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HORNSBY SHIRE COUNCIL

REPORT ON PROPOSED FILLING

OLD MAN'S VALLEY
HORNSBY

REPORT S8463/2-AC JULY, 1989

S8463/2-AC CPT:BS
10th July 1989

The Shire Clerk,
Hornsby Shire Council,
296 Pacific Highway,
HORNSBY. N.S.W. 2077

ATTENTION MR. WARREN LATHAM

Dear Sir,

RE: Report on Proposed Filling, Old Man's Valley, Hornsby

Please find enclosed our report on the geotechnical investigations for the proposed filling at Old Man's Valley, Hornsby.

Our estimates of costs and fees for further geotechnical work in the area of proposed fill and for undertaking a rock mechanics study of the eastern quarry face as outlined in the report are included in Appendices D and E respectively.

We also recommend that consultations continue during the pre-construction and construction phases. It is understood that the Council will be responsible for detail designs and for supervising and directing the works, and that the Council will advise when consultations are required. We have not made an estimate of costs and fees for such consultations as these are dependent upon the progress of work. However, these consultations would be undertaken in accordance with standard Terms of Agreement for Professional Services (rev 89/3), a copy of which is attached in Appendix D.

Should you have any queries regarding this report please do not hesitate to contact Mr. Tony Scott or the undersigned.

Yours faithfully,
COFFEY & PARTNERS PTY. LTD.

C.P. THORNE

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CONTENTS (cont)

1.0 INTRODUCTION

This report follows our earlier reports S8463/1 dated 11th October 1988 and S8463/2-AB dated 1st March 1989 undertaken at the request of Hornsby Shire Council, who plan to construct a substantial fill over the headwaters of a series of creeks above the Hornsby breccia quarry (see Figure 1). The first report discussed the proposed additional fill at Old Man's Valley and recommended further work. The second report described the results of additional work with respect to the southern end of the proposed fill.

Subsequent to the issue of this second report and during work related to the northern end of the site, it became evident that the survey information which had been provided as part of the Brief was not correct. The shape of the slope below the existing fill was found to steepen down towards the creek rather than to flatten as the earlier survey showed. In addition, initial stability analyses of the northern end were not favourable. Following a meeting with the Council, further survey and investigation was requested as per our facsimile dated 26th April 1989.

The findings of the new survey at the southern end plus information provided concerning toe construction indicated that a complete revision of Report S8463/2-AB was necessary and that report must be considered as completely superseded.

Because of wet conditions and difficult access, the survey results were not received until late May and access for test pits and boreholes was not available until the first week of June.

This present report describes the additional field work and analyses relating to the southern end and the results of work at the northern end.

Information provided by the Council consisted of:

- Hornsby Shire Council "Old Man Valley Playing Field Development Report on Field Compaction Trial with Grid and Vibratory Padfoot Rollers", March 1983;
- Golder Associates "Geotechnical Investigation Proposed Alternations to the Northern Bund Wall and Associated Filling Program, Hornsby Quarry" (prepared for the Readymix Farley Group), November 1982;
- Golder Associates "Supplementary Report on Slope Stability Study Eastern Face, Hornsby Quarry" (prepared for Readymix Group), August 1982;
- Contour survey by Rygate & West, Surveyors, 13-4-1970 (on drawing by GH&D, 21st July 1970);
- Later contour survey on Council plan 428.14;
- Plans and sections showing approximate present and proposed surface levels (plan 428.21, 8 sheets);

- * Drawing showing current position of drainage gullies and piping;
- * Recent survey of Hornsby quarry;
- * Surveyed sections at Ch 170, 190, 215, 230, 270, 310, 350, 390 and 403.4m and a contour plan No. 428.24 of the area near the new drainage outlet pipes to the quarry.

The survey and other factual data supplied, including factual data in Golder Associates' report, has not been checked and this report relies on that data.

2.0 RESULTS OF FIELD WORK

2.1 Northern End

The field work for this report consisted of the drilling of one additional hole (BH6) near the toe of the highest section of the proposed fill, mapping of the quarry face below this section, excavation of pits (TP1 to TP7) and mapping of exposed features in the creek. Nine 50mm undisturbed tube samples were taken in the borehole and test pits.

The locations of the bore and test pits are shown in Figure 1 and logs are given in Appendix A. Results of laboratory testing are presented in Appendix B.

Attempts were also made to map areas of seepage and to measure flows during wet weather.

2.2 Southern End

Two additional boreholes (BH7 and BH8) were drilled at approximately Ch 215m and Ch 230m and a standpipe was installed in each borehole. A test pit was also excavated at about Ch 240m. The logs of earlier holes BH1 to BH5, together with BH7 and BH8, are given in Appendix A and locations are shown in Figure 1.

3.0 DISCUSSION OF SUBSURFACE CONDITIONS AT THE PROPOSED FILL SITE

3.1 General

As described in previous reports, the proposed fill is immediately above the Hornsby breccia quarry. The original landform comprised a steep sandstone slope at the rear of the site feeding a creek which ran through the centre of the site leaving two ridges (see Figure 2 which shows conditions in 1970).

Both ridges are breccia and the approximate sandstone/breccia interface is given in Figure 3. The southern breccia ridge is now almost fully covered with fill to form the present playing field area (Figure 3).

3.2 Surface and Subsurface Drainage

The surface runoff from the slope uphill of the site on the eastern side is intended to be intercepted by surface drains along the base of the slope which lead into a pipe which runs from about the centre of the site northwards to discharge into the valley to the north of the proposed fill area (Figure 4). It was observed during a very wet period that almost all the flow from the centre and southern slope disappeared south of the drain into the fill. Dye placed in this water did not show discharge on the downhill side of the fill. However, this cannot be considered as a definite indication that the two are not linked.

Seepage was noted from halfway along the access road which runs down to the quarry. This road forms a berm in the northern batter of the existing playing field and is cut into natural soil on the uphill side over part of its length (Figure 3 and Photographs 1a, 1b and 1c). A substantial localised seepage flow emerges from this batter in the centre of a feature which could be a shallow slip in the batter. Elsewhere, general seepage was evident along the toe. This seepage is presently collected in an unlined drain and led to the creek which runs from south to north along the west boundary.

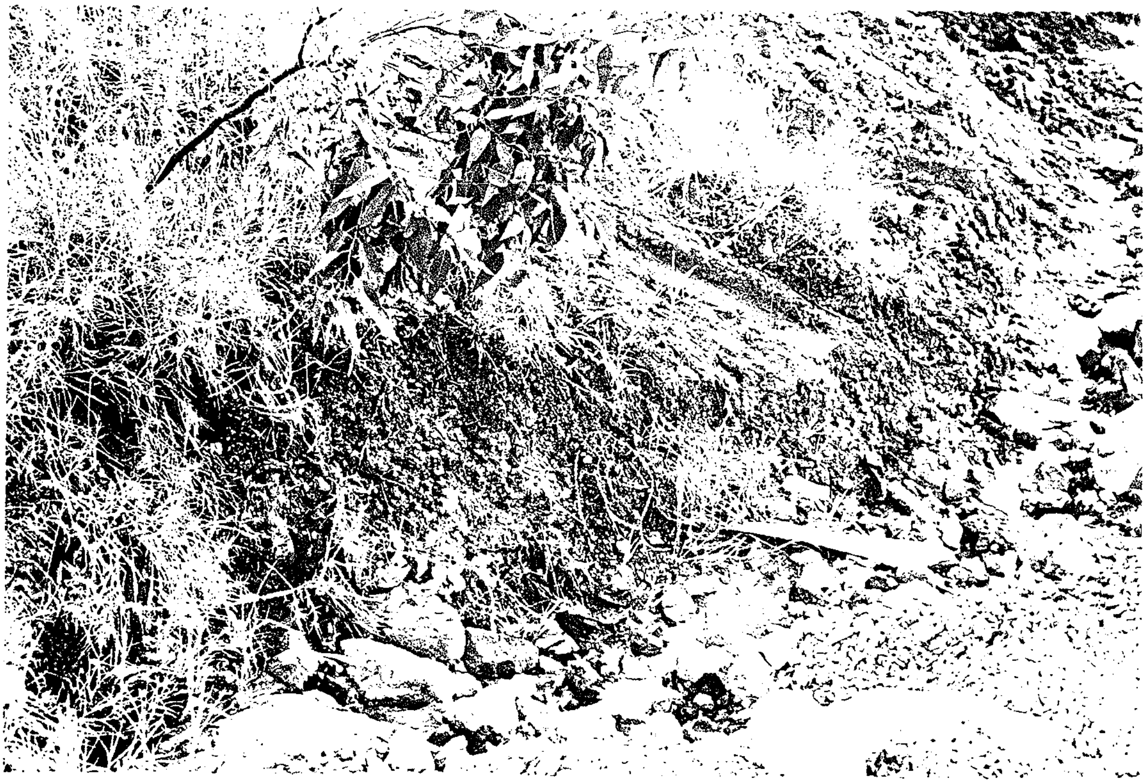
Seepage was also noted at the toe of the filled slope of the existing fill near BH7(Photographs 2a and 2b). As described below, a toe "key" was constructed along the toe and BH7 was drilled just uphill from the key and a standpipe was installed to check if water was ponding behind the key (Figures 1 and 5). This standpipe showed a water level at about the natural ground surface. A second standpipe was installed at BH8 just downhill from the toe. This standpipe showed a much lower water level. It is possible that there is a time lag in the response but it is also possible that the water level in BH7 is ponded in the residual/extremely weathered breccia behind the "key", while the water level in BH8 represents that in the underlying highly to moderately weathered breccia. More standpipes would be required to decide this issue.

The top of the fill bench below the access road is also cut into natural soil and further seepage is evident from this slope. This seepage is led partially to the west to the boundary creek and partly north to the existing depression.

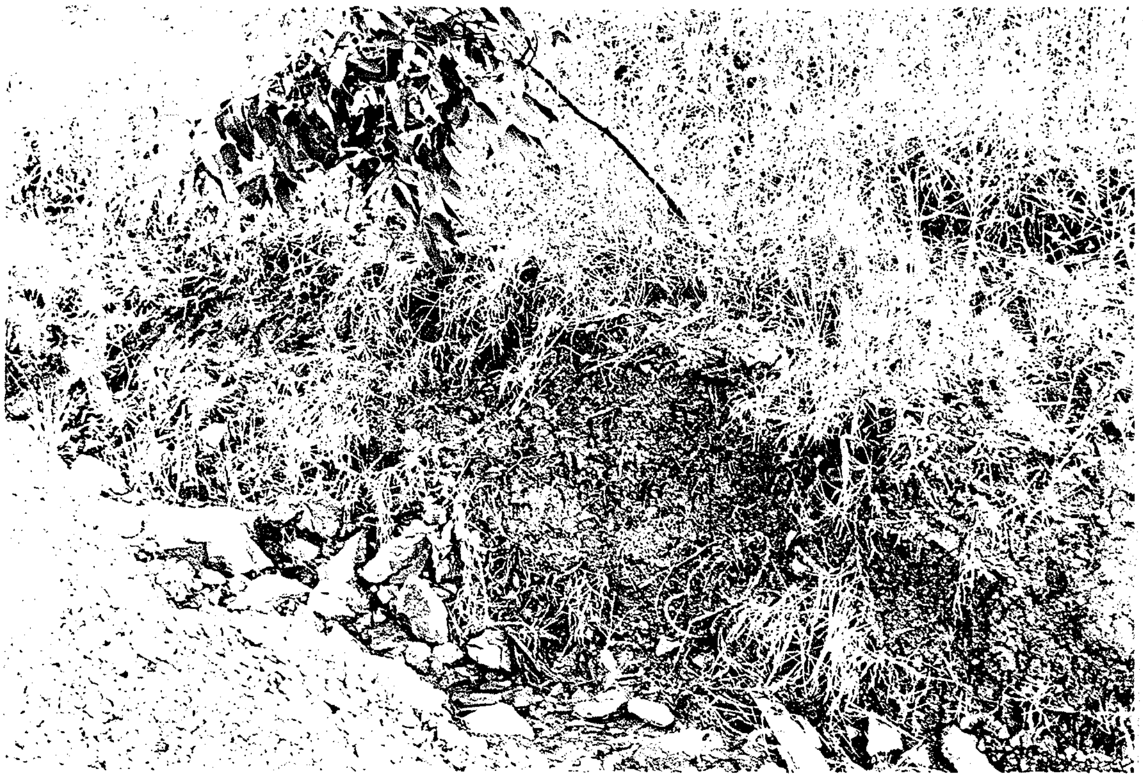
The original set of drainage depressions has been filled over at the top and further fill has been placed over the main east-west drainage depression, moving it north to its present location.

Despite wet conditions, little seepage was evident near the upper depressions in the fill. However, very substantial seepage emerged from the fill batter approximately on the line of the old depression (Photograph 3). This flow was the main contributor to the flow of this depression, which was measured at 5 l/sec where it entered the main west boundary creek about midday, roughly 6 hours after rain stopped. The flow was measured at 2.5 l/sec approximately 12 hours later.

Photograph 1a - Natural drainage gully developed at (Approx. Ch.260m) boundary between northern toe of playing fields and access road. Note residual red-brown clay exposed in gully. Water in gully is almost entirely derived from seepage from toe of fill embankment.

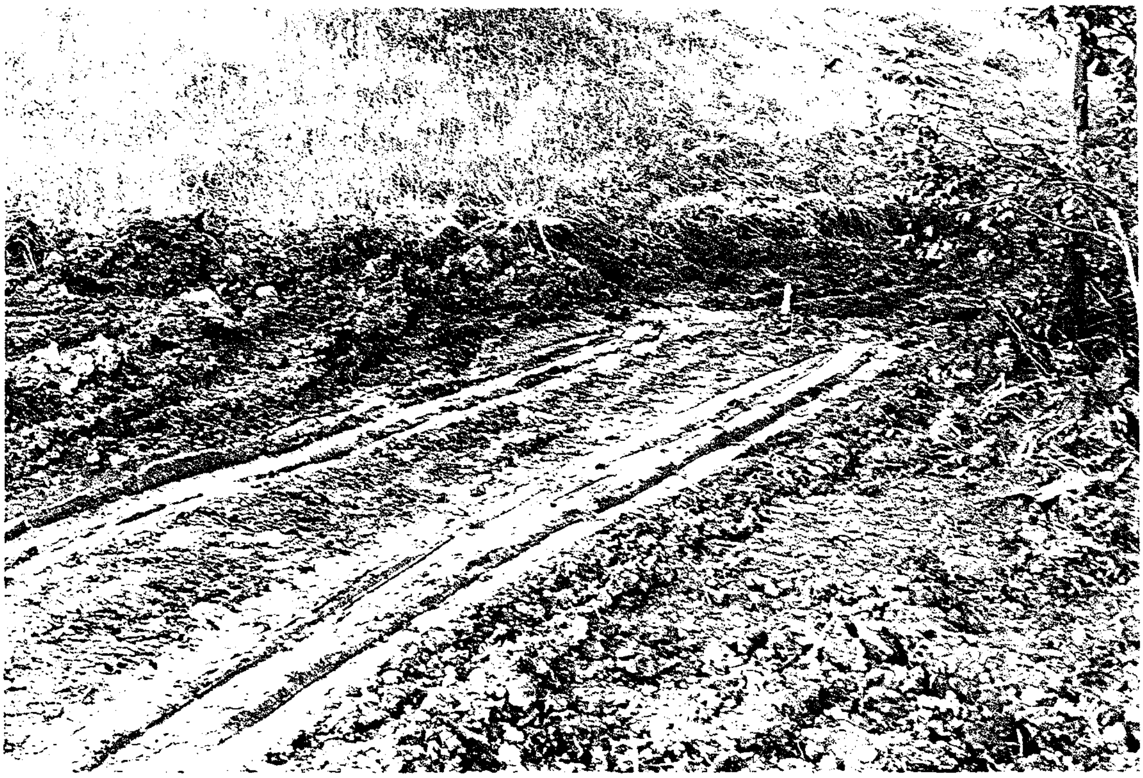


PHOTOGRAPH 1b - View looking west along drainage gully. Note wet soil and seepage to left of drainage gully. (Approx. Ch 260m)

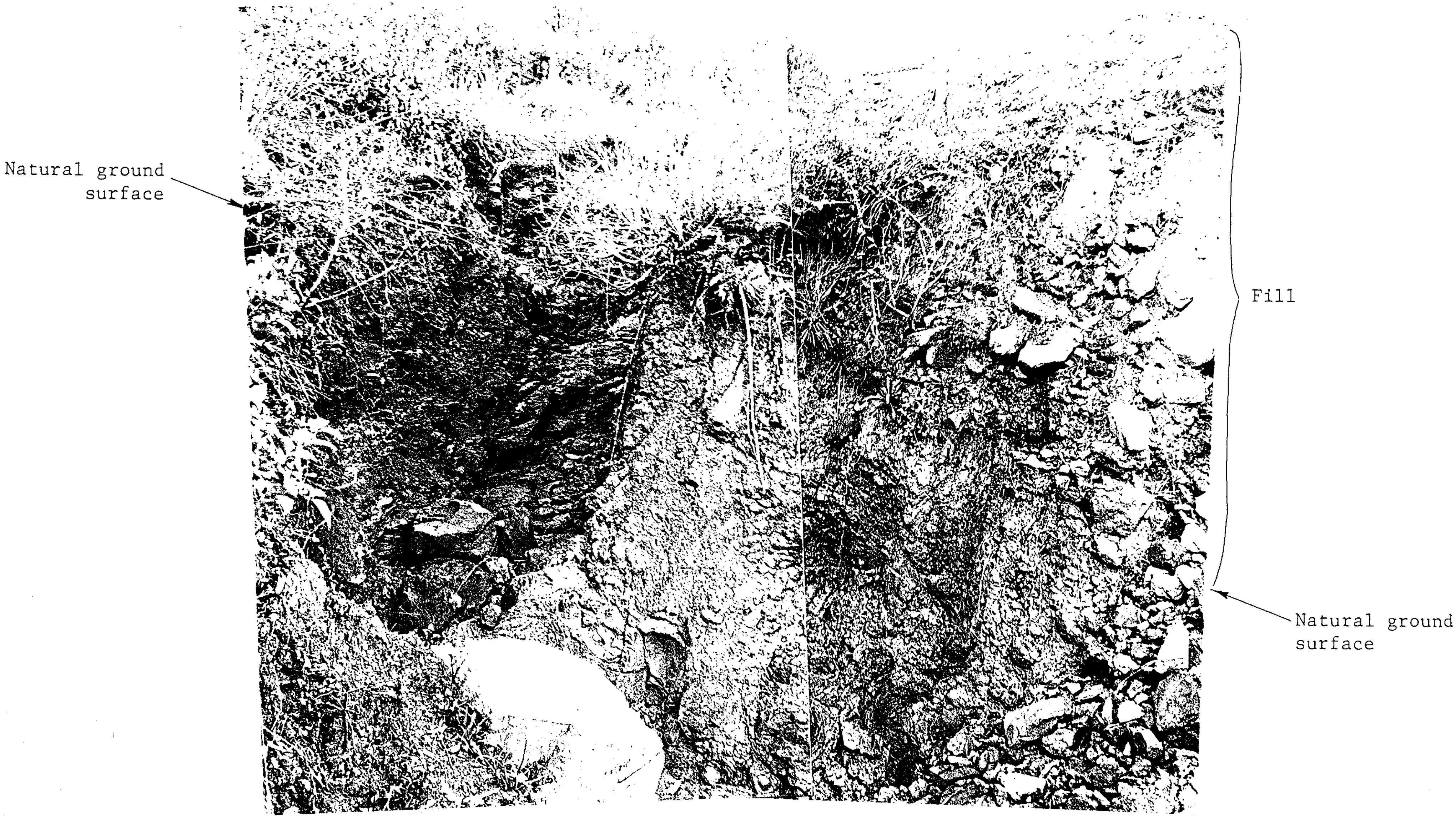


Photograph 1c - View of seepage emerging at toe of north western corner of existing playing fields. The seepage emerges near to the boundary between the fill and residual breccia soil. (Approx. Ch 260m)

Photograph 2a - Seepage emerging at western toe of existing playing fields at approximately Ch.220m.



Photograph 2b - View of boreholes BH7 and BH8 (white pipes). Note water siting on surface in foreground. This area was dry 12 hrs prior to photograph being taken. The water is seepage from fill toe. (Approx Ch 215m to 230m).



Photograph 3 - View of creek at Ch 350m at toe of filled area. Extremely weathered and highly weathered Breccia is exposed in eroded channel with fill overlying in upper right of photograph. Water flows of up to 5ℓ/sec were emerging near boundary of fill and natural material (See green mossy area), on 6-6-89.

In the quarry side, seepage was evident emerging from the toe of the natural slope on the eastern side of the road.

Groundwater levels were recorded in a number of standpipes in bores and standing water levels in pits were also recorded. These are summarised in Table 1.

Table 1
Water Levels in Boreholes (RL m AHD)

Bore	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Approx GSL (RL m)	130	130	130.5	130	128	95.89	118.6	113.5
3/2/89	blocked	120.5	119.7	119.8	119.7	-	-	-
14/2/89	119..8	blocked	118.9	118.8	119.1	-	-	-
14/4/89	blocked	122.9	122.3	120.6	blocked	93.09	-	-
8/6/89	---------------		destroyed		-----------------		116.2	105.75

During late May and early June an excavation for a new drainage pipe was made (Figures 3 and 4). This pipe is to collect drainage from all the main creeks east of the quarry so as to divert the water. It is understood that this pipe is to be placed with its invert at RL 90.5m, which is substantially lower than the previous pipe. The creek bed has rapidly eroded downwards as the result of this deeper outlet, exposing weathered breccia in its bed (Photograph 4).

Golder Associates, in their report dated August 1982 noted that there was no evidence of groundwater in the rock slope. It appears therefore that the fresh to slightly weathered breccia is drained by the quarry and that the water levels observed in the site above are the result of groundwater perched on the relatively impermeable residual soils and extremely weathered rock. The actual groundwater pressures at various depths in the weathered breccia profile are therefore uncertain.

3.3 Subsurface Conditions at Site

The site can be considered as having four zones with the boundaries running east west.

