

UR1974-51

Stability zones in the Leith-Forth area.

P.C. Stevenson

At the request of the Devonport Council the stability of the slopes in the area indicated on Figure 1 was examined during the period 22-30 May 1973 by P.C. Stevenson and C.J. Knights.

Precambrian basement rocks are only exposed at one place in the south of the area (Burns, 1963) and as they are deeply buried, have little influence on the slopes.

The relief of the area is provided by the Tertiary rocks which rise to over 100 m within the area and to over 120 m just outside it. These are not well exposed but consist of sediments capped by basalt. The sediments include clay and strongly iron-cemented sand and grit. The generally weak nature of the clay ensures that exposures are very rare and the details of the whole sedimentary succession are conjectural. The sand and grit are exposed in the steep ground to the north-west of Braddons Lookout; even here no succession can be made out.

The basalt capping varies in thickness. At the above locality it appears to be about 40 m thick, that is rather less than half the height of the escarpment, but at Forth, basalt is seen near river level and could form the whole of the slope from the river up toward the east. On the west of the river at Forth the Precambrian mica schist and quartzite form low slopes, but the base of the basalt is well exposed at an altitude of about 60 m on Kindred Main Road and extends to the top of the hill.

The instability of the slopes arises from the nature of the Tertiary rocks (both the basalt and the underlying sediments), and it must be emphasised that the results of this phenomenon also obscure all but the broad outlines of the geology.

The sediments are permeable where they consist of sand and grit, but impermeable where clay predominates. As the rock sequence also varies laterally there is a quite unpredictable distribution of groundwater and springs. The behaviour of the basalt is more complex. The unweathered basalt is usually a good aquifer, but where deeply weathered, it will degrade to clay below the water table and become impermeable. It also produces as a weathering product the fertile red soil which is itself rather freely permeable, but this creeps down the steep slopes and obscures the rocks beneath.

In both parts of the Tertiary, then, springs caused by the conjunction of permeable and impermeable beds are common, and they are well sited to produce softening and weakening in the sedimentary clay, in the basalt derived clay and even in the red soil itself.

Slope failure is therefore common on the steep slopes between Leith and Forth. The failures are of several styles. Where sound basalt overlies clay, rotational slumps are seen, but where weathering is deeper and no hard rock remains, slow earthflows are found (Eckel, 1958). Soil creep has also been mentioned, and soil erosion is evident above some springs.

The aim of the study was to assess the stability of the slopes. This has been done by recognition of present and past mass movement which shows as a disturbance of the slope and contour profiles. The risk areas are divided into those where failure is evident and those where similar and potentially hazardous geological conditions are thought to exist. These areas are shown on the map (fig. 1).

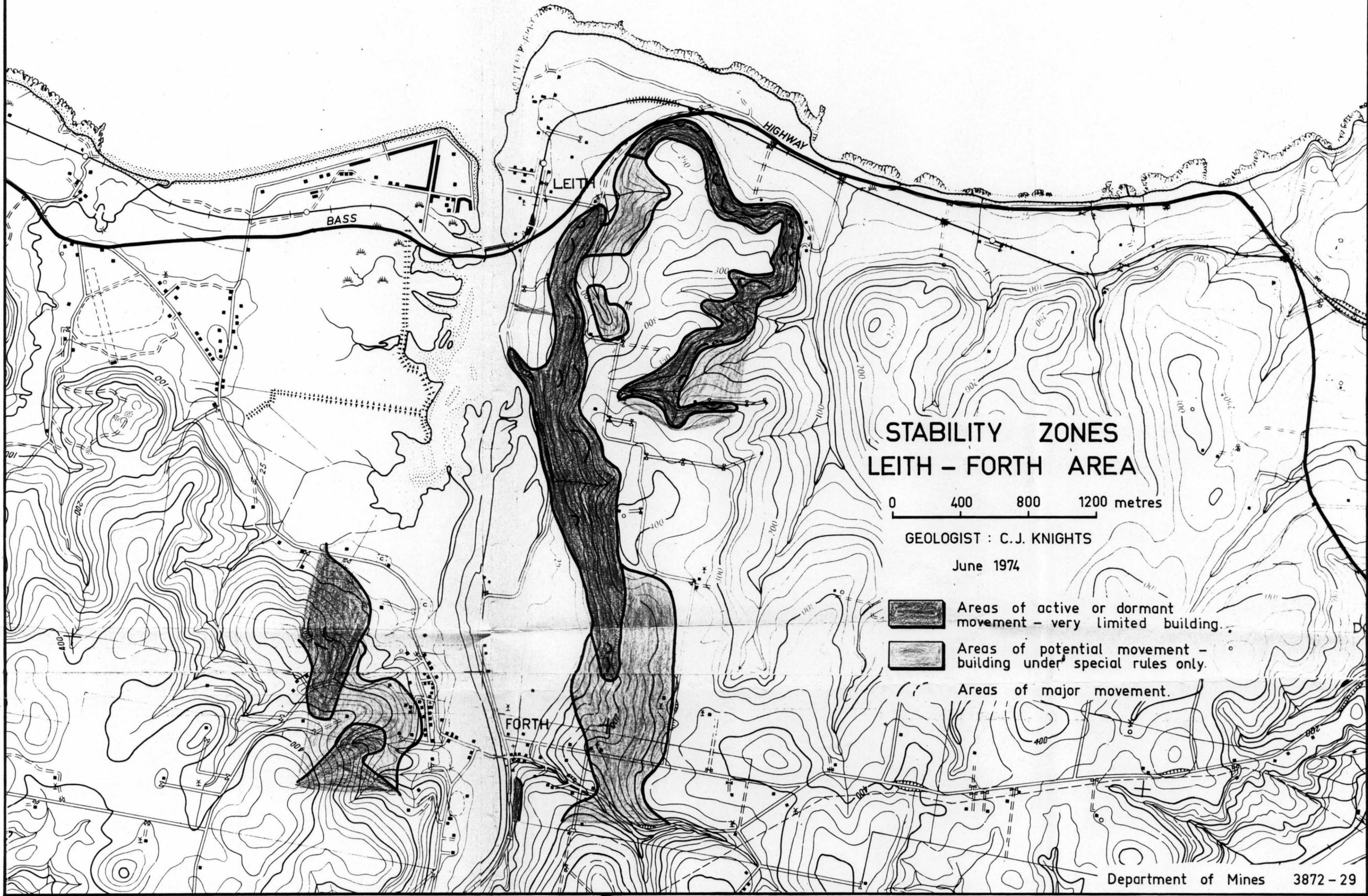
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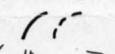


**STABILITY ZONES
LEITH - FORTH AREA**

0 400 800 1200 metres

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-  Areas of active or dormant movement - very limited building.
-  Areas of potential movement - building under special rules only.
-  Areas of major movement.

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