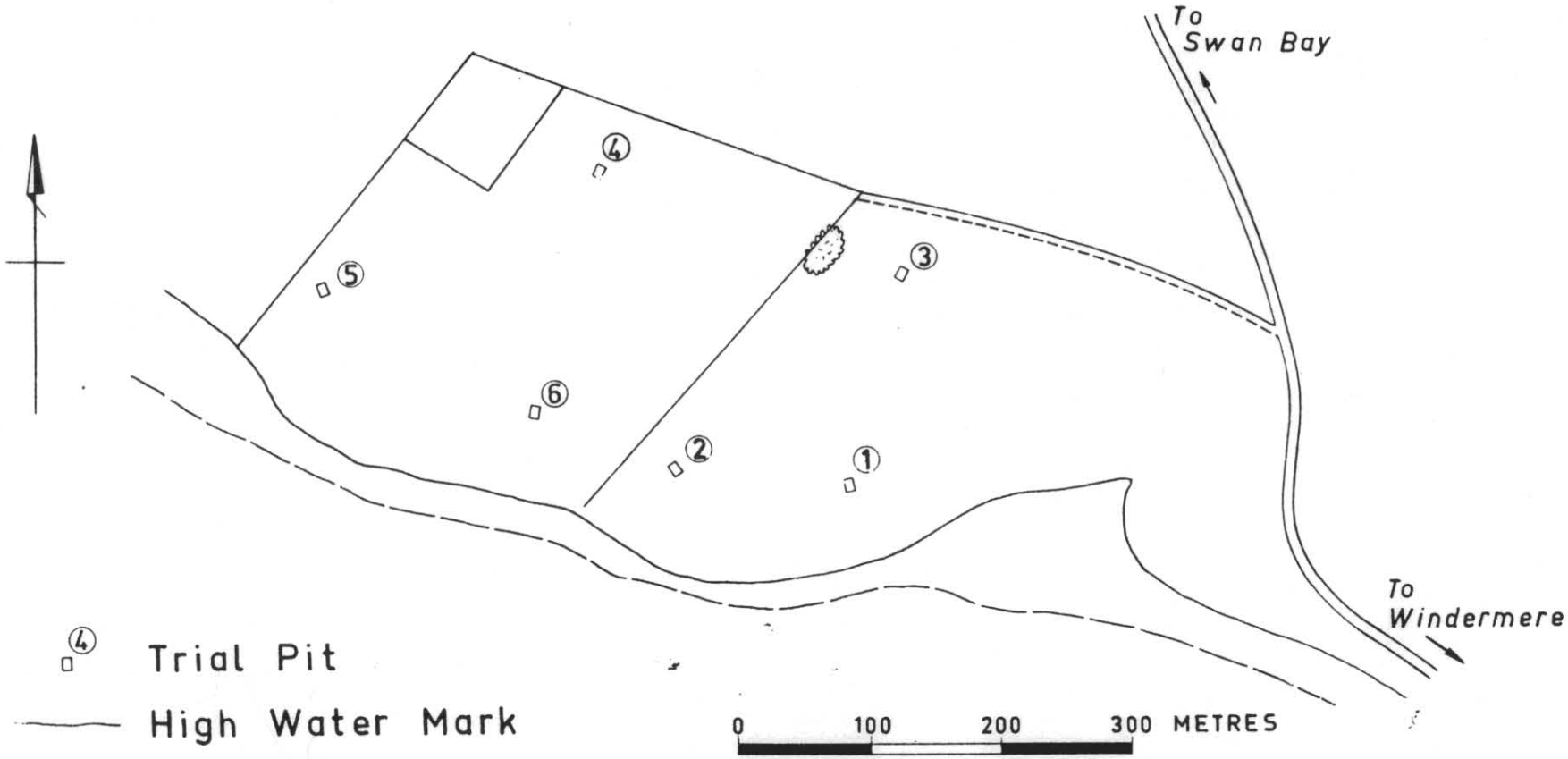
(*d*) that the planting of trees is encouraged especially in the steeper areas.

No detailed contour plan is known to exist for the area, but when such a plan is prepared in the course of subdivision, the areas of limitation could more clearly be defined.

[5 June 1972]

Figure 1.

SKETCH PLAN SHOWING LOCATION OF TRIAL PITS
Mr. R.H. Harris's Proposed Subdivision
Windermere



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INVESTIGATION AND PRODUCTION DEPT of MINES

DEPT MINES
3624

5 cm

S/S