The first zone is the sandstone country and lies south of about Ch 120m. This zone consists of breccia overburden fill over shallow residual sandy clays over sandstone, as evidenced by BH1 and BH2. The proposed fill extends to the south of the existing fill onto the steep sandstone hillside (see Figure 1).

Approximate level of creek before lowering of culvert invert level.

Boundary between alluvium, brown (top) and residual clay/breccia yellow-brown (bottom).

Photograph 4 - View showing scouring and erosion in creek after culvert invert level was lowered by approximately 1.5m about 3 weeks before photograph. Chainage 380m.

The second zone runs from Ch 120m up to near the access roadway at about Ch 230 to 270m. In this zone, breccia underlies all but the easternmost part of the fill. The sections at Ch 170, 190 and 215m (Figure 5) show the conditions, which consist of breccia overburden fill overlying the natural breccia land surface under the present playing field. It is understood that a "key" was constructed at the toe of the batter by excavating a trench 1.5m deep at the toe and 4.5m wide and filling with compacted fill. Downslope the weathering is deep and the creek has incised deeply into the weathered profile, giving very steep sides to the creek, with a flat floor covered with sandy alluvium. Over most of this length the fill batter and creek bank continue to give a more or less continuous slope from the top of the fill to the creek bed. Because the breccia is weathered deeply, the lower slope comprises extremely to highly weathered breccia, in the form of a sandy or gravelly clay with corestones of moderately to highly weathered breccia, and has essentially soil properties.

The third zone extends from the access road to the east west drainage depression. Here the boundary creek is less deeply incised and the ground beyond the creek slopes up more gently to the east. Breccia overburden fill has been placed at the back (east) side of this zone, covering the original drainage course, and it is understood that the drainage course was cleaned "to rock" prior to fill placement, although it has not been possible to confirm this. It is further understood that no attempt was made to place any subsurface drainage provisions in the depression.

To the west of the fill the natural surface consists of deeply weathered breccia at the southern end and alluvium to the north west (see Figure 3 and sections at 270, 310 and 350m on Figures 6 and 7). The depth of weathering, as evidenced by excavator refusal on slightly weathered grey breccia, decreases to the north. Intermediate between the alluvium, residual soil/ extremely weathered breccia is a clay layer of high plasticity and a cemented sand layer - both are thin. The alluvium consists of silty and clayey loose sand.

The fourth zone comprises the area north of the east-west drainage depression. The northern breccia ridge is deeply weathered breccia to at least 4m just at the change of slope above the creek and deeper towards the top. The test pits show a similar profile to that in the southern breccia ridge, with a thin layer of red residual clay of high plasticity over extremely and highly weathered breccia. There is a clear boundary where the steep breccia slope ends and the alluvium begins (see Figure 7). The alluvial area is extensive (Figure 3) and the creek has eroded through the alluvium into the underlying weathered rock in places. As in the southern ridge, it appears that the creek has downcut through the weathered breccia and in this zone there is a thin ridge of weathered breccia left between the creek and the access road which runs round the top of the quarry. The slightly weathered to fresh breccia occurs at about RL 90m in the quarry just opposite the new outlet pipe.

3.4 Results of Shear Strength Testing of Weathered Breccia

One triaxial and four direct shear strength tests have been undertaken on samples from the site. These results are summarised in Figure 8 as shear strength versus normal effective stress, and to allow plotting of the triaxial results the shear and normal stress on the failure surface have been used to give the plotted points.

There is a wide scatter of points, partially due to the influence of gravel size rock fragments which "reinforced" the shearing surface in some instances. In the scale of the real slope, such reinforcement would not occur. In assessing individual C' and Ø' values the unusually high points have been ignored.

It is normal practice to adopt, for design, values approximating the lower quartile, and to require a factor of safety of at least 1.5 using these. Figure 8 shows the average values and computed lower quartile results for all tests and for tests on extremely weathered breccia only. For the extremely weathered breccia, values of C' = 40 kPa and Ø' = 20° are obtained, while for all results the values are C' = 11 kPa and Ø' = 23°. The lower bound is C' = 5 kPa and Ø' = 25°.

There are areas around the pit with substantial slopes up to about 50° and 20 to 30m high and these slopes appear to be free of seepage. A friction angle of 20° and cohesion of 40 kPa would allow a slope to be about 25m high for a factor of safety of 1.0. For the overall lower quartile values of C' = 11 kPa, Ø' = 23° the corresponding height is about 9m, and for the lower bound value of C' = 5 kPa, Ø' = 25° it is about 4m.

The existence of the steep, highly weathered breccia slopes does not, therefore, necessarily indicate higher parameters than those given above as the extremely weathered breccia lower quartile, especially given that unsaturated conditions could exist in the slopes. The mass strength must, however, be higher than the lower bound for these slopes to exist.

The approach has therefore been adopted of using C' = 40 kPa and Ø' = 20° for weathered breccia and C' = 5 kPa, Ø' = 25° for residual soils. Because the cohesion intercept is uncertain a check has also been made assuming C' = 25 kPa, Ø' = 25° in the weathered breccia for some cases

For new compacted fill, values as previously discussed have been used, i.e. C' = 25°, Ø' = 25° for clay/shale and C' = 10 kPa, Ø' = 32° for sandstone fill.

For the purpose of analysis of the slopes incorporating existing fill it has been assumed that the strength of the fill can be taken to be the same as for the residual soils. For sandy alluvium C' = 0 kPa and Ø' = 30° has been adopted. The adopted values are given in Table 2.

Table 2
Parameters Used for Analysis

Material	Cohesion kPa	Friction Angle degrees	Density kN/m^3
Residual breccia Old fill	5	25	1.96
Weathered breccia	40 (25)	20 (25)	1.96 1.96
Alluvium	0	30	2.0
Sandstone fill	10	32	2.0
Clay shale fill	25	25	2.0

4.0 DESCRIPTION OF ROCK IN QUARRY

4.1 General

The Sydney 1:100,000 Geological Series Sheet 9130 indicates that Old Man's Valley is underlain by volcanic breccia, with the surrounding plateau comprising Hawkesbury Sandstone (see Figure 9a). Hornsby Quarry, situated immediately west of the proposed filling at Old Man's Valley, is sited within the volcanic breccia which is generally called the Hornsby Diatreme. The geology sheet indicates the Hornsby Diatreme to be dumbell shaped and elongate for about 1.5 km in the NE/SW direction and is generally less than 400m wide. The southern extremity of the diatreme is separated from the main body by a sandstone bar across Old Man's Valley. The Thornleigh Diatreme is situated some 200m to the south west (along projection of the long axis) of the Hornsby Diatreme and is separated from it by Hawkesbury Sandstone. The relationship between the Hornsby and Thornleigh Diatremes is not known. They may represent unrelated individual intrusions or they may be related. Further, it is unknown whether the Hornsby Diatreme represents a single intrusion or a number of intrusions. Certainly, the dumbell shape alludes to the possibility of more than one intrusion. If the Hornsby Diatreme represents a number of intrusions, their relationships and effects on one another are unknown.

A diatreme can be defined as "a pipe-like volcanic conduit filled with pyroclastic debris (tuff or lapilli tuff) and blocks of wall rock". Diatremes in the Sydney Basin are thought to be Jurassic age and are generally considered to have resulted from violent intrusions of molten magma into surrounding country rocks which are Hawkesbury Sandstone in this case. Figure 9b outlines hypothesised stages of general development and features of diatremes found in the Sydney Basin.

Figure 1 (site plan) shows the interpolated boundary between the volcanic breccia and the Hawkesbury Sandstone. The location of this boundary has been assessed based on field mapping along creek lines and of surface exposures as shown on Figure 3 undertaken by Coffey & Partners and on the rock material penetrated by Coffey & Partners' boreholes and test pits, and Golder Associates boreholes (G1 to G3) The top of the breccia was intersected by BH3, BH4 and BH6 of this investigation and was penetrated by boreholes G1, G2 and G3 of Golder Associates' investigation of August 1982.

Limited geological mapping of the joints and bedding was also carried out on the exposed rock faces within the quarry.

4.2 Structure

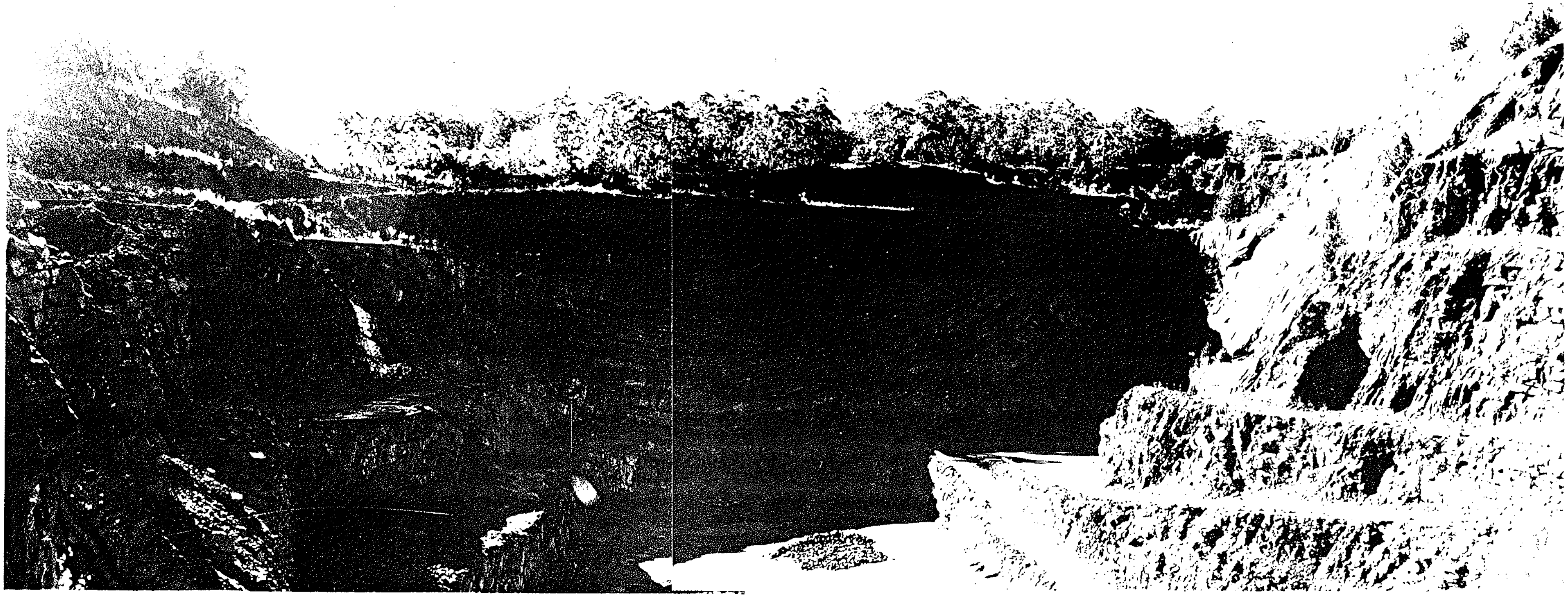
While no mapping of the Hawkesbury Sandstone exposures in the east of Old Man's Valley was undertaken, the Hawkesbury Sandstone typically comprises near horizontal beds of sandstone to about 4m thick which may be internally cross bedded at angles ranging from about 5° to 30° to the horizontal. Joints within the Hawkesbury Sandstone are typically subvertical, with the main joint sets striking NNE-SSW and WNW-ESE.

Exposures of the Hornsby Diatreme in Hornsby Quarry indicate a basinal layering of the diatreme. This basinal layering is particularly well defined in the eastern face of the quarry (see Photographs 5a and 5b). According to Crawford et al (Ref. 1) "although the original crater deposits probably had a slight centroclinal dip, the exaggerated basinal structure observed here is probably due to peripheral drag as the volcanic breccia subsided within the surrounding ring fault".

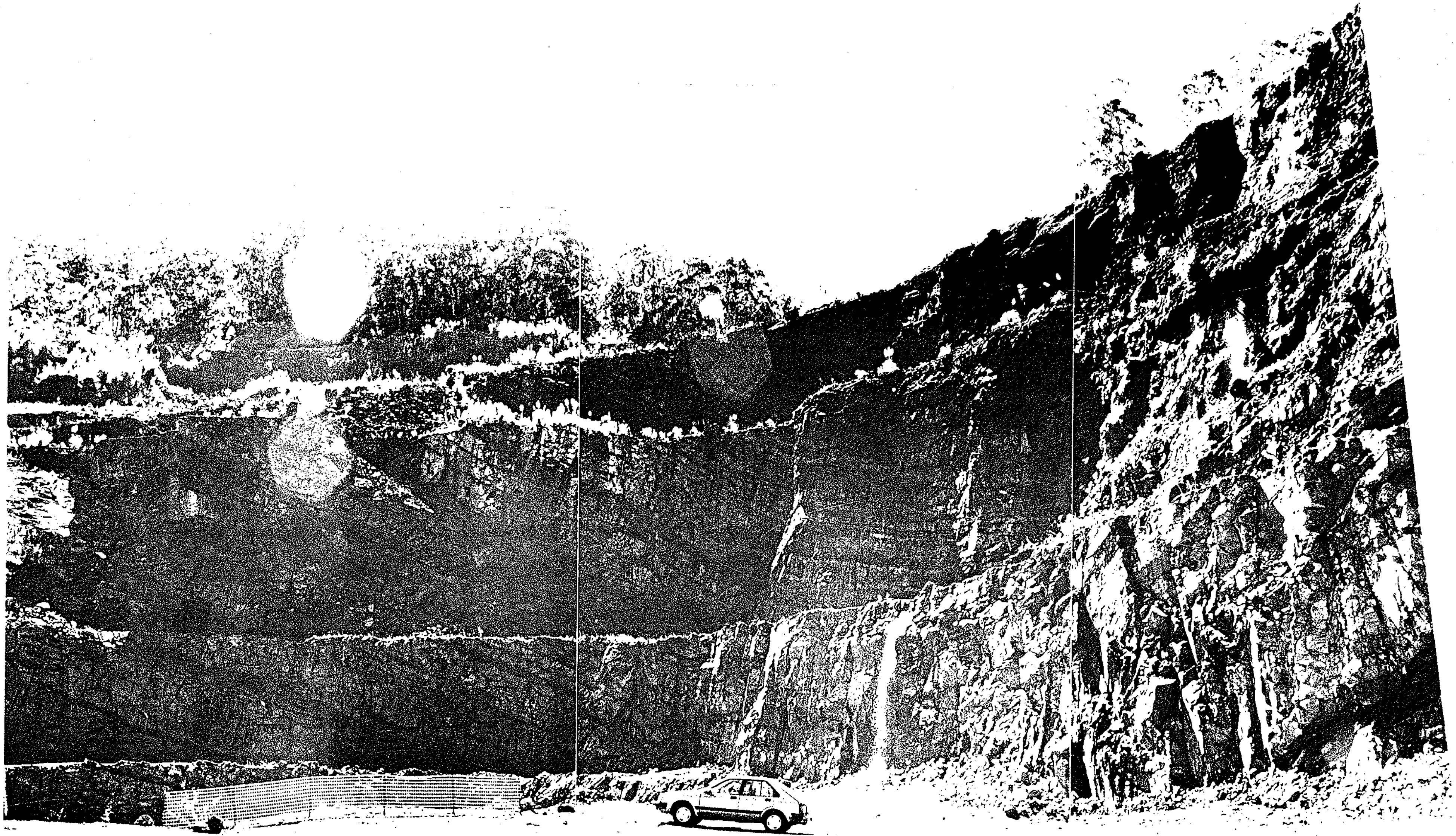
The bedding planes form weaknesses within the rock seam as evidenced by a number of slides around the quarry (Photograph 6). The largest of these is on the south eastern side of the quarry while there are other smaller ones on the northern side. The orientation of the bedding is therefore important to the stability of the eastern quarry face beneath the proposed filling.

Results of the mapping of bedding planes of the diatreme exposed in the quarry are summarised in Figure 4. The mapping indicates that the dip of the bedding planes in the quarry ranges from less than 10° and up to 75o. Over the northern half of the quarry face, beds generally dip towards the south east quadrant while over the southern half, beds generally dip towards the north east quadrant. Most bedding was observed to be dipping into the eastern face of the quarry, indicating that the centre of the basinal structure or the pipe structure probably lies east of the current quarry. Extrapolation of the measured bedding dip directions suggests that the centre of the basinal structure is situated east of the existing quarry behind the present eastern face of the quarry. The general lack of clear bedding structures in Golder's hole G2 and in Coffey & Partners' hole BH6 is consistent with this assessment of the structure.

A limited survey was conducted of major joints exposed in the eastern face of the quarry on the existing benches at the approximate levels of RL 90m and RL 68m, termed benches 1 and 2 respectively. Only joints with a continuity of greater than 1m were considered.



PHOTOGRAPH 5a - Well developed basinal layering in eastern face of Hornsby Quarry.



PHOTOGRAPH 5b - View of north east corner of pit - note bedding dipping into east face.

PHOTOGRAPH 6 - Bedding plane exposed by slide
on south east corner of pit.

Results of the joint survey on benches 1 and 2, individually and combined, are presented on stereonets in Figure 10. The plot for bench 1 indicates that the dominant joint set strikes north-south and is sub-vertical or dips steeply to the west; the minor joint set strikes east-west and dips steeply to north and south, typically to the north. There is also a possible subordinate set striking north-west/south-east and dipping steeply to the south-west, although this may be part of the dominant joint set. Similarly, the plot for bench 2 has the north-south and east-west joints encountered in bench 1.

The combined plot indicates the presence of two main joint sets. Joint set 1, the dominant joint set, strikes north-south (mean strike $001^{\circ}/181^{\circ}$) and dips steeply (mean dip 86°) to the west. Joint set 2, a subordinate set, strikes east-west (mean strike $088^{\circ}/268^{\circ}$) and dips steeply (mean dip 77°) to the north and south, typically to the south.

The orientation of joint set 1 appears to correlate with the orientation used by Golder Associates in their report Slope Stability Study, Eastern Face Hornsby Quarry dated August 1982. Observations of the lower benches at the eastern quarry face indicate similar joint orientations to those outlined above. Observations of joint set 1 indicated a spacing between joints typically ranging from 0.6m to 2m.

It should be noted that many low angle joints were intersected in the volcanic breccia in both Coffey & Partners boreholes and Golder Associates boreholes. These did not appear to be well developed in the quarry face. They may have been masked by bedding planes and rock fractures or the structure of the rock mass behind the quarry face may be different to that exposed.

The boundary between the volcanic breccia of the diatreme and the surrounding Hawkesbury Sandstone was not located during the investigation. Hence, the steepness of the junction is uncertain. However, Crawford et al (Reference 1) has indicated that this boundary in other diatremes of the Sydney Basin is commonly characterised by steep sandstone walls.

5.0 DISCUSSION OF SLOPE STABILITY ABOVE QUARRY LEVEL AT SOUTH END

The section chosen for analysis is that at Ch 215m where the creek most closely approaches the toe. The section at Ch 190m is not very different.

As noted in Section 3.2, there is uncertainty regarding the groundwater conditions in this area because of the discrepancy in water levels at BH7 and BH8. Accordingly, two situations have been analysed:

* A continuous groundwater system following the original ground surface to the toe of the fill and then dropping to the creek.

* A dual system with groundwater in the fill and residual/extremely weathered breccia at the old ground surface level down to the toe of the fill, and with groundwater in the underlying highly weathered breccia at a lower level as indicated in BH8.

The results are given in Table 3 and plots of selected analyses are shown in Appendix C. These analyses indicate that the existing factors of safety calculated for the lower quartile strength values are in the range 1.1 to 1.3. If the additional fill was added these values reduce to 1.07 to 1.2. The present factors of safety for failures to the top of the creek bank are about 1.1 to 1.2. It should be noted that the factors of safety are very sensitive to soil parameters and that the test results show a large scatter - a 5° increase in friction angle in the highly weathered breccia increases the factor of safety by about 0.3. Analyses of flatter slopes indicated that the fill would have to be flattened to a 1 in 3 slope to give a factor of safety of 1.5.

It must be concluded that, based on the work to date, the present condition does not have the margin of safety commonly accepted for engineering structures and that the addition of further fill at the top of the batter should not occur without stabilisation measures. These issues are discussed further in the Conclusions.

Table 3
Results of Stability Analyses at Ch 215m

Case	Configuration	Groundwater	Weathered Breccia		Fill(New)		Factor of Safety
			C'	Ø'	C'	Ø'	
South 1	To RL140.85m	Single	40	20	25	25	1.07
1A			25	25	25	25	1.07
South 2	Existing	Single	40	20	-	-	1.11
2A			25	25	-	-	1.07
South 3	To RL140.85m	Dual	40	20	25	25	1.20
3A			25	25	25	25	1.26
South 4	Existing	Dual	40	20	-	-	1.32
			Failure in EW/Residual only				1.14
			Failure in Residual only				1.21
4A	Existing	Dual	25	25	-	-	1.36
South 8	Fill flattened to 3:1	Dual	40	20	-	-	1.50

6.0 DISCUSSION OF SLOPE STABILITY AT NORTHERN END

6.1 Results at Ch 350

Several sections have been analysed. The highest is at Ch 350m and results are summarised in Table 3 and plots of selected analyses are given in Appendix C. The proposed slopes show factors of safety of about 1.25 for fill placed directly over the alluvium. A series of analyses was undertaken for various alternative slopes, as shown in Figure 11, using both circular and non-circular analyses. For most of the circular analyses, a fresh rock level was not specified. Experience has shown that although this results in deep failure surfaces which, in reality, would encounter the rock, the factors of safety are reasonably accurate and can usually be matched by non-circular surfaces which follow the top of the actual rock surface.

Non-circular analyses are time consuming because it is not possible to undertake fully automatic searches for the worst failure surface (a typical slip circle analysis will involve several hundred trials). Nevertheless, some non-circular analyses have been done and these, too, are shown in Figure 11. They show values about 0.1 higher than the corresponding slip circles and if more analyses were done it is expected that this difference would reduce.

The analyses used $C' = 0$ and $\phi' = 30^{o}$ for the alluvium. Replacement of this material near the toe with a layered drain would not substantially improve these strengths and hence the analyses can be taken as applying to the case where the drain is constructed as described later. The water levels used in all analyses assume that the drainage measures described later are implemented and are successful.

Based on the analyses an overall slope of about 2.75:1 is required for a factor of safety of 1.5 at Ch 350m.

Table 4
Summary of Analyses at Ch 350m*

Case	Slope	Analysis Type	Comment	Fill	Factor of Safety
1	1.75:1	Circular	-	Shale	1.24
1A				Sandstone	1.28
2	2.25:1	Circular	-	Shale	1.31
2A				Sandstone	1.34
3	2.50:1	Circular	-	Shale	1.40
4	2.75:1	Circular	-	Shale	1.42
5	3:1	Circular	-	Shale	1.47
5A	3:1	Circular	-	Sandstone	1.49
6	3:1	Non-Circular	-	Shale	1.60
3R	2.50:1	Circular	With rock at RL 90.0m	Shale	1.48
3L	2.78:1	Non-Circular	-	Shale	1.50

NOTE: All analyses assume drainage measures implemented and successful

6.2 Results at Ch 310m

At this section the existing fill is about 20m back from the creek, with a residual breccia slope between. The data suggests a greater depth of weathering than at Ch 350 (Figure 6). Because of the unknown quality of the fill, a groundwater level at the fill and residual soil surface has been assumed.

A summary of the stability analyses is given in Table 5 and plots of selected analyses are given in Appendix C. A plot of factor of safety versus slope is shown in Figure 12.

The results indicate that the proposed slope is not sufficiently stable and that flattening of the fill slope to 1 in 3 is required to provide a factor of safety of 1.5.

An alternative arrangement using a 1.75:1 slope to a 15m wide berm to RL 115m at the toe was also analysed. With this berm a slope above the berm of 3:1 to RL 139m gave a factor of safety of 1.5.

Reducing the upper level of the fill to RL 130m increases the factor of safety by about 0.05.

Table 5
Summary of Analyses at Ch 310m

Case	Configuration	Fill	Factor of Safety
C310A	2:1 Slope (no rock)	Shale	1.16
B	2:1 Slope (no rock)	Sandstone	1.07
C310A1	2.5:1 Slope (no rock)	Shale	1.26
B1	2.5:1 Slope (no rock)	Sandstone	1.18
C1	2.5:1 Slope (rock at RL91.5m)	Shale	1.30
C310A2	2.75:1 Slope (no rock)	Shale	1.32
B2	2.75:1 Slope (no rock)	Sandstone	1.24
C2	2.75:1 Slope (rock at RL92.0m)	Shale	1.37
C310A3	3:1 Slope (no rock)	Shale	1.37
B3	3:1 Slope (no rock)	Sandstone	1.29

Table 5 (cont)
Summary of Analyses at Ch 310m

Case	Configuration	Fill	Factor of Safety
C310A4	3.5:1 Slope (no rock)	Shale	1.47
B4	3.5:1 Slope (no rock)	Sandstone	1.38
C4	3.5:1 Slope (rock at RL91.0m)	Shale	1.57
C310A5	3.75:1 Slope (no rock)	Shale	1.54
B5	3.75:1 Slope (no rock)	Sandstone	1.45
C5	3.75:1 Slope (rock at RL91.0m)	Shale	1.71
C310C6	2.5:1 Slope (rock at RL91.0m)	Shale	1.35
C7	3.0:1 Slope (rock at RL91.0m)	Shale	1.48
C8	3.25:1 Slope (rock at RL91.0m)	Shale	1.55
C310C9	1.75:1 Slope to RL115m (rock at RL91.0m)	Shale	1.53
C9A	2:1 Slope to RL115m (rock at RL91.0m)	Shale	1.69
C310C10	1.75 slope to RL115 then 3.5:1 to RL139 (rock at RL91.0m)	Shale	1.60
C10A	As C10 but 2:1 slope	Shale	1.35
C10B	As C310A4 but to RL130m	Shale	1.52

6.3 Stability North of Ch 350m

In this area the designed toe is on the sloping breccia slope. No analyses have been done. However, flattening of the slope will be necessary and this could be done by extending the toe down to the alluvial flat below.

7.0 STABILITY OF QUARRY SLOPE

The toe of the fill will come within 50m of the top of the present position of the eastern face of the quarry and would be within 25m of the final development profile for the eastern face at Ch 350m. The critical section for the interaction of the proposed filling and the quarry face appears to be the section of the face north of about Ch 270m.

The structure of the volcanic breccia rock mass behind the eastern face was investigated by Golders in their report of August 1982 in which two fully cored boreholes were drilled to depths of about 50m (refer Cross Section Ch 270m). This information has been supplemented by limited mapping of the quarry face as described in Section 4.0 above. However, the rock mass structure is not well defined other than in the very general sense that the vent plug appears to be behind the eastern face and bedding dips towards it. The structure in detail appears to be quite complex and is difficult to assess without a major rock mechanics study.

The eastern quarry face appears to be well drained in that no significant areas of groundwater seepage were observed following the recent period of consistent rainfall. Apart from this observation and the report of water loss below 42m in Golder borehole G2 there is no factual information on water conditions behind the eastern face.

The Golder report of August 1982 concludes "... the eastern quarry face is therefore considered to remain stable at the slopes, and to the depth, proposed for further development of the quarry". This conclusion is consistent with observations made as part of this study. However, it is not possible to assess stability of the eastern face in a quantitative manner due to the lack of structural data on the rock mass behind the face.

The proposed filling is unlikely to significantly load the quarry face as it now stands, nor is it likely to adversely affect groundwater conditions behind the face. On this basis Golder's conclusion appears reasonable for the quarry face as it now stands. However, if further excavation of the eastern face or significant blasting near the eastern face is to occur then it is recommended that a major rock mechanics study be undertaken to allow a quantitative assessment of face stability before any such activity is allowed to proceed.

8.0 DRAINAGE MEASURES AND CONSTRUCTION PROVISIONS

8.1 Surface Drainage

Stability of the proposed fill is critically dependent on the provision of surface and subsurface drainage measures.

The surface drainage must prevent ponding of surface water and encourage rapid runoff so as to minimise infiltration of water into the fill. Drainage at the rear (eastern) side of the site is inadequate in its present form and must be modified to divert surface water into the drain system. It will, as a minimum, be necessary to provide a concrete cutoff wall to rock across the lowest section to divert the water which now enters the fill and, in the same location, to provide a lined drain to carry concentrated flows direct to the main drain. In addition, all entrances must be substantially upgraded and provided with measures to prevent blockage.

8.2 Subsurface Drainage - Southern End

In the area above the existing playing field there are stormwater drainage pipes which must be checked to see if they can sustain the additional loading and if not they must be modified to take the load or removed and other provisions made for surface drainage.

A subsoil drainage blanket should be provided at the base of the existing sandstone cuttings over the length of the cuttings where fill is to be placed against them. These drains should be 4m wide by 0.3m deep and consist of drainage gravel (see specification below). If desired, the shape in cross section may be modified but the cross section area should remain the same. For protection, these should be filled over to a depth of 0.5m by sandy clay or gravelly sand fill as obtained from the adjacent quarry for previous fill at the site. These subsoil drains should be positively drained into the overall drainage system.

In areas where the sandstone cutting shows weathering or fracturing, vertical drainage wicks should be placed and joined into the horizontal drains. Wick drains should be Mebra wick drain 7007 or similar, fastened to the rock face. Alternatively, sand could be placed against the face.

In the area to the south of the existing fill, stripping of the existing slope will produce a series of benches. Subsoil drains of at least 0.5m x 0.5m should be placed at the base of each bench slope, draining out to beyond the fill. A drain should also be placed along the existing southern fill toe. If the base of each slope is in rock the drainage gravel may be placed directly on it and filter cloth laid over the gravel, otherwise the filter cloth should encompass the gravel.

Provision of drainage at the toe of the existing west facing fill slope beneath the present playing field will be dependent on other action taken in this area.

8.3 Subsurface Drainage - Northern End

Figure 13 shows a tentative layout for subsurface drainage at the northern end. A large filter cloth protected gravel drain is proposed down the present central depression, extending down to the present edge of filling. Because of the high measured flows at this location, a higher capacity drain is required downstream of this point and a rockfill drainage layer protected by conventional two stage filters is proposed. Prior to placement of this drain the area should be stripped of all alluvium, residual soil and extremely weathered breccia. Dewatering of this excavation will be necessary and, depending on the nature of exposed rock, it may be necessary to slush grout the surface, both to inhibit softening and to minimise seepage into the underlying rock.

Other feeder drains are proposed plus separate drains along the existing road and at the toe of the underlying slope.

It will be essential to include subsoil drainage with any extension to the northern surface water drainage pipe.

Headwalls and pipe outlets are recommended to facilitate clearing of the outlets.

Depending on details of the amended fill design it may prove necessary to modify the drainage details given in Figure 13 and this drawing must be considered as indicative only.

At the exits of the main drains a perforated pipe should be placed back into the drain for 5m and an outlet structure should be built at the end of the drain. These structures are to facilitate cleaning to prevent blocking of the outlets.

As a further measure, the final 1m of fill is to be clay fill compacted to 100% of standard compaction. The purpose of this is to provide a relatively impermeable seal to the top of the fill. If services are planned which might penetrate this later the layer should be deepened.

8.4 Filter Cloth and Drainage Gravel

It is recommended that a non-woven needle punched geotextile be used as the filter cloth, such as BIDIM U14 or similar. Where the base for the drain is uneven a sand layer should be used to provide an even bed for the fabric.

Drainage gravel should consist of durable 20mm stone satisfying the requirements for concrete aggregate. It should contain no more than 2% by weight finer than 5mm. Sand bed material must have less than 5% passing 75 microns.

Graded filter drain material for use in the alluvial area should be of similar quality and to the grading shown in Figure 14. The rock component of the drain may be sandstone provided it is checked and found to be sufficiently durable. Not all sandstone will satisfy this requirement, even when fresh.

If desired, graded filters may be used elsewhere to replace filter cloth.

8.5 Staging and Construction

Prior to placement of fill on the natural surface, all vegetation and topsoil should be removed and the surface graded to an even slope.

The fill should be placed in layers and compacted to a minimum density ratio of 95% by standard compaction. The stability calculations assume the strength of either ripped sandstone or clay/shale fill compacted to this density, and failure to maintain this minimum standard will endanger stability. For the same reason, other forms of fill should not be used without further consultation. Density tests to check fill compaction should be undertaken in accordance with the publication "Guidelines for the Specification and Testing of Earthworks" prepared by a sub-committee of the Australian Geomechanics Society. In addition, periodic effective strength tests should be done on the actual fill used to check design assumptions.

The staging of construction must be managed such that:

(1) Surface water is diverted around and away from the fill and the subsurface drains.

(b) The disposition of more permeable (e.g. sandstone) and less permeable (e.g. clay) fill must be organised so that water cannot build up within the permeable material. In particular, the placement of more permeable fill behind (i.e. further from the toe) impermeable fill must be avoided. If necessary, additional subsurface drainage should be provided to positively drain permeable zones in the fill.

The main central drain should be constructed prior to filling and be covered by 1m of fill to protect it from erosion.

The herringbone drains should be joined into the main drains and constructed ahead of filling in sections.

Monitoring of groundwater levels and flows from drains should be undertaken on a regular basis.

9.0 CONCLUSIONS

9.1 General

It must be recognised that the placement of fill over natural watercourses above the edge of an operating quarry is an inherently difficult and potentially dangerous undertaking.

Control of surface and subsurface drainage and close attention to fill quality will be essential and must be greatly improved from the present situation.

If ever the drainage systems become inoperative, for example by blocking of drains above the slope, the potential exists for a Coledale style flow slide to develop, and hence ongoing maintenance is essential.

The original proposal does not have an adequate margin of safety against failure. Some suggestions for alternatives are provided for consideration.

9.2 Southern End

The difficulties at this end occur because of poor drainage near the toe of the existing fill and proximity of the steep slope to the creek.

The possibilities for improving drainage at the toe are limited but could consist of placement of a toe drain by excavating in sections. These measures alone would not, however, prove sufficient and consideration must be given to either:

(1) Piping the creek and providing a toe buttress. Subsurface drainage along the creek would be necessary and the pipe would have to be designed very conservatively since overflow could result in scouring of a path to the quarry. The additional fill would add weight to the top of the quarry slope and further studies of this effect would be necessary.

(2) Flattening the existing batter and improving toe drainage.

It is recommended that placement of fill in this southern end be limited to the following until remedial measures are taken:

(a) Placement of fill to the south of the existing fill. The verbal recommendations given for that area should be implemented as noted in Section 8.2.

(b) At the rear of the present playing field not closer than 60m from the present crest. The drainage measures of Section 8.2 must be implemented prior to fill placement.

Additional boreholes should be drilled and piezometers installed to check whether the poor drainage conditions extend all along the toe and whether there is a dual or single groundwater system. Additional strength tests should also be carried out on fill, residual soil and highly weathered rock samples to check the applicability of the values obtained from samples further north. A proposal for this work is given in Appendix D.

9.3 Northern End

The analyses indicate that substantially flatter slopes are required and hence the fill configuration will have to be modified. Preferred configurations should be developed using the guidelines given in Section 6 and further advice sought concerning the stability of the new proposals.

A key issue is the depth of weathering, the actual groundwater regime, and the strength and permeability of the existing fill. Further investigations should be undertaken, including test pits, boreholes, installation of standpipes and additional laboratory testing. A proposal for this work is given in Appendix D.

The drainage measures shown are indicative only. However, the works above the fill at the base of the sandstone slope should be implemented immediately.

9.4 Quarry Face

On the basis of information available, Golder Associates' conclusion appears reasonable. In view of the possible ramifications if the quarry were to be extended, consideration should be given to implementing a rock mechanics study in conjunction with other work. A proposal for this work is given in Appendix E.

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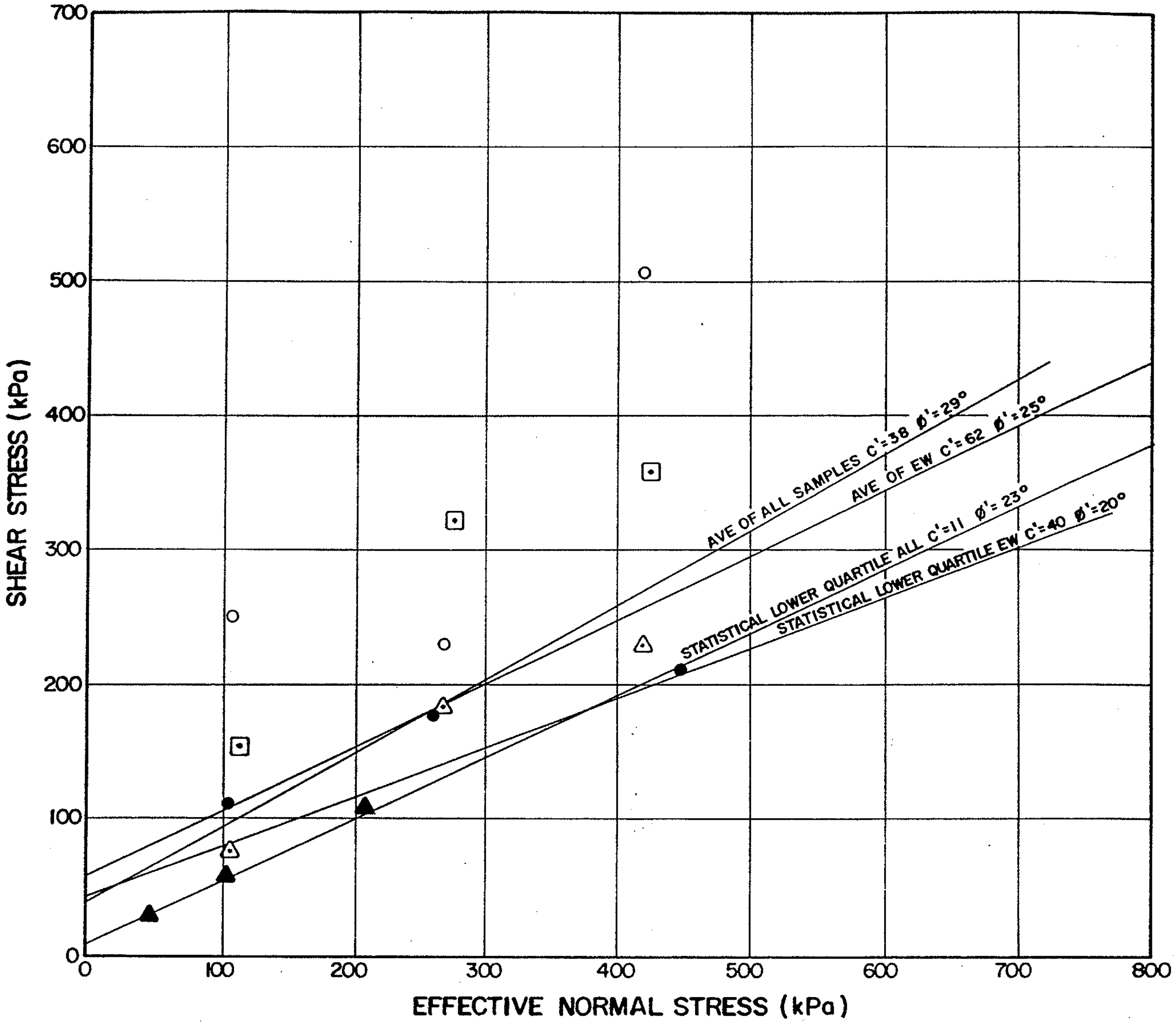
REFERENCES

1. Crawford et al "Diatremes of the Sydney Basin in A Guide to the Sydney Basin", Geological Survey of NSW Bulletin No. 26, 1980



LEGEND		WET DENSITY t/m³
○	TP1 AT 0·4m	1·99
△	0·8m	1·83
⊡	0·9m	1·88
●	TP3 AT 1·3m	1·92
▲	BH6 AT 1·5-1·58m	2·09

AVE WET DENSITY 1·96 t/m³

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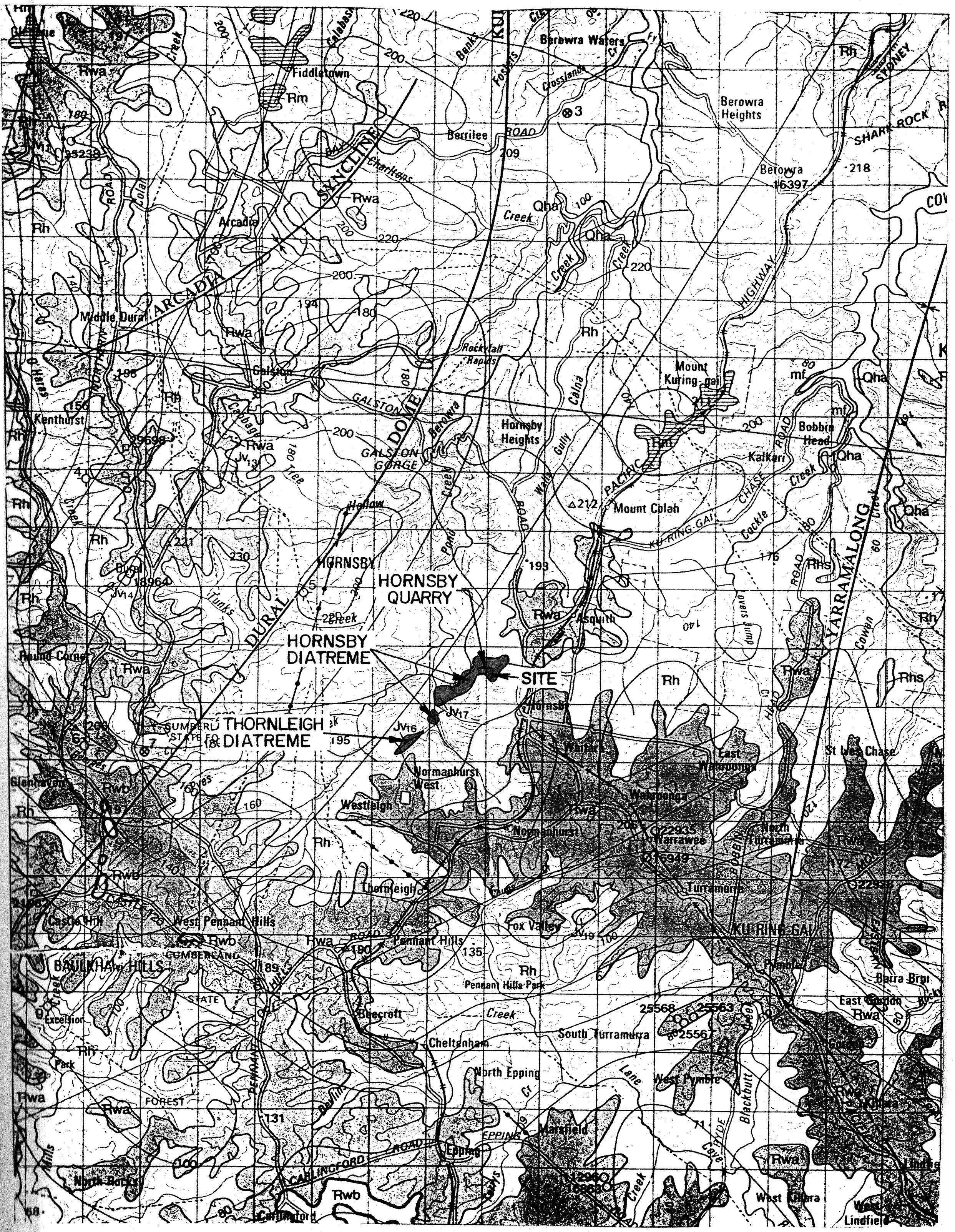
drawn	CPT/SW
approved	AS
date	11/7/89
scale	

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
SHEAR TEST SUMMARY

COFFEY

FIGURE 8

job no: S8463/2



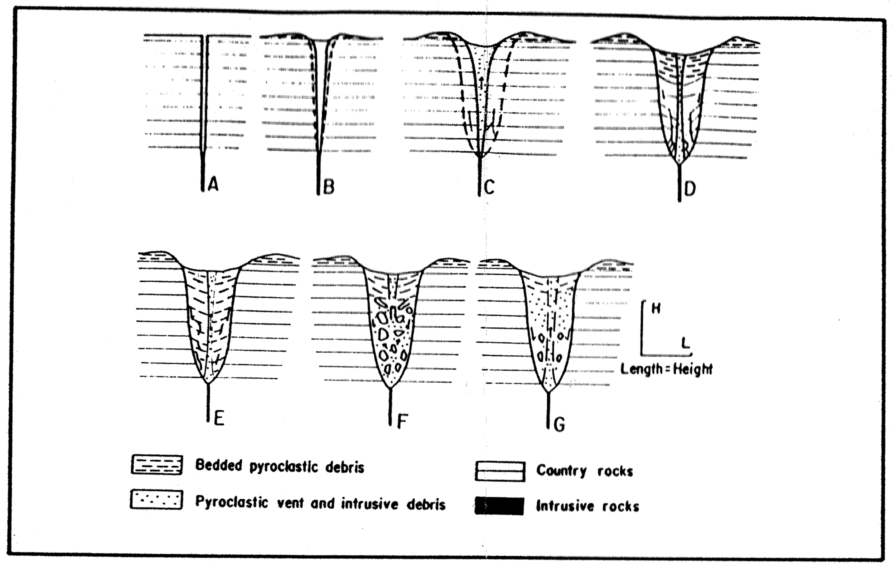
▨ Rh HAWKESBURY SANDSTONE

▩ WIANAMATTA GROUP

● Jv VOLCANIC BRECCIA-DIATREME

SCALE 1:100000

FIGURE 9a



Stages of development of maar-diatreme volcanoes.

A. Magma rises along a fissure, contacts water, and initiates phreatomagmatic eruptions.

B. The fissure is enlarged through spalling and slumping of wall-rocks. At the surface a rim of bedded pyroclastic debris forms.

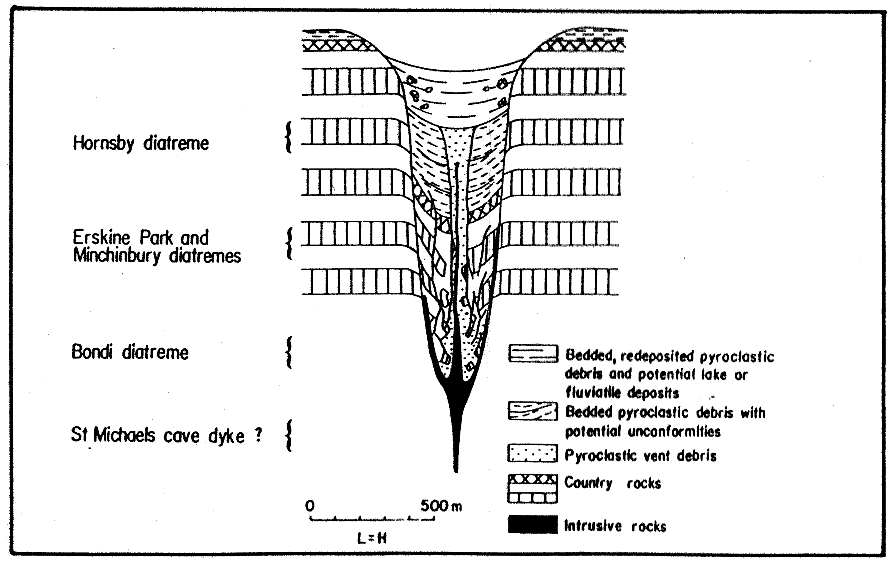
C. Instability of the walls of the increasingly large eruption channel causes large-scale spalling and a ring-fault forms.

D. The wallrocks enclosed by the ring-fault and the overlying bedded pyroclastic debris subside, in part being faulted and fractured.

E. Stage D may proceed to E, subsidence continues as a consequence of prolonged activity, and the subsiding country-rocks become largely eliminated through incorporation into the ejecta.

F. Stage D may proceed to F, tuffisite intrudes the faulted and fractured subsided country-rocks as well as overlying tuffs and in part replaces the country-rocks. Bedding of pyroclastic rocks is largely lost.

G. Stages E and F may proceed to G, continual activity leads to further subsidence of the pyroclastic debris and remnants of country-rocks, and a zoned diatreme forms. Figure and text from Lorenz (1975).



Features in the well-exposed Sydney Basin diatremes can be tentatively correlated with particular levels in the diatreme model of Lorenz (1975). Diagram adapted from Lorenz (1975).

FIGURE 9b

FROM "DIATREMES OF THE SYDNEY BASIN."
CRAWFORD ET. AL, IN "A GUIDE TO THE
SYDNEY BASIN." GEOLOGY SURVEY OF
N.S.W. BULLETIN No26.

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Incorporated in Queensland

scale (metres)

revision	description	drawn	approved	date

drawn AS/SW
checked AS.
date 16/6/89

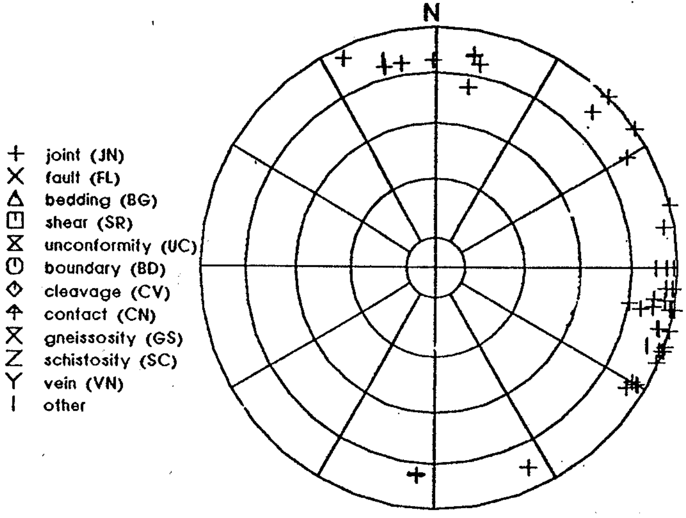
HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
REGIONAL GEOLOGY &
STAGES IN FORMATION OF DIATREME

COFFEY

FIGURE 9

job no S8463/2

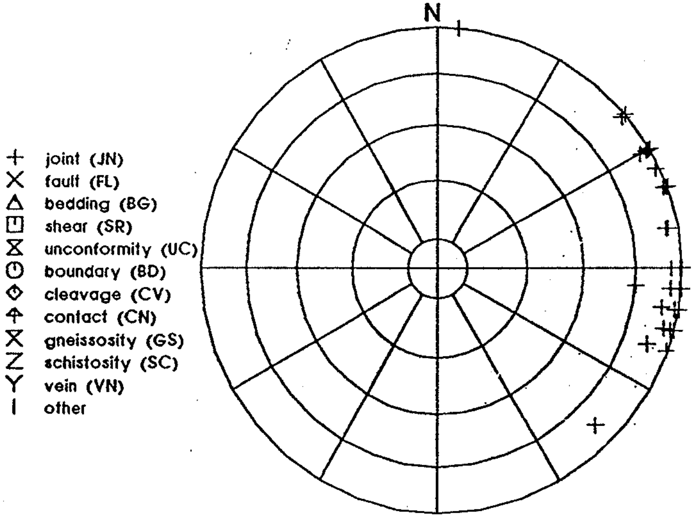
polar equal-area stereograph



BENCH 1

54 JOINTS

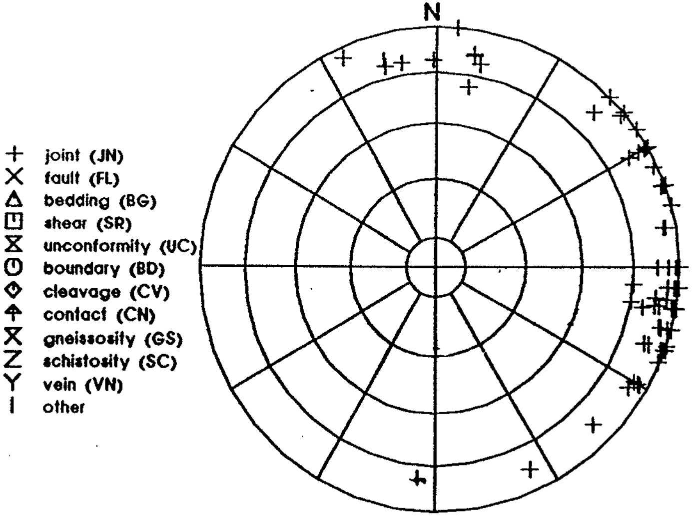
polar equal-area stereograph



BENCH 2

41 JOINTS

polar equal-area stereograph



BENCH 1 & 2 COMBINED

95 JOINTS

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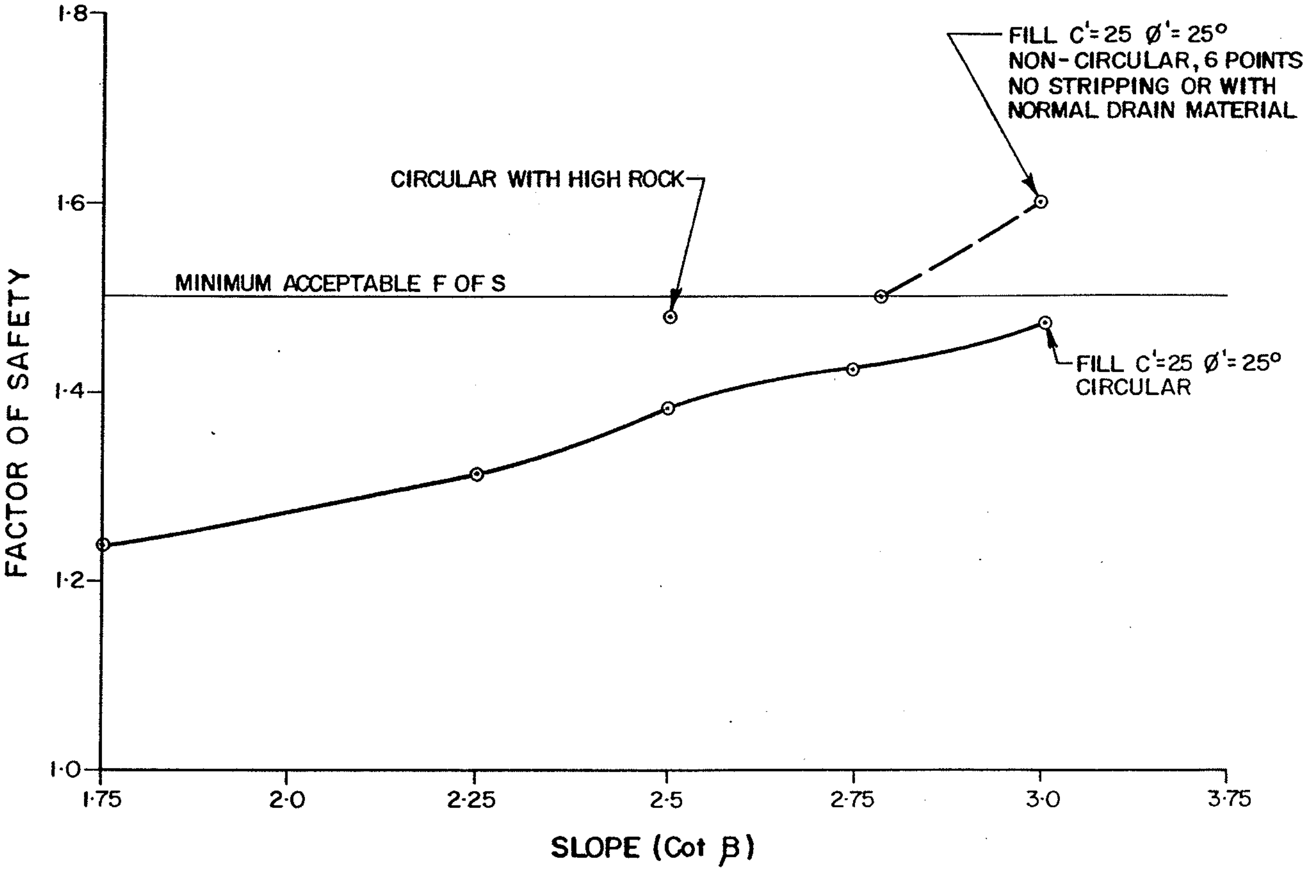
drawn AS/SW
approved AS
date 16/6/89
scale NTS

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
JOINT SURVEY
HORNSBY QUARRY EASTERN FACE

COFFEY

FIGURE 10

job no: S8463/2



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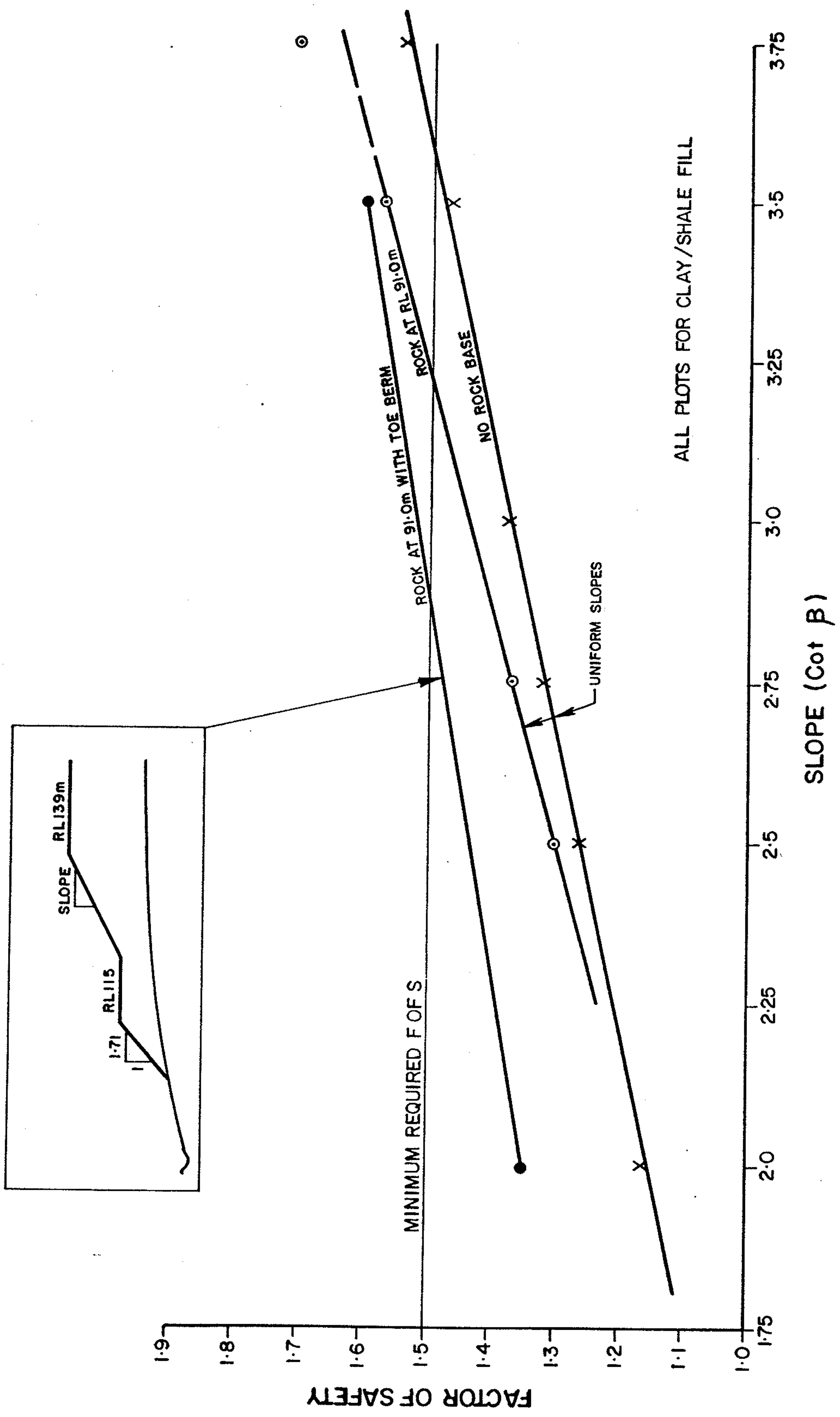
drawn	CPT/SW	HORNSBY SHIRE COUNCIL OLD MAN'S VALLEY CH350- SUMMARY OF STABILITY ANALYSES	FIGURE 11
approved	AS		
date	11/7/89		job no: S8463/2
scale			



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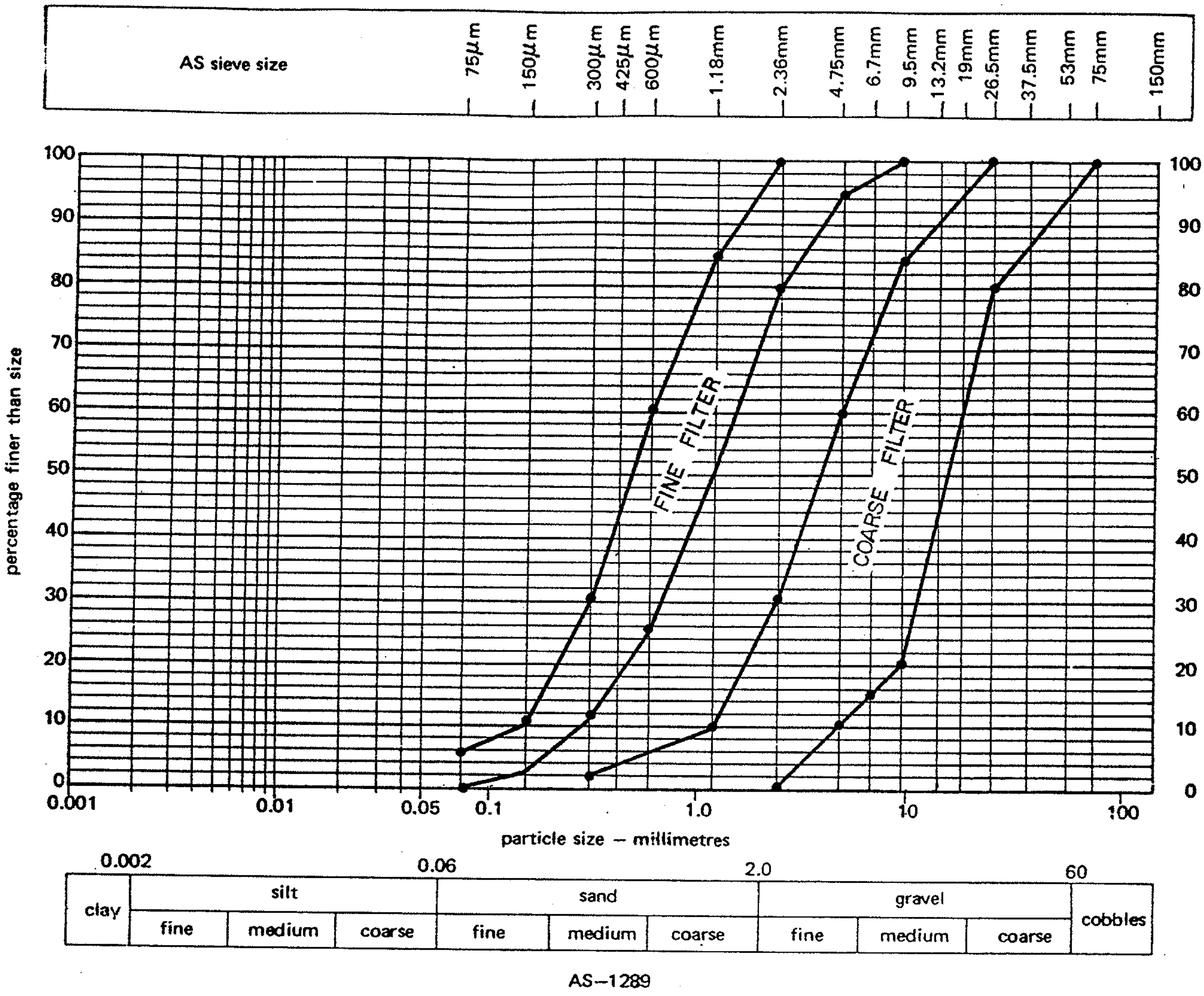
approved	AS
date	11/7/89
scale	

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
CH310-RESULTS OF STABILITY ANALYSES

COFFEY

FIGURE 12

job no: S8463/2



Graded filters shall conform to the requirements for concrete aggregate AS2758.1 except that grading shall be as shown above.

Rockfill shall have not more than 10% by weight finer than 19mm and maximum particle size of 300mm.

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drawn	CPT/SW
approved	AS
date	11/7/89
scale	

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
GRADED FILTERS

COFFEY

FIGURE 14

job no S8463/2

Coffey & Partners Pty. Ltd
Incorporated in Queensland.

engineering log - borehole

COFFEY

borehole no: **BH1**
sheet 1 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	30.1.89
principal:		hole completed:	30.1.89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Approx 131.0 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetrometer kPa 100 200 300 400	structure and additional observations
ADT		NIL					▨	SP	FILL: SAND fine to coarse grained yellow - brown	M			with some GRAVEL
							▨	SC	FILL: SAND fine to coarse grained yellow - brown CLAY medium plasticity				becoming gravelly with depth
				7 , 7 ,6 N*= 13		1	▨						
				6 , 14,26 N*=40		2	▨						
							▨	GW	GRAVEL fine to coarse grained brown to grey SAND, fine to coarse CLAY, medium plasticity				FILL
R		C.				3	▨						
						4	▨						
						5	▨		BRECCIA boulder cored through approx 0.9m diameter				
R						6	▨	SC	CLAYEY SAND: fine to coarse grained yellow - brown to brown CLAY, low to medium plasticity	>Wp			RESIDUAL ?
						7			Coring Commenced at 6.15m				
						8							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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T87-230

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COFFEY

engineering log - cored borehole

borehole no: **BH1**
sheet 2 of 3

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 30-1-89
hole completed: 30-1-89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000 - TRUCK
barrel type and length: NMLC 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: Approx 131.0 m
datum: AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
			131								
				1							
				2							
				3							
				4							
				5							
				6							
NMLC					⁙	SANDSTONE: fine to medium grained, orange, - brown, indistinct bedding,	HW				JT, 70deg, planar, rough 6.20-6.40
					⁙						JT, 70deg, planar, rough 6.73-6.90
				7	⁙	SANDSTONE: fine to medium grained, grey indistinct bedding 5-10% dark grey, organic material in flakes <1mm thick			D 0.50		
				8							

General Defect Description:

METHOD	
AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	core drilling
NQ,HQ	core drilling
⊔	casing used
	barrel withdrawn

▽	water level
▷	water inflow
*	not measured Drilling Water
◁	partial loss
◀	complete loss

POINT LOAD TEST
D -diametral
A -axial

GRAPHIC LOG/CORE LOSS

⁙	core recovered (hatching indicates material)
☐	no core recovered

WEATHERING	
FR	-fresh
SW	-slightly
MW	-moderately
HW	-highly
EW	-extremely

STRENGTH	
EL	-extremely low
VL	-very low
L	-low
M	-medium
H	-high
VH	-very high
EH	-extremely high

DEFECTS	
JT	-joint
PT	-parting
SM	-seam
CL	-clay
RO	-rough
DC	-decomposed
PL	-planar
IR	-irregular

T87-229

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COFFEY

engineering log - cored borehole

borehole no: **BH1**
sheet 3 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	30-1-89
principal:		hole completed:	30-1-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting: EDSON 3000 - TRUCK
barrel type and length: NMLC 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: Approx 131.0 m
datum: AHD

drilling information | **rock substance** | **rock mass defects**

method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
NMLC					⁙	**SANDSTONE:** fine to medium grained, grey indistinct bedding 5-10% dark grey, organic material in flakes <1mm thick			D 0.30		
						Borehole BH1 Terminated at	8.60	m			
				9							
				10							
				11							
				12							
				13							
				14							
				15							
				16							

General Defect Description:

METHOD

AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	core drilling
NQ,HQ	core drilling
⊟	casing used
	barrel withdrawn

▽	water level
▷	water inflow
*	not measured Drilling Water
◁	partial loss
◀	complete loss

POINT LOAD TEST

D -diametral
A -axial

GRAPHIC LOG/CORE LOSS

⁙	core recovered (hatching indicates material)
☐	no core recovered

WEATHERING

FR	-fresh
SW	-slightly
MW	-moderately
HW	-highly
EW	-extremely

STRENGTH

EL	-extremely low
VL	-very low
L	-low
M	-medium
H	-high
VH	-very high
EH	-extremely high

DEFECTS

JT	-joint
PT	-parting
SM	-seam
CL	-clay
RO	-rough
DC	-decomposed
PL	-planar
IR	-irregular

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COFFEY

engineering log - borehole

borehole no:	BH2
sheet	1 of 3
office job no:	S8463/2
client:	HORNSBY SHIRE COUNCIL
principal:	
project:	OLD MANS VALLEY
borehole location:	SEE FIGURE 1
hole commenced:	30-1-89
hole completed:	30-1-89
logged by:	SRM
checked by:	AS
drill model and mounting:	EDSON 3000 - TRUCK
hole diameter:	100mm
slope:	-90 DEG
bearing:	
R.L.Surface:	Approx 131.2 m
datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		NIL						GW	FILL: GRAVEL fine to coarse grained brown Sand fine to coarse CLAY low to medium plasticity	M			FILL
						1							
				15 , 20 , 10 N*=30				GC	FILL: GRAVEL Fine to coarse grained CLAY medium to high plasticity	<Wp			FILL
						2							
				6 , 5 , 10 N*= 15									
						3							
				12 , 14 , 9 N*=23									
						4							
						5							
R		C											
				6 , 13 , 2 N*=34		6							
			◁										
						7							
								SC	CLAYEY SAND: fine to coarse grained orange - brown to grey CLAY medium to high plasticity				Extremely weathered sandstone
						8							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - borehole

borehole no: **BH2**
sheet 2 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	30-1-89
principal:		hole completed:	30-1-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Approx 131.2 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetro-meter kPa 100 200 300 400	structure and additional observations
R						9 10	▨	SC	CLAYEY SAND: fine to coarse grained orange - brown to grey CLAY medium to high plasticity	<Wp			Extremely weathered sandstone
						11 12 13 14 15 16			COMMENCED CORING AT 10.30m				

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
∇	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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COFFEY

engineering log - cored borehole

borehole no: BH2
sheet 3 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	30-1-89
principal:		hole completed:	30-1-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting: EDSON 3000 - TRUCK
barrel type and length: NMLC - 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: Approx 131.2 m
datum: AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
				9							
				10		Continued from non-core borehole					
NMLC						SANDSTONE: fine to coarse grained, orange, - grey, indistinct bedding,	EW				
							HW				
				11			MW		D A 0.30 0.40		PT, 0-10deg
				12							PT, 0-10deg
				13					D A 0.70 1.20		
						Borehole BH2 Terminated at 13.30 m					
				14							
				15							
				16							

General Defect Description:

METHOD
- AS auger screwing
- AD auger drilling
- R roller/tricone
- W washbore
- NMLC core drilling
- NQ,HQ core drilling
- casing used
- barrel withdrawn

- water level
- water inflow
- * not measured Drilling Water
- partial loss
- complete loss

POINT LOAD TEST
- D -diametral
- A -axial

GRAPHIC LOG/CORE LOSS
- core recovered (hatching indicates material)
- no core recovered

WEATHERING
- FR -fresh
- SW -slightly
- MW -moderately
- HW -highly
- EW -extremely

STRENGTH
- EL -extremely low
- VL -very low
- L -low
- M -medium
- H -high
- VH -very high
- EH -extremely high

DEFECTS
- JT -joint
- PT -parting
- SM -seam
- CL -clay
- RO -rough
- DC -decomposed
- PL -planar
- IR -irregular

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engineering log - borehole

COFFEY

borehole no: BH3
sheet 1 of 3

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 31-1-89
hole completed: 31-1-89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000 - TRUCK
hole diameter: 100mm
slope: -90 DEG
bearing:
R.L.Surface: Approx 129.9 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetro-meter kPa 100 200 300 400	structure and additional observations
ADT		NIL						SC	FILL: SAND Fine to coarse grained brown CLAY medium plasticity GRAVEL fine to coarse	<Wp			FILL Gravel contains breccia fragments
				6 , 3 , 4 N*=7		1		CL	FILL: CLAY, medium plasticity, GRAVEL fine to coarse				
				3 . 4 , 4 N*=8		2					VSt	×	
R		C											
						3							
						4							
						5							
				5 , 6 , 10 N*=16							H	×	
						6							
						7							
				10 , – – N*=R		8							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube

*bit shown by suffix

B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - borehole

COFFEY

borehole no:	BH3
sheet	2 of 3
office job no:	S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	31-1-89
principal:		hole completed:	31-1-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Apporx129.9 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetro-meter kPa 100 200 300 400	structure and additional observations
R						9	▩	GP	FILL: Fine to coarse grained brown SAND fine to coarse CLAY medium	<Wp	H		FILL
									COMMENCED CORING AT 9.00m				
						10							
						11							
						12							
						13							
						14							
						15							
						16							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - cored borehole

COFFEY

borehole no: BH3
sheet 3 of 3

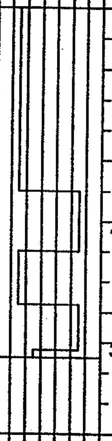
office job no: S8463/2

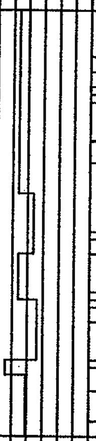
client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 31-1-89
hole completed: 31-1-89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000 - TRUCK
barrel type and length: NMLC 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: Approx 129.9 m
datum: AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
		No measurement recorded				Continued from non-core borehole					
NMLC				9 10		BRECCIA: medium to coarse grained, light - brown, indistinct bedding,	HW				Fractured zone 9.30-9.35 Smooth, clean 10mm JT, 60deg, irregular, rough 9.50-9.55 Seam, clay filled 5mm Seam, clay filled 5mm Seam, clay filled 10mm JT, 60deg, irregular, rough 9.86-9.95 Fractured zone 10.0-11.20
						BRECCIA: medium to coarse grained, light - grey,	MW		D 4.00		Fissured <2mm thick in Breccia at 45deg Fractured zone 10.50-10.60
						BRECCIA: medium to coarse grained, light - brown,	HW				Fractured zone 10.60-10.70 Seam, clay filled 10mm
				11		BRECCIA: medium to coarse grained, light - grey,	MW		D 3.20		Fractured zone 50mm JT, 60deg, curved, rough 10.95-11.00 Fissured, 60deg, <2mm thick, 11.05-11.20
						BRECCIA: medium to coarse grained, light - brown,	HW				Fractured zone 11.30-11.35 Seam, clay, 10mm thick Crushed seam 20mm thick Crushed seam 10mm thick JT, 50deg, planar, rough 11.80-11.85
				12		Borehole BH3 Terminated at	11.80	m			
				13							
				14							
				15							
				16							





General Defect Description:

METHOD
AS auger screwing
AD auger drilling
R roller/tricone
W washbore
NMLC core drilling
NQ,HQ core drilling
casing used
barrel withdrawn

water level
water inflow
* not measured Drilling Water
partial loss
complete loss

POINT LOAD TEST
D -diametral
A -axial

GRAPHIC LOG/CORE LOSS
core recovered (hatching indicates material)
no core recovered

WEATHERING
FR -fresh
SW -slightly
MW -moderately
HW -highly
EW -extremely

STRENGTH
EL -extremely low
VL -very low
L -low
M -medium
H -high
VH -very high
EH -extremely high

DEFECTS
JT -joint
PT -parting
SM -seam
CL -clay
RO -rough
DC -decomposed
PL -planar
IR -irregular

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engineering log - borehole

COFFEY

borehole no: **BH4**
sheet 1 of 3

office job no: S8463/2

client: HORNSBY COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 31-1-89
hole completed: 31-1-89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000 - TRUCK
hole diameter: 100mm
slope: -90 DEG
bearing:
R.L.Surface: Approx 130.2 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
ADT		NIL						CL	FILL: CLAY medium plasticity dark brown GRAVEL fine to coarse	<Wp			FILL Gravel comprising breccia and sandstone
				3 , 3 ,3 N*=6		1					VSt	X	
								GC	FILL: SANDY CLAYEY GRAVEL as above SAND fine to coarse				
						2							
R		C											
						3							BRECCIA BOULDER IN FILL
						4							
R													
						5							
						6							
						7							
						8							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION

1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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COFFEY

borehole no: **BH4**
sheet 2 of 3

engineering log - borehole

office job no: S8463/2

client:	HORNSBY COUNCIL	hole commenced:	31-1-89
principal:		hole completed:	31-1-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Approx 130.2 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetro-meter kPa 100 200 300 400	structure and additional observations
							▩	GC	FILL: SANDY CLAYEY GRAVEL as above SAND fine to coarse	<Wp	VSt		
R									COMMENCED CORING AT 8.30m				
						9							
						10							
						11							
						12							
						13							
						14							
						15							
						16							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests.

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - cored borehole

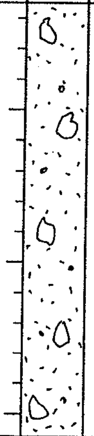
borehole no: **BH4**
sheet 3 of 3

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 31-1-89
hole completed: 31-1-89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000-TRUCK
barrel type and length: NMLC 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: Approx 130.2 m
datum: AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
						Continued from non-core borehole					
NMLC				9 10 11		BRECCIA: medium to coarse grained, light - brown, indistinct bedding.	HW				Crushed seam 10mm thick Seam, clay filled 5mm Seam, clay filled 5mm Crushed zone 25mm thick JT, 50deg, irregular, rough JT, 70deg, planar, rough Crushed zone 25mm thick Seam, clay filled 5mm thick JT, 40deg, planar, rough JT, 40deg, planar, rough JT, irregular, rough 10.70 - 10.75 Seam, clay filled 10mm thick JT, 40deg, clean, planar, rough JT, 40deg, clean, planar, rough Fractured / crushed zone 11.00-11.15
						Borehole BH4 Terminated at 11.15 m					
				12							
				13							
				14							
				15							
				16							

General Defect Description:

METHOD

AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	core drilling
NQ,HQ	core drilling
⊟	casing used
	barrel withdrawn

▽	water level
▷	water inflow
*	not measured Drilling Water
◁	partial loss
◁	complete loss

POINT LOAD TEST

D	-diametral
A	-axial

GRAPHIC LOG/CORE LOSS

⁞	core recovered (hatching indicates material)
☐	no core recovered

WEATHERING

FR	-fresh
SW	-slightly
MW	-moderately
HW	-highly
EW	-extremely

STRENGTH

EL	-extremely low
VL	-very low
L	-low
M	-medium
H	-high
VH	-very high
EH	-extremely high

DEFECTS

JT	-joint
PT	-parting
SM	-seam
CL	-clay
RO	-rough
DC	-decomposed
PL	-planar
IR	-irregular

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COFFEY

engineering log - borehole

borehole no: **BH5**
sheet 1 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	1.2.89
principal:		hole completed:	1.2.89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Approx 125.5 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetro- meter kPa 100 200 300 400	structure and additional observations
ADT		NIL				0	▨	GC	FILL: CLAYEY GRAVEL Fine to coarse light brown CLAY medium plasticity SAND fine to coarse	M			FILL - gravel is breccia and some sandstone
						1	▨	SC	FILL: CLAYEY SAND as above CLAY low to medium plasticity				
				4 , 7 , 16 N*=23		2	▨						
				3 , 3 , 3 N*=6		3	▨				VSt	×	
							▨	CL	FILL: CLAY as above				FILL contains timber fragments
				10 , 11 , - N*=R		4	▨						
R		C					▨						
			◁			5	▨						
						6	▨						
						7	▨						
						8	▨						

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION

1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - borehole

borehole no: BH5
sheet 2 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	1.2.89
principal:		hole completed:	1.2.89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG	R.L.Surface:	Approx 125.5 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
R						9 10	▩	CL	FILL: CLAY as above	M	VSt		FILL contains timber fragments
							▨	SC	CLAYEY SAND: fine to coarse grey to orange				
						11 12 13 14 15 16			CORING COMMENCED AT 10.55m				

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - cored borehole

COFFEY

borehole no: **BH5**
sheet 3 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	1-2-89
principal:		hole completed:	1-2-89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK MOUNTED			slope:	-90 DEG	R.L.Surface:	Approx125.5 m
barrel type and length:	NMLC 3.0m	fluid:	WATER	bearing:		datum:	AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
				9							
				10		Continued from non-core borehole					
NMLC				11	⁙	SANDSTONE: fine to coarse grained, orange, - brown, indistinct bedding,	MW		D A 0.10 0.20		
				12	⁙	SANDSTONE: fine to coarse grained, red, - brown, / grey, indistinct bedding,			D A 0.10 0.20		
				13	⁙				D A 0.10 0.10		PT CL 10mm thick
				14		Borehole BH5 Terminated at 13.55 m					
				15							
				16							

General Defect Description:

METHOD

AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	core drilling
NQ,HQ	core drilling
⊞	casing used barrel withdrawn

▽	water level
▷	water inflow
*	not measured Drilling Water
◁	partial loss
◁	complete loss

POINT LOAD TEST

D -diametral
A -axial

GRAPHIC LOG/CORE LOSS

⁙	core recovered (hatching indicates material)
☐	no core recovered

WEATHERING

FR	-fresh
SW	-slightly
MW	-moderately
HW	-highly
EW	-extremely

STRENGTH

EL	-extremely low
VL	-very low
L	-low
M	-medium
H	-high
VH	-very high
EH	-extremely high

DEFECTS

JT	-joint
PT	-parting
SM	-seam
CL	-clay
RO	-rough
DC	-decomposed
PL	-planar
IR	-irregular

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engineering log - borehole

COFFEY

borehole no: **BH6**
sheet 1 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	20.3.89
principal:		hole completed:	20.3.89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE FIGURE 1	checked by:	AS
drill model and mounting:	EDSON 3000 - TRUCK	slope:	-90 DEG
hole diameter:	100mm	bearing:	
R.L.Surface:	95.9 m	datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
ADV		NIL						SC	CLAYEY SAND: fine to medium grained dark grey brown CLAY medium plasticity	M	L MD		TOPSOIL
				U50				CL	SANDY CLAY: low to medium plasticity brown SAND fine to coarse	<Wp	F		ALLUVIUM
						1		SP	SAND: medium to coarse grained grey brown				
				U50		2		CL	SANDY CLAY: low to medium plasticity dark brown to yellow brown SAND fine to medium		St VSt		RESIDUAL
				U50					SANDY GRAVELLY CLAY medium to high plasticity yellow brown	>Wp			RESIDUAL to EW BRECCIA
						3			Commenced Coring at 2.95m V bit refusal at 2.95m				
						4							
						5							
						6							
						7							
						8							

METHOD

AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT

C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER

*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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COFFEY

engineering log - cored borehole

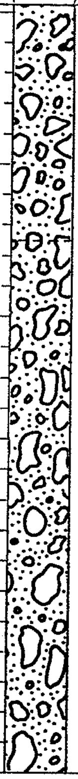
borehole no: **BH6**
sheet 2 of 3.

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE PLAN

hole commenced: 20.3.89
hole completed: 20.3.89
logged by: SRM
checked by: AS

drill model and mounting: EDSON 3000 - TRUCK
barrel type and length: NMLC 3.0m
fluid: WATER
slope: -90 DEG
bearing:
R.L.Surface: 95.9 m
datum: AHD



method	case-lift	water	R.L.	depth metres	substance description rock type: grain characteristics colour, structure, minor components	weathering	point load test Is(50) MPa	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
				1				
				2				
					Continued from non-core borehole			Fractured zone 100mm
NMLC				3	BRECCIA: medium to coarse grained, red, - brown, indistinct bedding,	MW		Crushed seam 10mm Partings every 50mm for 1.6m Crushed seam 10mm
								Crushed seam 10mm
								JT, 60deg, IR, RO, 3.75 - 3.83m JT, 60deg, IR, RO, 3.90 - 3.95m
				4			D 0.53	Fractured zone from 50mm Crushed zone 20mm
								Crushed zone 15mm
					BRECCIA: medium to coarse grained, grey, indistinct bedding,	SW		Fractured / Crushed zone, 4.55 - 4.65m
								JT, 45deg, IR, RO, 4.8 - 4.85m Fractured zone 20mm thick JT, 90deg, PL, RO, 4.9 - 5.1m
				5				
								JT, 60deg, IR, RO, 5.5 - 5.55m
						FR	D 0.83	
				6				JT, 45deg, PL, RO, 6.0 - 6.05m
								JT, 40deg, PL, RO, 6.2 - 6.25
								Fractured zone on joint 45deg JT, 50deg, IR, RO, 6.65 - 6.7m JT, 50deg, IR, RO Crushed seam 5mm thick
				7			D 1.05 A 2.10	
								JT, 45deg, PL, RO
				8				JT, 60-90deg, curved, RO, 7.95 - 8.2m

Est. Strength: EL VL L M H VH EH

defect spacing mm: 30 100 300 1000 3000

General Defect Description:

METHOD

AS	auger screwing
AD	auger drilling
R	roller/tricone
W	washbore
NMLC	core drilling
NQ,HQ	core drilling
	casing used
	barrel withdrawn

▽	water level
▷	water inflow
*	not measured Drilling Water
◁	partial loss
◀	complete loss

POINT LOAD TEST
D -diametral
A -axial

GRAPHIC LOG/CORE LOSS

⁚	core recovered (hatching indicates material)
☐	no core recovered

WEATHERING

FR	-fresh
SW	-slightly
MW	-moderately
HW	-highly
EW	-extremely

STRENGTH

EL	-extremely low
VL	-very low
L	-low
M	-medium
H	-high
VH	-very high
EH	-extremely high

DEFECTS

JT	-joint
PT	-parting
SM	-seam
CL	-clay
RO	-rough
DC	-decomposed
PL	-planar
IR	-irregular

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engineering log - cored borehole

COFFEY

borehole no: BH6
sheet 3 of 3

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	20.3.89
principal:		hole completed:	20.3.89
project:	OLD MANS VALLEY	logged by:	SRM
borehole location:	SEE PLAN	checked by:	AS

drill model and mounting:	EDSON 3000 - TRUCK			slope:	-90 DEG	R.L.Surface:	95.9 m
barrel type and length:	NMLC 3.0m	fluid:	WATER	bearing:		datum:	AHD

drilling information					rock substance					rock mass defects	
method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
NMLC						BRECCIA: medium to coarse grained, grey, indistinct bedding.	FR				Fractured zone 50mm thick JT, 70deg, PL, RO, iron-stained Two joints sets intersecting at approx. 70deg JT, 70deg, PL, RO, 8.65 - 8.8m
				9							JT, 45deg, PL, SM JT, 90deg, PL, SM, 8.80 - 9.25m JT, 90deg, PL, SM, 9.25 - 9.35m JT, 90deg, IR, RO, 9.4 - 9.75m
				10					D 0.56 A 0.60		JT, 90deg, PL, SM, iron-stained, 9.75 - 10.25 Zone of multiple intersecting joint sets, most planar, smooth, 40 - 60deg, 10.2 - 10.5m
				11							Crushed zone 5mm thick JT, 45deg, PL, SM
						Borehole BH6 Terminated at	11.50	m			
				12							
				13							
				14							
				15							
				16							

General Defect Description:

METHOD				POINT LOAD TEST		WEATHERING		STRENGTH		DEFECTS	
AS	auger screwing	∇	water level	D	-diametral	FR	-fresh	EL	-extremely low	JT	-joint
AD	auger drilling	▷	water inflow	A	-axial	SW	-slightly	VL	-very low	PT	-parting
R	roller/tricone	*	not measured Drilling Water	GRAPHIC LOG/CORE LOSS		MW	-moderately	L	-low	SM	-seam
W	washbore	◁	partial loss	⁞	core recovered (hatching indicates material)	HW	-highly	M	-medium	CL	-clay
NMLC	core drilling	◁	complete loss	☐	no core recovered	EW	-extremely	H	-high	RO	-rough
NQ,HQ	core drilling							VH	-very high	DC	-decomposed
╞╡	casing used barrel withdrawn							EH	-extremely high	PL	-planar
										IR	-irregular

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engineering log - cored borehole

COFFEY

borehole no: **BH7**
sheet 1 of 1

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	7.6.89
principal:		hole completed:	7.6.89
project:	OLD MANS VALLEY	logged by:	AS
borehole location:	SEE DRAWING NO S8463/2-1	checked by:	CPT

drill model and mounting:	PROLINE			slope:	-90 DEG	R.L.Surface:	118.6 m
barrel type and length:	NMLC 1.5m	fluid:	WATER	bearing:		datum:	AHD

method	case-lift	water	R.L.	depth metres	graphic log core loss	substance description rock type: grain characteristics colour, structure, minor components	weathering	Est. Strength EL VL L M H VH EH	point load test Is(50) MPa	defect spacing mm 30 100 300 1000 3000	defect description type, inclination planarity, roughness, coating, thickness unless otherwise noted defects follow general description below
NMLC		8.6.89 ▽		0 – 2.45		FILL: NO CORE gravelly clay red, brown, to yellow, brown.					
				2.45 – 2.8		CLAY: medium to high plasticity yellow, brown.	EW				350mm CL SM
				2.8 – 3.5		NO CORE: 0.75m					
				3.5 – 4.26		BRECCIA: yellow, brown, fragmented, some thin clay seams	HW				Core from 3.5 to 4.26 fragmented by joints clay seams and partings
						Borehole BH7 Terminated at 4.26 m					

Standpipe piezometer installed at 3.45m. Slotted from 1.45m to 3.45m. Clay plug at surface.

General Defect Description:

METHOD
- auger screwing
- auger drilling
- roller/tricone
- washbore
- core drilling
- core drilling
- casing used
- barrel withdrawn

▽ water level
▷ water inflow
* not measured Drilling Water
◁ partial loss
◁ complete loss

POINT LOAD TEST
D -diametral
A -axial

GRAPHIC LOG/CORE LOSS
core recovered (hatching indicates material)
no core recovered

WEATHERING
FR -fresh
SW -slightly
MW -moderately
HW -highly
EW -extremely

STRENGTH
EL -extremely low
VL -very low
L -low
M -medium
H -high
VH -very high
EH -extremely high

NQ,HQ
JT -joint
PT -parting
SM -seam
CL -clay
RO -rough
DC -decomposed
PL -planar
IR -irregular

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COFFEY

engineering log - borehole

borehole no: **BH8**
sheet 1 of 2

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
borehole location: SEE FIGURE 1

hole commenced: 7.6.89
hole completed: 7.6.89
logged by: AS
checked by: CPT

drill model and mounting: EDSON 2000 TRUCK
hole diameter: 100mm
slope: -90 DEG
bearing:
R.L.Surface: 113.5 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetrometer kPa 100 200 300 400	structure and additional observations
ADT		NIL						CH	CLAY: medium to high plasticity red brown	D M	F St		RESIDUAL
						1		CH	CLAY: medium to high plasticity yellow brown				EW BRECCIA
						2 3 4			BRECCIA extremely weathered to highly weathered yellow brown some core stones and gravel		VSt		EW/HW BRECCIA
						5 6 7			BRECCIA highly weathered yellow - brown some corestones		H		HW BRECCIA
		▽ 8.6.89				8							

METHOD	
AS	auger screwing*
AD	auger drilling*
R	roller/tricone
W	washbore
CT	cable tool
HA	hand auger
DT	diatube
*bit shown by suffix	
B	blank bit
V	V bit
T	TC bit
e.g.	ADT

SUPPORT	
C	casing
M	mud

PENETRATION
1 2 3
no resistance ranging to refusal

WATER	
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES	samples and tests
U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
based on unified classification system

MOISTURE	
D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX	
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - borehole

COFFEY

borehole no: **BH8**
sheet 2 of 2

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	hole commenced:	7.6.89
principal:		hole completed:	7.6.89
project:	OLD MANS VALLEY	logged by:	AS
borehole location:	SEE FIGURE 1	checked by:	CPT

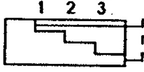
drill model and mounting:	EDSON 2000 TRUCK	slope:	-90 DEG	R.L.Surface:	113.5 m
hole diameter:	100mm	bearing:		datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetro-meter kPa 100 200 300 400	structure and additional observations
ADT						9			BRECCIA highly weathered yellow - brown some corestones	D	H		HW BRECCIA
						10 11 12 13 14 15 16			Borehole BH8 Terminated at 9.25 m Standpipe piezometer installed at 9.25m. Slotted from 7.25m to 9.25m. Clay plug at surface.				

METHOD
AS auger screwing*
AD auger drilling*
R roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
*bit shown by suffix
B blank bit
V V bit
T TC bit
e.g. ADT

SUPPORT
C casing
M mud

PENETRATION



no resistance ranging to refusal

WATER
* not measured
▽ water level
water outflow
water inflow

NOTES samples and tests
U50 undisturbed sample 50 mm diameter
D disturbed sample
N standard penetration test:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
based on unified classification system

MOISTURE
D dry
M moist
W wet
Wp plastic limit

CONSISTENCY/DENSITY INDEX
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

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engineering log - excavation

COFFEY

pit no **TP1**
sheet 1 of 1

client:	HORNSBY SHIRE COUNCIL
principal:	
project:	OLD MANS VALLEY
pit location:	SEE FIGURE 1
equipment type and model:	KATO HD 1250 SE
excavation dimensions:	3.0 m long 1.2 m wide
office job no:	S8463/2
pit commenced:	18.5.89
pit completed:	18.5.89
logged by:	AS
checked by:	CPT
R.L.Surface:	106.3 m
datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED					CL	TOPSOIL: SILTY CLAY brown	D	MD		TOPSOIL
				U50				CH	GRAVELLY CLAY: high plasticity red brown				RESIDUAL
				U50 U50		1		CH	GRAVELLY CLAY: high plasticity red brown to yellow brown some moderately weathered breccia core stones				EW BRECCIA
				Bs		2 3			BRECCIA extremely weathered/highly weathered, orange brown some large breccia core stones		D VD		EW/HW BRECCIA
						4			BRECCIA highly weathered red brown to yellow brown some core stones				HW BRECCIA clay seam moist - wet at 4.40m
									BRECCIA moderately weathered light grey				MW BRECCIA
						5 6 7 8			Pit TP1 Terminated at 4.70 m near refusal				

METHOD

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator
HA	hand auger
DT	diatube

SUPPORT

T	timbering
N	nil

PENETRATION

1 2 3 no resistance ranging to refusal

WATER

D	none encountered
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - excavation

pit no TP2
sheet 1 of 1

client:	HORNSBY SHIRE COUNCIL	office job no:	S8463/2
principal:		pit commenced:	18.5.89
project:	OLD MANS VALLEY	pit completed:	28.5.89
pit location:	SEE FIGURE 1	logged by:	AS
		checked by:	CPT
equipment type and model:	KATO HD 1250 SE	R.L.Surface:	123.0 m
excavation dimensions:	2.5 m long 1.2 m wide	datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED					CH	CLAY: high plasticity red brown	D	St		RESIDUAL
						1 2			BRECCIA highly weathered light grey brown		MD D		HW BRECCIA
						3 4 5 6 7 8			Pit TP2 Terminated at2.50 m				

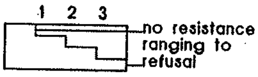
METHOD

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator
HA	hand auger
DT	diatube

SUPPORT

T	timbering
N	nil

PENETRATION



WATER

D	none encountered
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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COFFEY

engineering log - excavation

pit no
TP3
sheet 1 of 1

client:	HORNSBY SHIRE COUNCIL	office job no:	S8463/2
principal:		pit commenced:	18.5.89
project:	OLD MANS VALLEY	pit completed:	18.5.89
pit location:	SEE FIGURE 1	logged by:	AS
		checked by:	CPT
equipment type and model:	KATO HD 1250 SE	R.L.Surface:	102.6 m
excavation dimensions:	2.5 m long 1.2 m wide	datum:	AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED					SP	SAND: fine to medium grained brown	D	L		ALLUVIUM
				U50		1		CH	SANDY CLAY: high plasticity dark grey		St		
				U50		2 3		CH	GRAVELLY CLAY: orange brown numerous MW breccia core stones		D VD		EW BRECCIA 5m north of TP3 another pit was dug exposing a layer of cemented sand/weathered sandstone at 1.2m to 1.9m. This was overlain by the sandy clay and was underlain by EW Breccia. A U50 tube was taken in the sandy clay & cemented sand, at 1.3m depth.
						4 5 6 7 8			Pit TP3 Terminated at 3.20 m				

METHOD

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator
HA	hand auger
DT	diatube

SUPPORT

T	timbering
N	nil

PENETRATION

1 2 3
no resistance ranging to refusal

WATER

D	none encountered
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - excavation

COFFEY

pit no TP4
sheet 1 of 1

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	pit commenced:	2.6.89
principal:		pit completed:	2.6.89
project:	OLD MANS VALLEY	logged by:	AS
pit location:	SEE FIGURE 1	checked by:	CPT

equipment type and model: CATERPILLER EXCAVATOR

R.L.Surface: 94.7 m

excavation dimensions: 2.0 m long 1.2 m wide

datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetro-meter kPa 100 200 300 400	structure and additional observations
BH		NIL						SP	SAND: fine to coarse dark brown grey some clay and gravel	D M	L		ALLUVIUM
						1							
			▽◁ 2.6.89										
						2				M W			
								CH	CLAY: medium to high plasticity yellow brown some breccia core stones		St		EW BRECCIA
									BRECCIA moderately weathered yellow brown		H		MW BRECCIA
						3			Pit TP4 Terminated at 3.00 m Near Refusal on slightly weathered Breccia				SW BRECCIA
						4							
						5							
						6							
						7							
						8							

METHOD
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

SUPPORT
T timbering
N nil

PENETRATION
1 2 3
no resistance ranging to refusal

WATER
D none encountered
* not measured
▽ water level
◁ water outflow
▷ water inflow

NOTES samples and tests
U50 undisturbed sample 50 mm diameter
D disturbed sample
N standard penetration test:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
based on unified classification system

MOISTURE
D dry
M moist
W wet
Wp plastic limit

CONSISTENCY/DENSITY INDEX
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

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engineering log - excavation

COFFEY

pit no **TP5**
sheet 1 of 1

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	pit commenced:	2.6.89
principal:		pit completed:	2.6.89
project:	OLD MANS VALLEY	logged by:	AS
pit location:	SEE FIGURE 1	checked by:	CPT

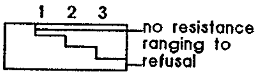
equipment type and model: CATERPILLER EXCAVATOR
R.L.Surface: 99.5 m
excavation dimensions: 2.0 m long 1.2 m wide
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetro-meter kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED					SP	SAND: fine to coarse brown grey some gravel	D M	L MD		ALLUVIUM
								CH	CLAY: medium to high plasticity light grey		St		
						1		CH	CLAY: medium to high plasticity yellow brown		VSt		EW BRECCIA
						2			BRECCIA Extremely Weathered/Highly Weathered yellow brown some core stones				EW/HW BRECCIA
						3			BRECCIA Highly Weathered yellow brown				HW BRECCIA
						4			BRECCIA Moderately Weathered/Highly Weathered light grey to yellow brown		H		MW/HW BRECCIA
						5			Pit TP5 Terminated at 4.30 m Near refusal & near limit of reach				
						6							
						7							
						8							

METHOD
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator
- HA hand auger
- DT diatube

SUPPORT
- T timbering
- N nil

PENETRATION



WATER
- D none encountered
- * not measured
- ▽ water level
- ◁ water outflow
- ▷ water inflow

NOTES samples and tests
- U50 undisturbed sample 50 mm diameter
- D disturbed sample
- N standard penetration test:
- N* SPT + sample recovered
- Nc SPT with solid cone
- V vane shear
- P pressuremeter
- Bs bulk sample
- R refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE
- D dry
- M moist
- W wet
- Wp plastic limit

CONSISTENCY/DENSITY INDEX
- VS very soft
- S soft
- F firm
- St stiff
- VSt very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

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COFFEY

engineering log - excavation

pit no **TP6**
sheet 1 of 1

office job no: S8463/2

client: HORNSBY SHIRE COUNCIL
principal:
project: OLD MANS VALLEY
pit location: SEE FIGURE 1

pit commenced: 7.6.89
pit completed: 7.6.89
logged by: AS
checked by: CPT

equipment type and model: CATERPILLER 215BSA EXCAVATOR
excavation dimensions: 2.5 m long 1.2 m wide

R.L.Surface: 93.2 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density indexc	hand penetro- meter kPa 100 200 300 400	structure and additional observations
BH		NIL						SC	CLAYEY SAND: fine to coarse grained grey some gravel	M	L MD		ALLUVIUM
						1							
			▽			2							
								CH	CLAY: medium to high plasticity yellow brown	M W	F St		RESIDUAL / EW BRECCIA
			▽ 7.6.89			3			BRECCIA extremely weathered - highly weathered yellow brown some light grey mottling some core stones and gravel	-	St VSt		EW/HW BRECCIA
									BRECCIA moderately weathered light grey				MW BRECCIA
									Pit TP6 Terminated at3.60 m Near Refusal on slightly weathered Breccia				SW BRECCIA
						4							
						5							
						6							
						7							
						8							

METHOD

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator
HA	hand auger
DT	diatube

SUPPORT

T	timbering
N	nil

PENETRATION

1 2 3
no resistance ranging to refusal

WATER

D	none encountered
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test:
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - excavation

COFFEY

pit no **TP7**
sheet 1 of 1

client:	HORNSBY SHIRE COUNCIL	office job no:	S8463/2
principal:		pit commenced:	7.6.89
project:	OLD MANS VALLEY	pit completed:	7.6.89
pit location:	SEE FIGURE 1	logged by:	AS
		checked by:	CPT

equipment type and model: CATERPILLER 215BSA EXCAVATOR
excavation dimensions: 2.0 m long 1.2 m wide
R.L.Surface: 93.3 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL					▨	SC	CLAYEY SAND: fine to coarse grained grey some gravel	M	L MD		ALLUVIUM
						1							
						2							
			▷ 7.6.89							M			very high water inflow large tree trunks in alluvium
						3	▨	CH	CLAY: medium plasticity yellow brown	W	St		RESIDUAL / EW BRECCIA
									BRECCIA extremely weathered/highly weathered yellow brown to light grey numerous corestones		H		EW/HW BRECCIA
									Pit TP7 Terminated at 3.60 m				
						4							
						5							
						6							
						7							
						8							

METHOD

N	natural exposure
X	existing excavation
BH	backhoe bucket
B	bulldozer blade
R	ripper
E	excavator
HA	hand auger
DT	diatube

SUPPORT

T	timbering
N	nil

PENETRATION

1 2 3 no resistance ranging to refusal

WATER

D	none encountered
*	not measured
▽	water level
◁	water outflow
▷	water inflow

NOTES samples and tests

U50	undisturbed sample 50 mm diameter
D	disturbed sample
N	standard penetration test
N*	SPT + sample recovered
Nc	SPT with solid cone
V	vane shear
P	pressuremeter
Bs	bulk sample
R	refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION

based on unified classification system

MOISTURE

D	dry
M	moist
W	wet
Wp	plastic limit

CONSISTENCY/DENSITY INDEX

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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engineering log - excavation

COFFEY

pit no	TP8
sheet	1 of 1

office job no: S8463/2

client:	HORNSBY SHIRE COUNCIL	pit commenced:	7.6.89
principal:		pit completed:	7.6.89
project:	OLD MANS VALLEY	logged by:	AS
pit location:	SEE FIGURE 1	checked by:	CPT

equipment type and model: CATERPILLER 215BSA EXCAVATOR

R.L.Surface: 110.6m

excavation dimensions: 2.0 m long 1.2 m wide

datum: AHD

method	penetration 1 2 3	support	water	notes samples, test,etc	R.L.	depth metres	graphic log	classification symbol	material soil type:plasticity or particle characteristics colour, secondary and minor components	moisture condition	consistency/ density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED				▨	CH	CLAY: medium to high plasticity red brown	M	F St		RESIDUAL
						1	▨	CH	CLAY: medium to high plasticity red brown	D M	St		EW BRECCIA?
						2							
						3 4			BRECCIA extremely weathered/highly weathered yellow - brown numerous highly weathered corestones		H		EW/HW BRECCIA
						5 6 7 8			Pit TP8 Terminated at 4.20 m Limit of Reach				

METHOD
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator
- HA hand auger
- DT diatube

SUPPORT
- T timbering
- N nil

PENETRATION
1 2 3 no resistance ranging to refusal

WATER
- D none encountered
- * not measured
- ▽ water level
- water outflow
- water inflow

NOTES samples and tests
- U50 undisturbed sample 50 mm diameter
- D disturbed sample
- N standard penetration test:
- N* SPT + sample recovered
- Nc SPT with solid cone
- V vane shear
- P pressuremeter
- Bs bulk sample
- R refusal

CLASSIFICATION SYMBOLS AND SOIL DESCRIPTION
based on unified classification system

MOISTURE
- D dry
- M moist
- W wet
- Wp plastic limit

CONSISTENCY/DENSITY INDEX
- VS very soft
- S soft
- F firm
- St stiff
- VSt very stiff
- H hard
- Fb friable
- VL very loose
- L loose
- MD medium dense
- D dense
- VD very dense

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COFFEY

triaxial shear test

LABORATORY : SYDNEY

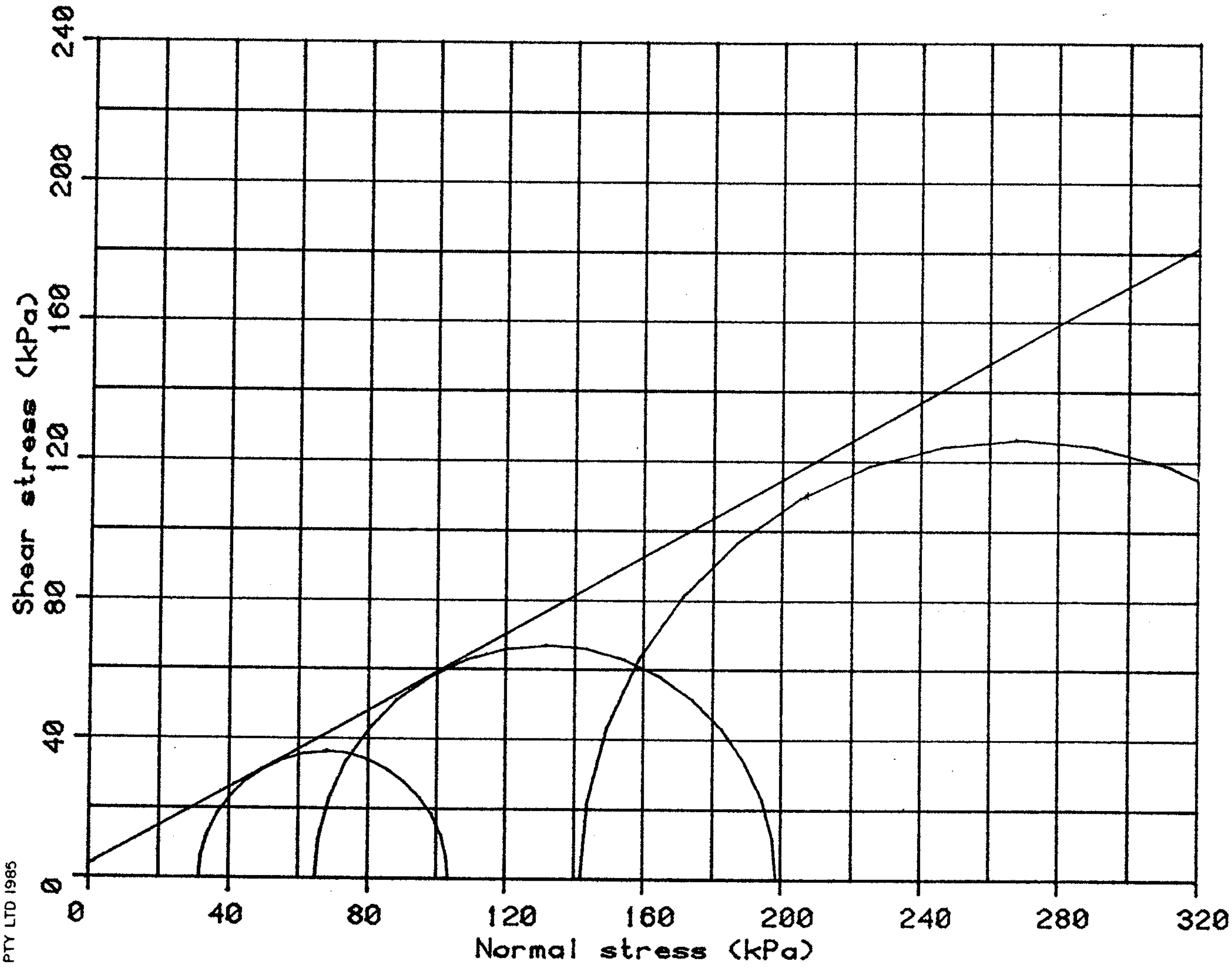
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MAN'S VALLEY
LOCATION :

JOB NO : S8463/2
TESTED BY : GC
DATE : 04/04/89
TEST FILE # : 530

BOREHOLE: BH 6
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

DEPTH : 1.50 -
: 1.85

MATERIAL CLASSIFICATION : (CL) Sandy CLAY - medium plasticity, mottled yellow grey brown, fine to coarse sand.



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TYPE OF TEST : CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (Ø') : ....29.. deg.
COHESION (C') : ....4.. KPa
WET DENSITY : 2.090 t/m3
BACK PRESSURE : 200.000 kPa
STRAIN RATE : 0.007 %Min

MOISTURE CONTENTS
INITIAL : ..15..0 %
FINAL - TOP : ..17..7 %
- MIDDLE : ..18..3 %
- BOTTOM : ..21..1 %

DATA FROM TEST FILE No.s : 530 538 545

NATA

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COFFEY

triaxial shear test

LABORATORY : SYDNEY

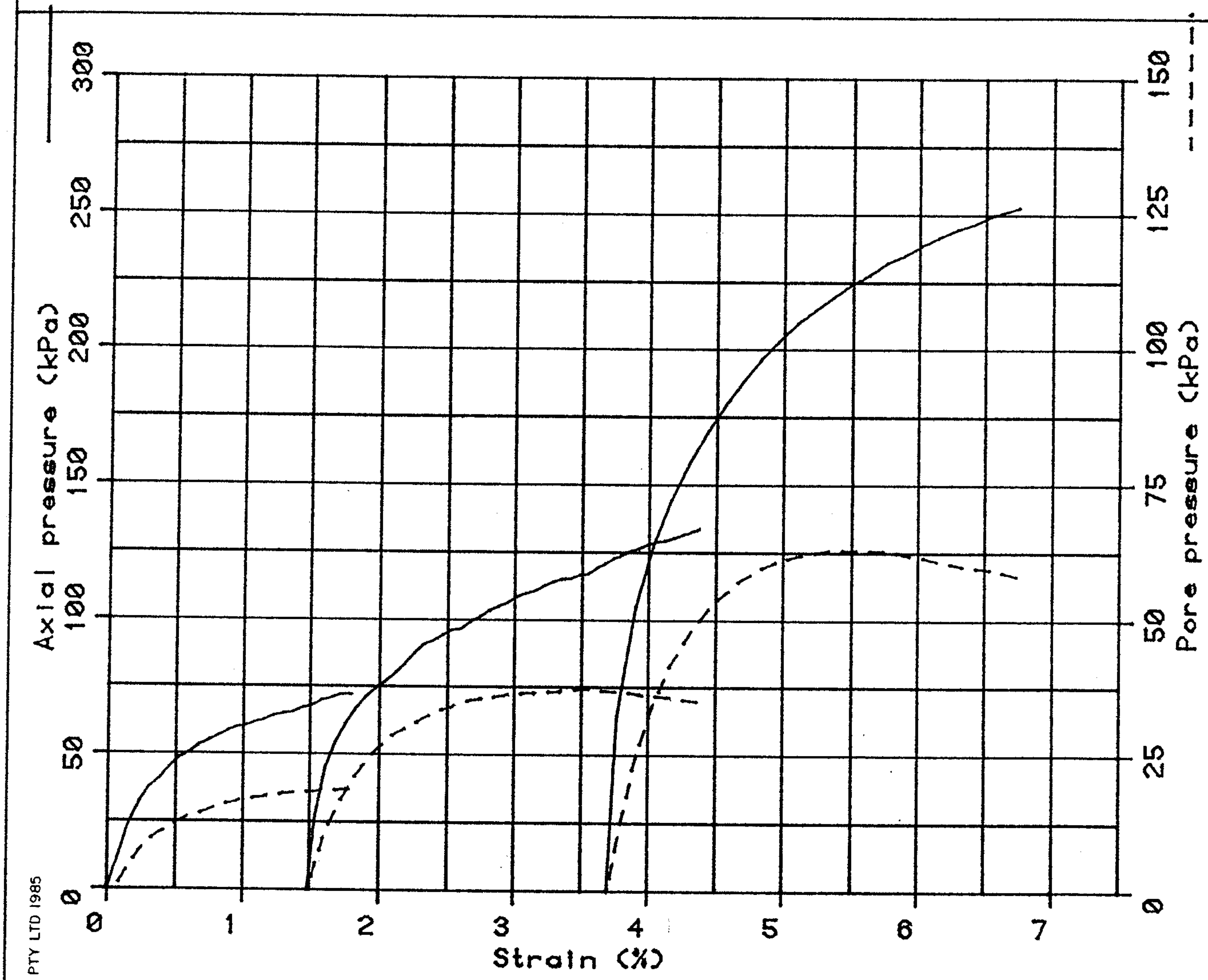
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MAN'S VALLEY
LOCATION :

JOB NO : S8463/2
TESTED BY : GC
DATE : 04/04/89
TEST FILE # : 530

BOREHOLE: BH 6
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

DEPTH : 1.50 - 1.85

MATERIAL CLASSIFICATION : (CL) Sandy CLAY - medium plasticity,mottled yellow grey brown,fine to coarse sand.



TYPE OF TEST : CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (Ø') : ...29... deg.
COHESION (C') : ...4... KPa
WET DENSITY : 2.090 t/m3
BACK PRESSURE : 200.000 kPa
STRAIN RATE : 0.007 %Min

MOISTURE CONTENTS
INITIAL : ...15.0 %
FINAL - TOP : ...17.7 %
- MIDDLE : ...18.3 %
- BOTTOM : ...21.1 %

DATA FROM TEST FILE No.s : 530 538 545

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COFFEY

triaxial shear test

LABORATORY : SYDNEY

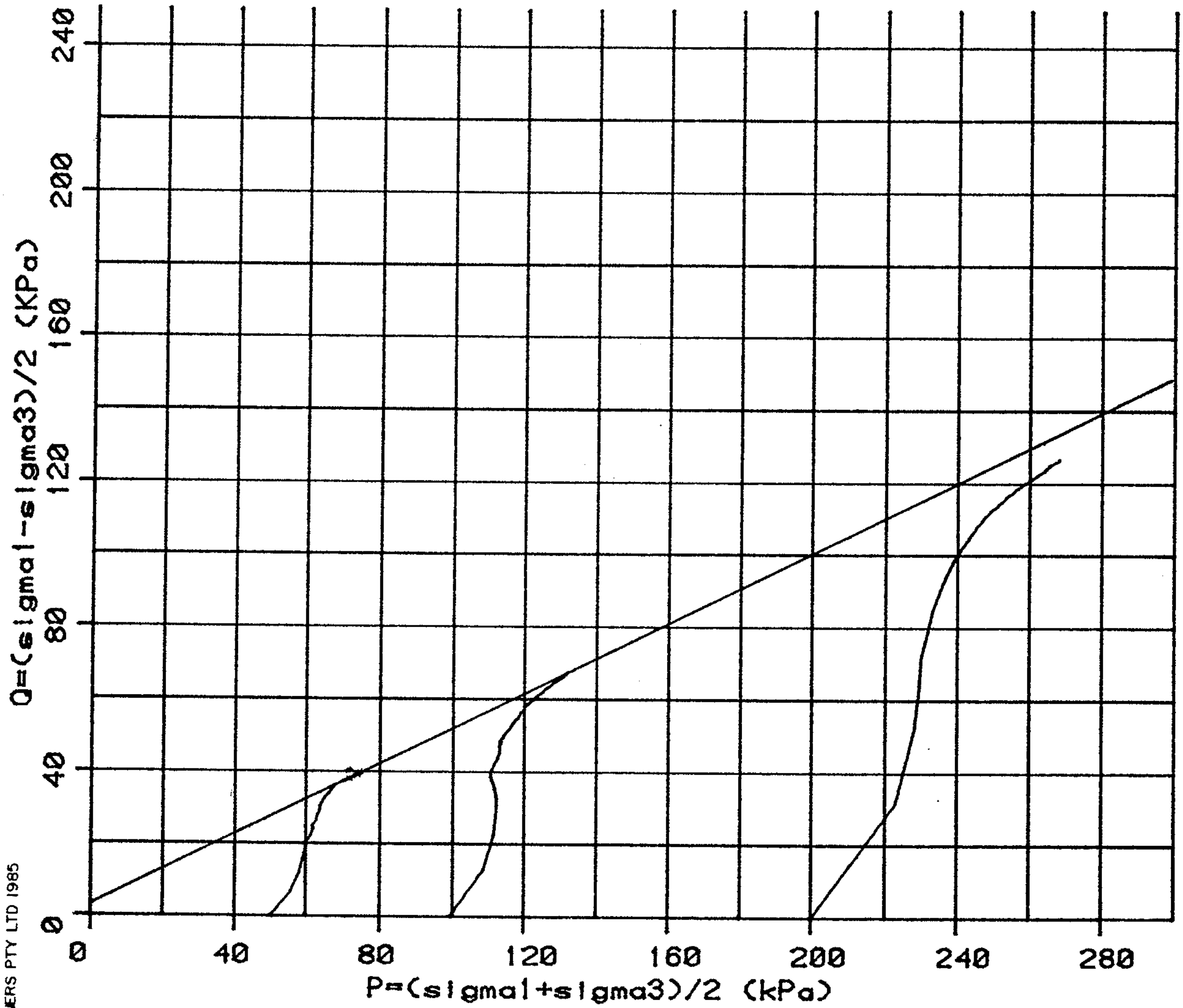
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MAN'S VALLEY
LOCATION :

JOB NO : S8463/2
TESTED BY : GC
DATE : 04/04/89
TEST FILE # : 530

BOREHOLE: BH 6
FAILURE CRITERIA: PEAK PRINCIPAL STRESS RATIO

DEPTH : 1.50 - 1.85

MATERIAL CLASSIFICATION : (CL) Sandy CLAY - medium plasticity, mottled yellow grey brown, fine to coarse sand.



TYPE OF TEST : CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENT

ANGLE OF FRICTION (Ø') : ...29.. deg.
COHESION (C') : ...4... KPa
WET DENSITY : 2.090 t/m3
BACK PRESSURE : 200.000 kPa
STRAIN RATE : 0.007 %Min

MOISTURE CONTENTS
INITIAL : ...15.0 %
FINAL - TOP : ...17.7 %
- MIDDLE : ...18.3 %
- BOTTOM : ...21.1 %

DATA FROM TEST FILE No.s : 530 538 545

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direct shear test

COFFEY

LABORATORY : SYDNEY

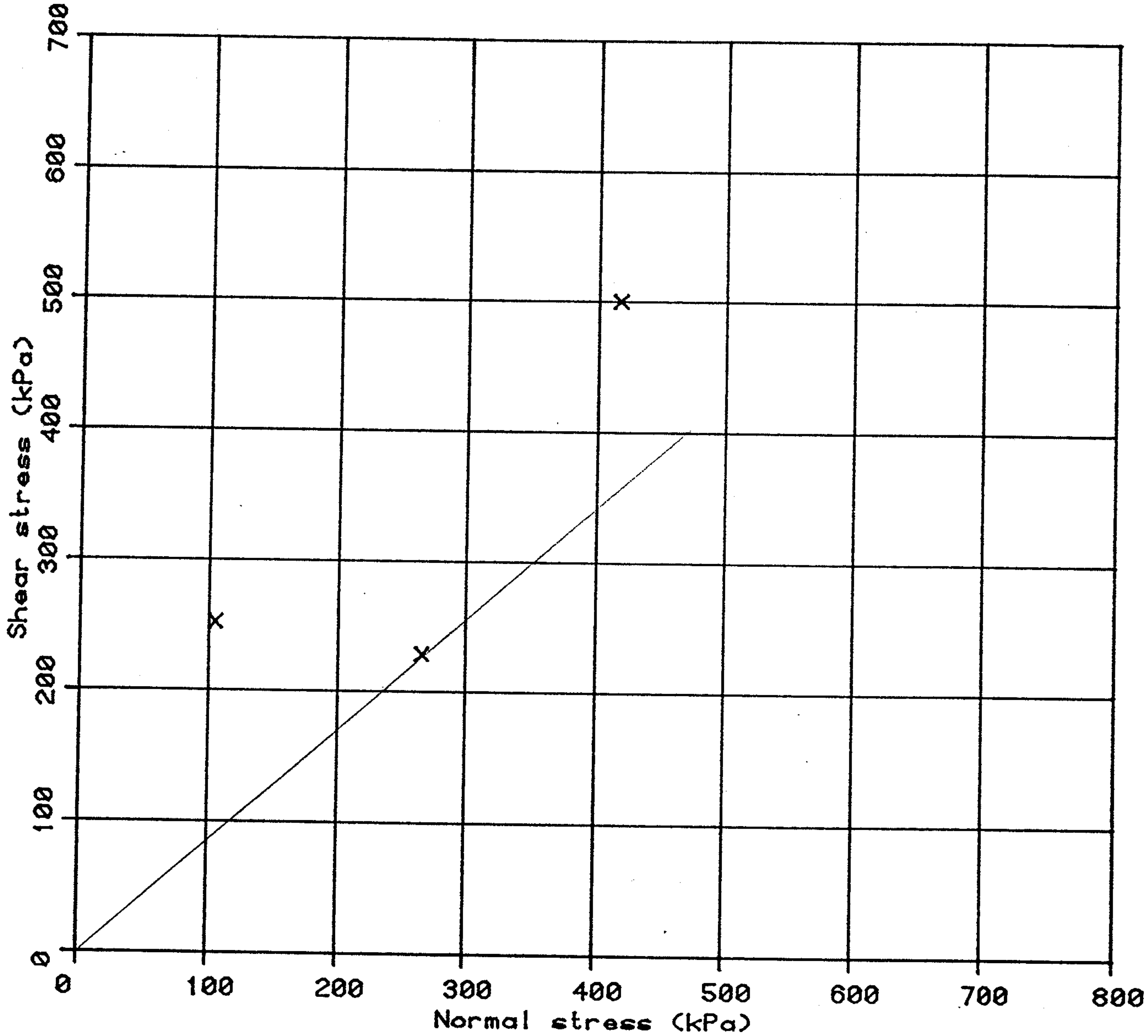
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 26/05/89

BOREHOLE : TP 1
SHEAR STRESS : PEAK

DEPTH : 0.40 -
: 0.40

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity, mottled brown, fine to coarse sand, fine to medium gravel.



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.99 t/m3
INITIAL MOISTURE CONTENT : 21.60 %

COHESION C : ....0.... kPa
ANGLE OF FRICTION : ....41.... deg.

DATA FROM TEST FILE No.s : 634 637 643

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Coffey & Partners Pty. Ltd.
Inc in Qld

direct shear test

COFFEY

LABORATORY : SYDNEY

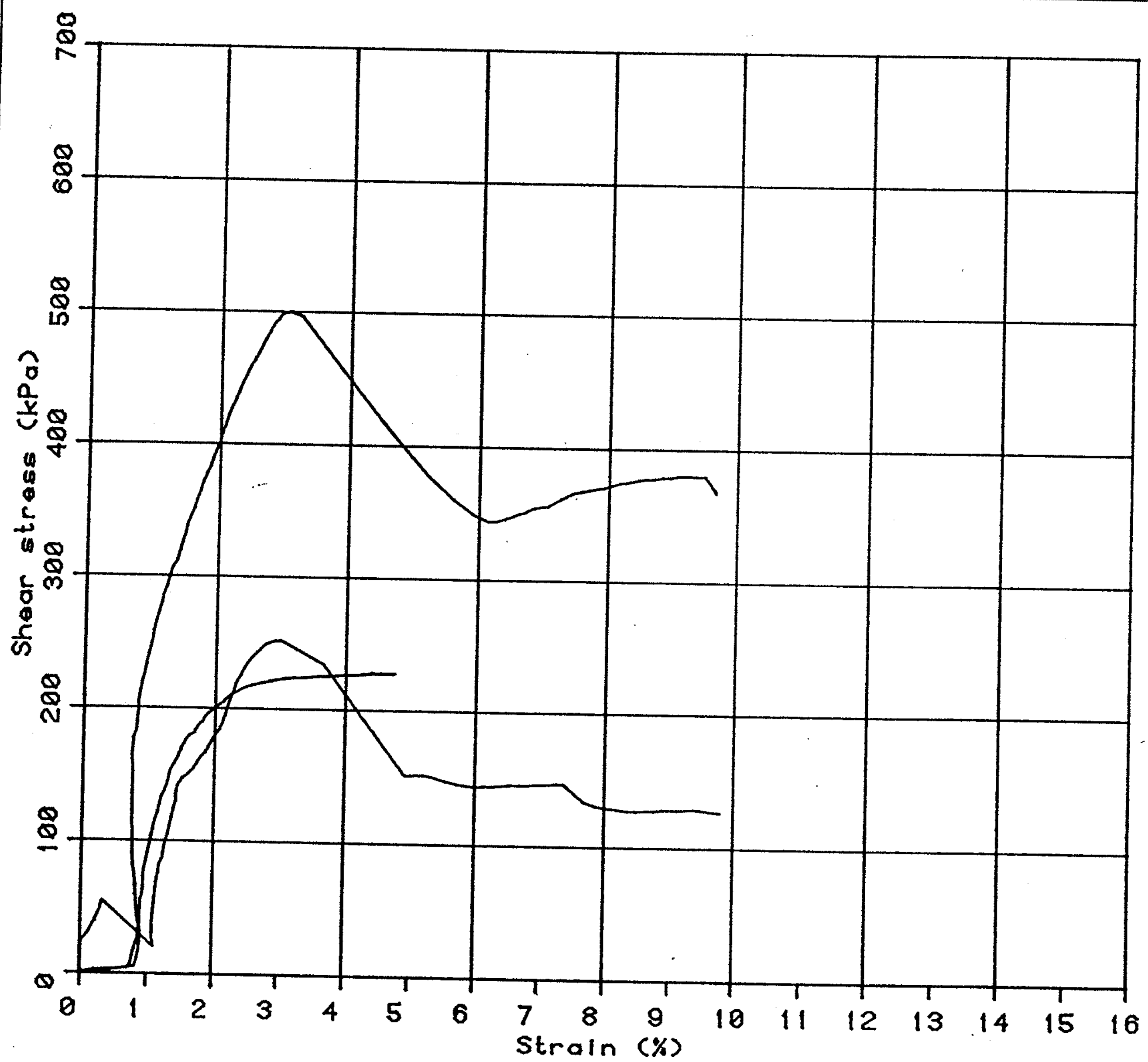
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 26/05/89
TEST FILE # : 634

BOREHOLE: TP 1
SHEAR STRESS : PEAK

DEPTH : 0.40 -
: 0.40

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity, mottled brown, fine to coarse sand, fine to medium gravel.



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.99 t/m3
INITIAL MOISTURE CONTENT : 21.60 %

COHESION C : ....0.... kPa
ANGLE OF FRICTION : ....41.... deg.

DATA FROM TEST FILE No.s : 634 637 643

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Inc in Qld

COFFEY

direct shear test

LABORATORY : SYDNEY

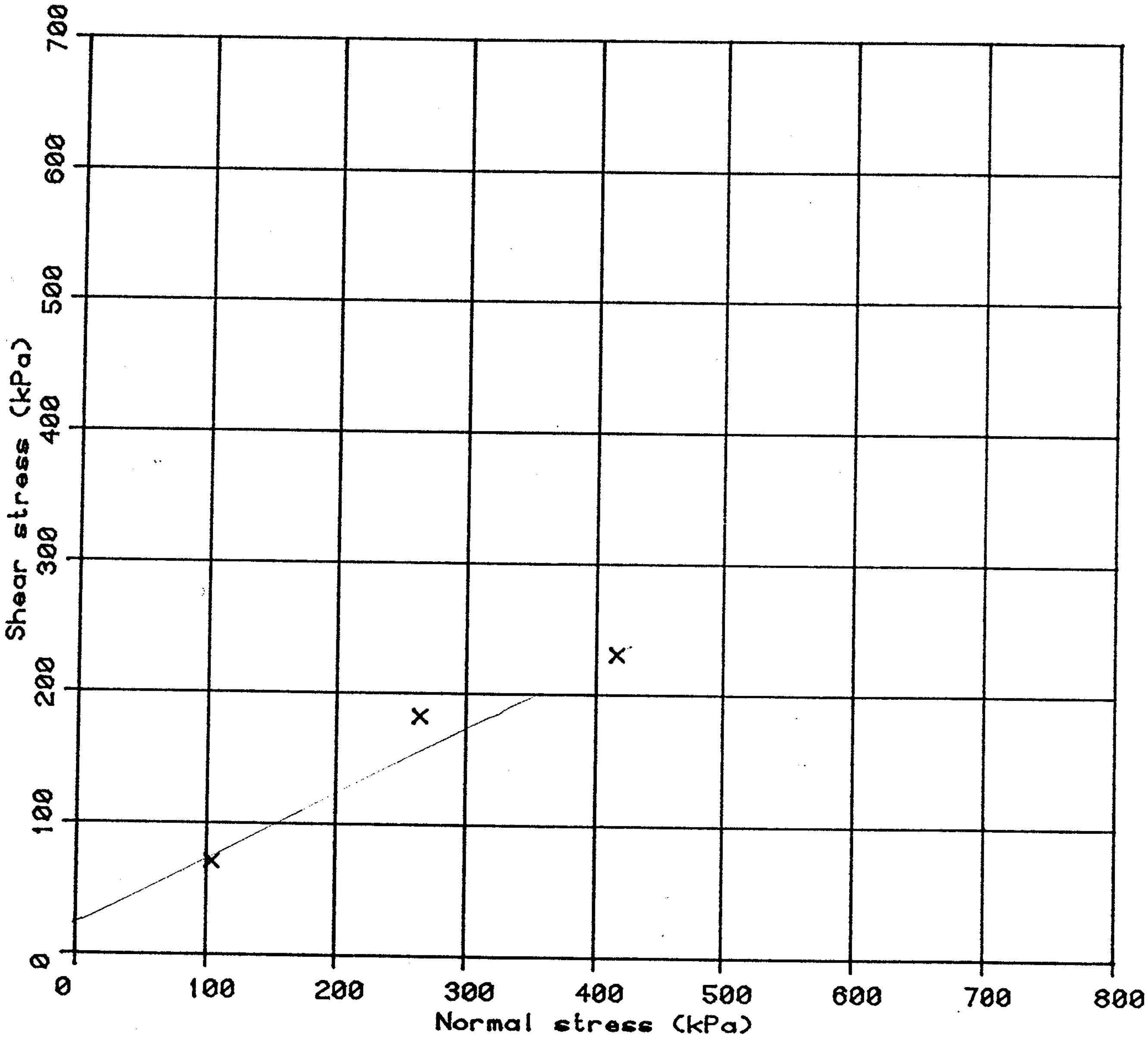
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 26/05/89

BOREHOLE: TP 1
SHEAR STRESS : PEAK

DEPTH : 0.80 -
: 0.80

MATERIAL CLASSIFICATION : (CH) Gravelly Sandy CLAY - high plasticity, red yellow brown, fine to coarse sand, fine gravel.



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.83 t/m3
INITIAL MOISTURE CONTENT : 32.50 %

COHESION C : ....25.... kPa
ANGLE OF FRICTION : ....26.... deg.

DATA FROM TEST FILE No.s : 633 638 644

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060

Coffey & Partners Pty. Ltd.
Inc in Qld

direct shear test

LABORATORY : SYDNEY

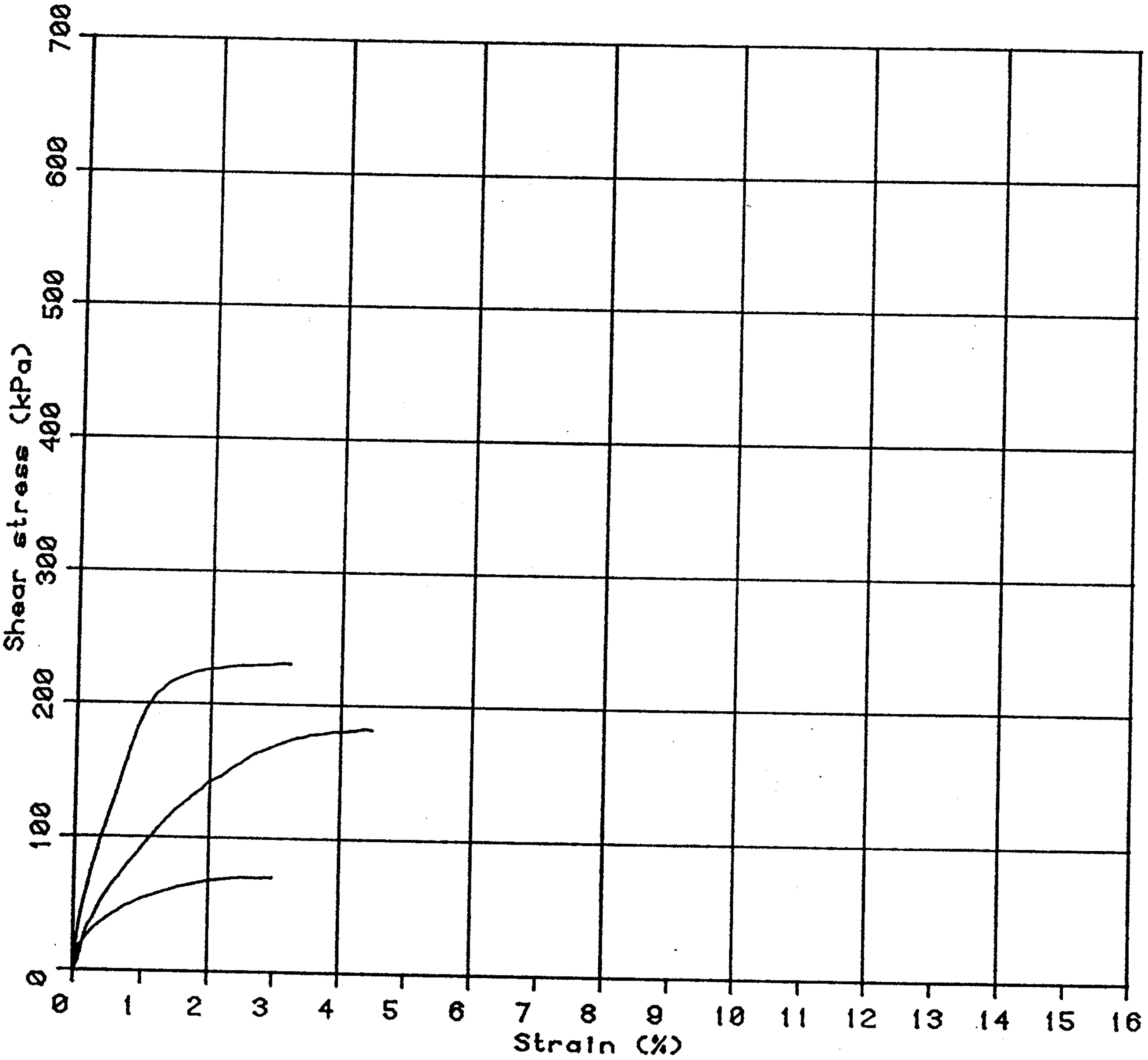
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 26/05/89
TEST FILE # : 633

BOREHOLE: TP 1
SHEAR STRESS : PEAK

DEPTH : 0.80 -
: 0.80

MATERIAL CLASSIFICATION : (CH) Gravelly Sandy CLAY - high plasticity, red yellow brown, fine to coarse sand, fine gravel.



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.83 t/m3
INITIAL MOISTURE CONTENT : 32.50 %

COHESION C : ..25..... kPa
ANGLE OF FRICTION : ..26..... deg.

DATA FROM TEST FILE No.s : 633 638 644

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Inc in Qld

COFFEY

direct shear test

LABORATORY : SYDNEY

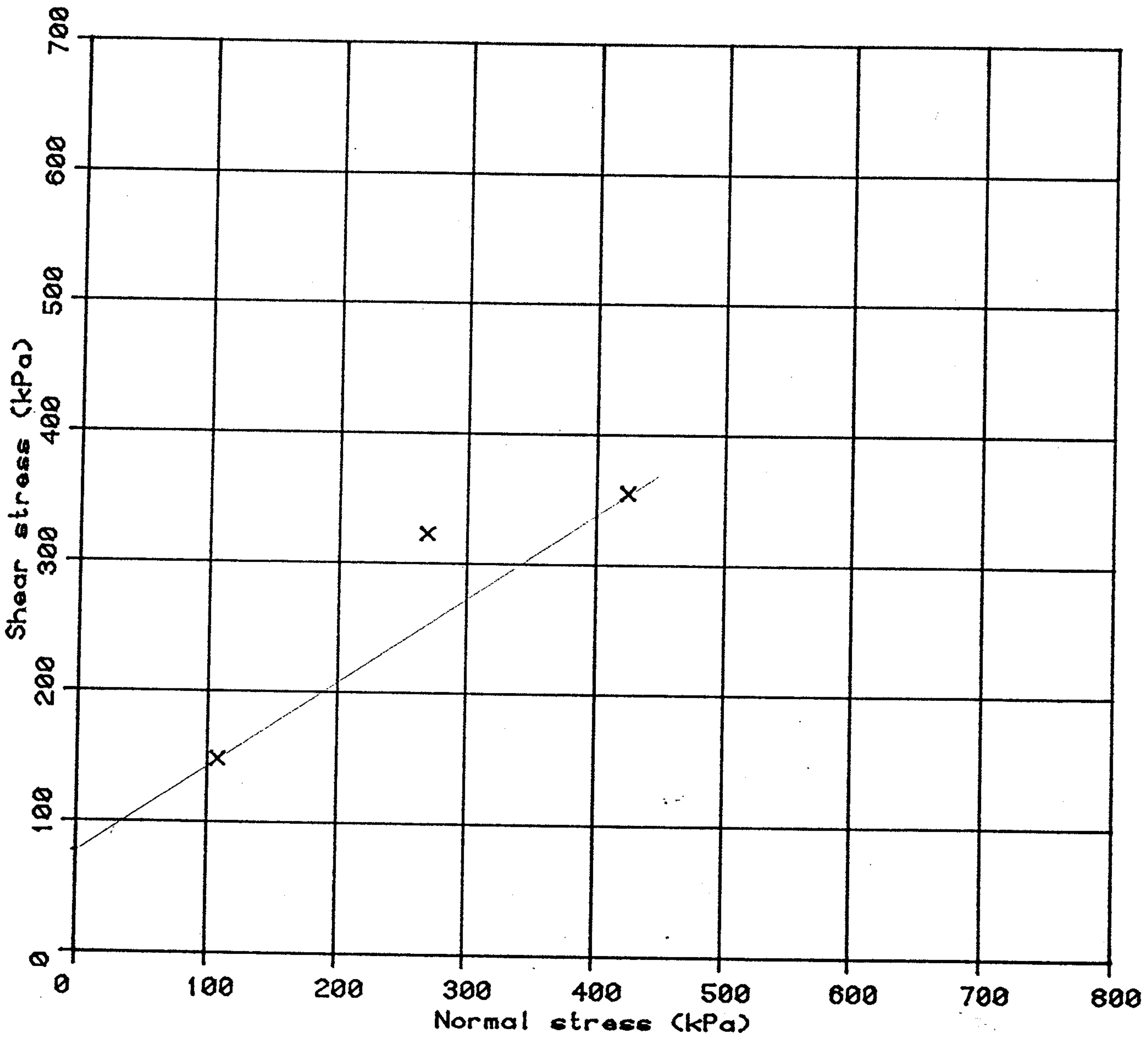
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 07/06/89

BOREHOLE: TP 1
SHEAR STRESS : PEAK

DEPTH : 0.90 -
: 0.90

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity,mottled yellow red brown,fine to coarse sand,fine to medium gravel.EW



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.88 t/m3
INITIAL MOISTURE CONTENT : 23.00 %

COHESION C : ....80.... kPa
ANGLE OF FRICTION : ....32.... deg.

DATA FROM TEST FILE No.s : 650 658 664

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direct shear test

COFFEY

LABORATORY : SYDNEY

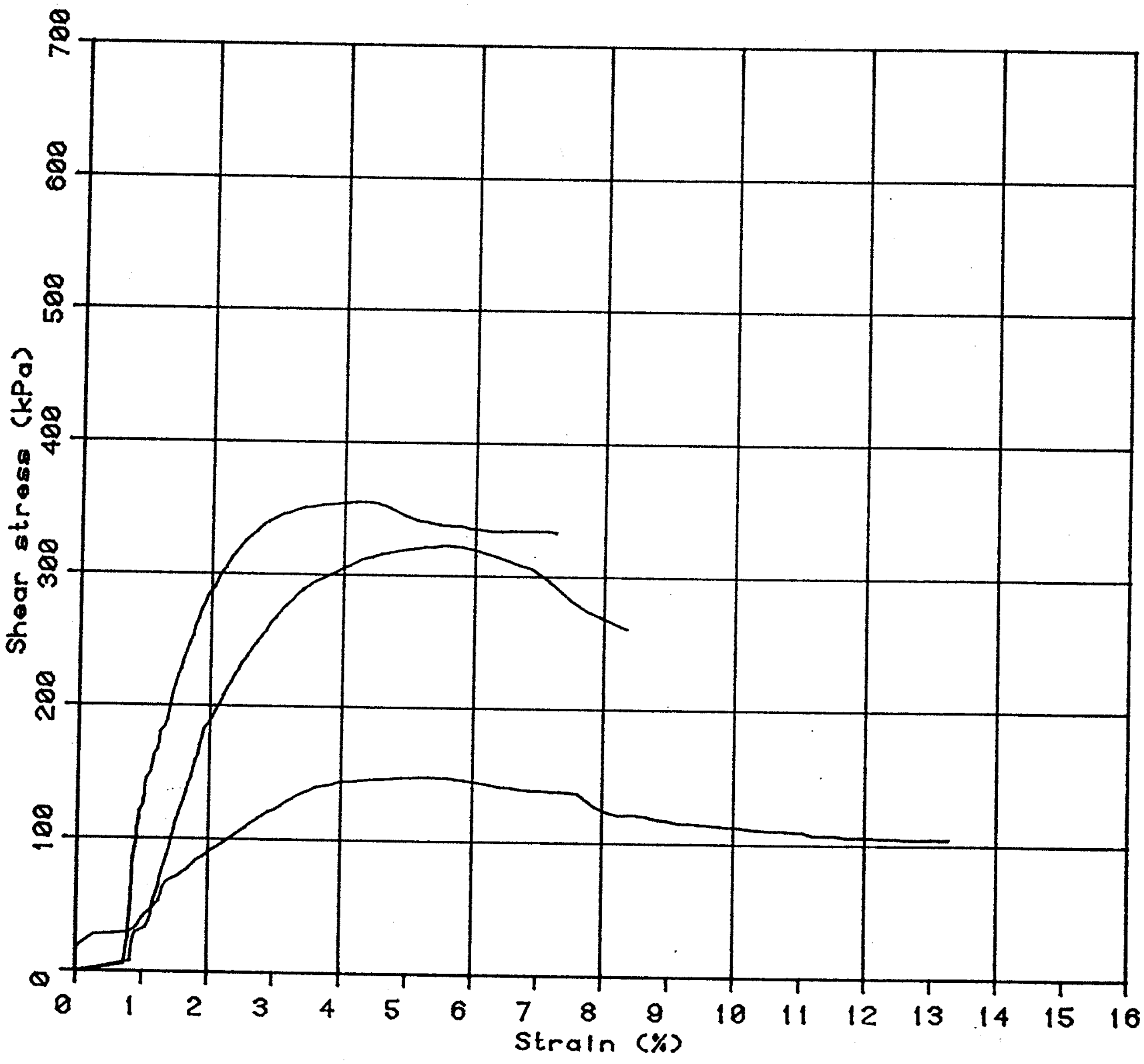
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 07/06/89
TEST FILE # : 650

BOREHOLE: TP 1
SHEAR STRESS : PEAK

DEPTH : 0.90 -
: 0.90

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity, mottled yellow red brown, fine to coarse sand, fine to medium gravel. EW



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.88 t/m3
INITIAL MOISTURE CONTENT : 23.00 %

COHESION C : ....80.... kPa
ANGLE OF FRICTION : ....32.... deg.

DATA FROM TEST FILE No.s : 650 658 664

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Inc in Qld

direct shear test

COFFEY

LABORATORY : SYDNEY

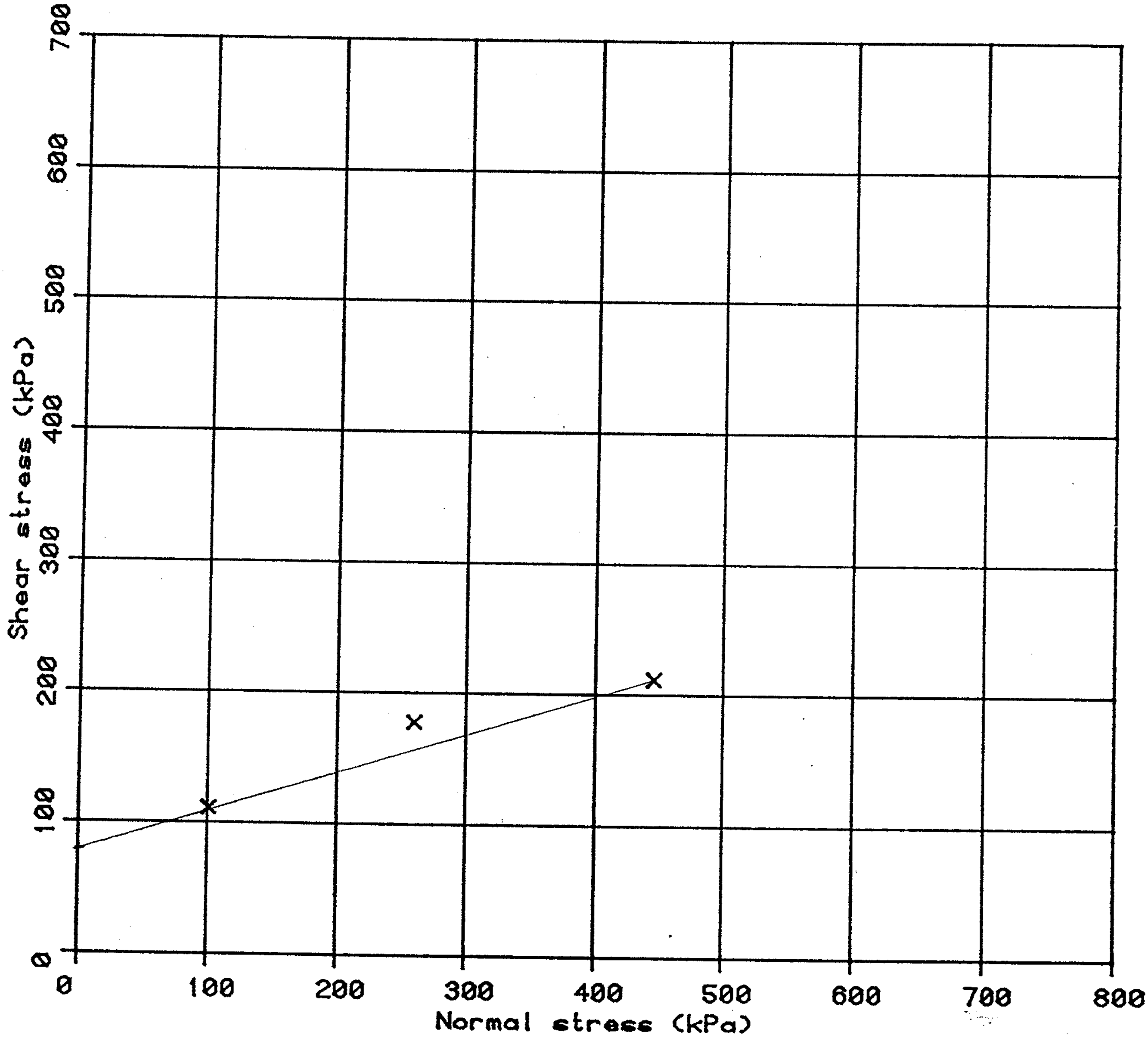
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8483/2
TESTED BY : GC
DATE : 21/05/89

BOREHOLE: TP3
SHEAR STRESS : PEAK

DEPTH : 1.30 -
: 1.30

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity, light grey mottled red brown, fine to coarse sand, fine gravel. EW BREC



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.92 t/m3
INITIAL MOISTURE CONTENT : 20.00 %

COHESION C : ....80.... kPa
ANGLE OF FRICTION : ....17.... deg.

DATA FROM TEST FILE No.s : 617 625 629

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COFFEY

direct shear test

LABORATORY : SYDNEY

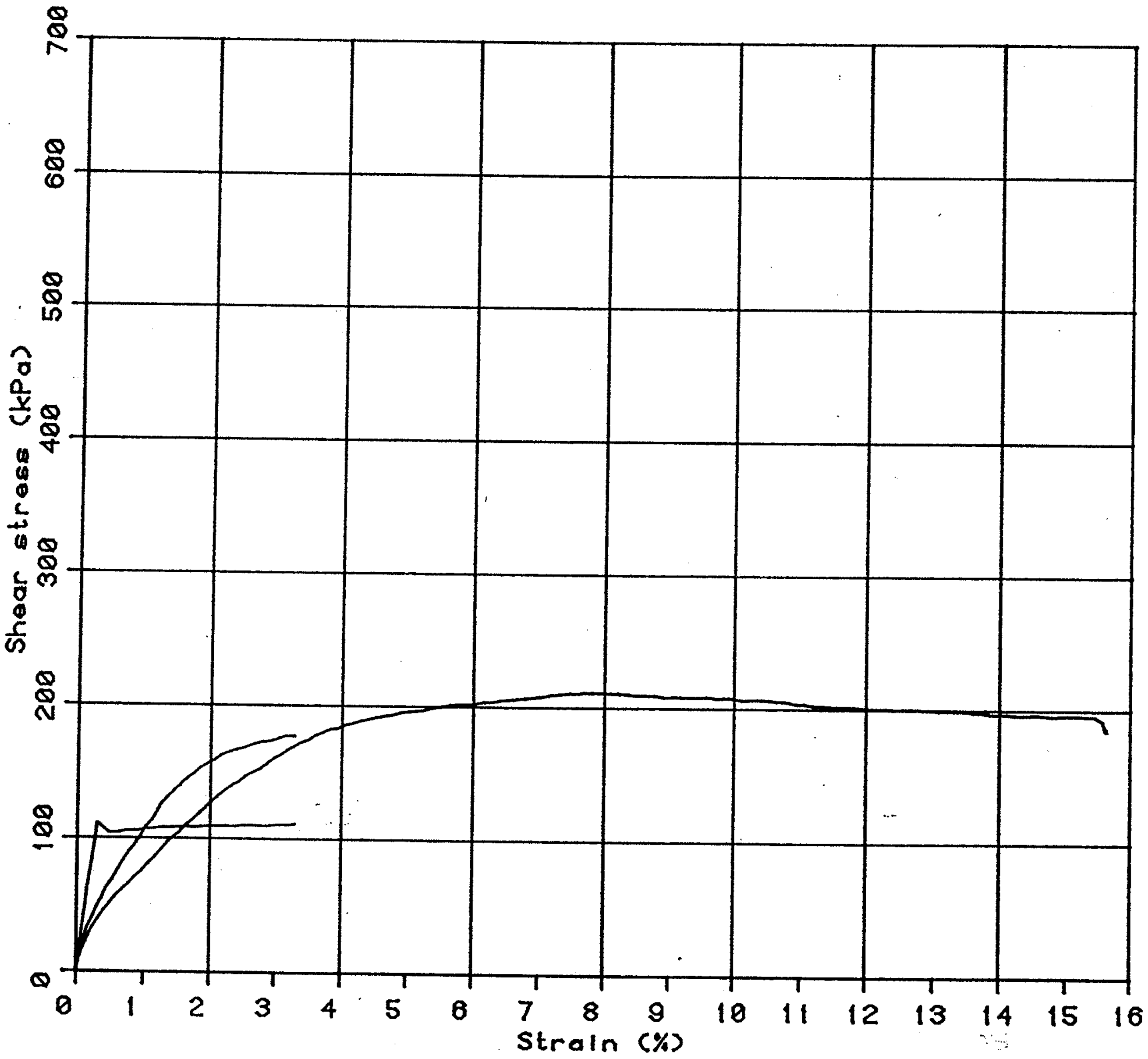
CLIENT : HORNSBY SHIRE COUNCIL
PRINCIPAL :
PROJECT : OLD MANS VALLEY
LOCATION : HORNSBY

JOB NO : S8463/2
TESTED BY : GC
DATE : 21/05/89
TEST FILE # : 617

BOREHOLE : TP3
SHEAR STRESS : PEAK

DEPTH : 1.30 -
: 1.30

MATERIAL CLASSIFICATION : (CL) Gravelly Sandy CLAY - medium plasticity, light grey mottled red brown, fine to coarse sand, fine gravel. EW BREC



SHEAR RATE : 0.005 mm/Min
WET DENSITY : 1.92 t/m3
INITIAL MOISTURE CONTENT : 20.00 %

COHESION C : ...80.... kPa
ANGLE OF FRICTION : ....17.... deg.

DATA FROM TEST FILE No.s : 617 625 629

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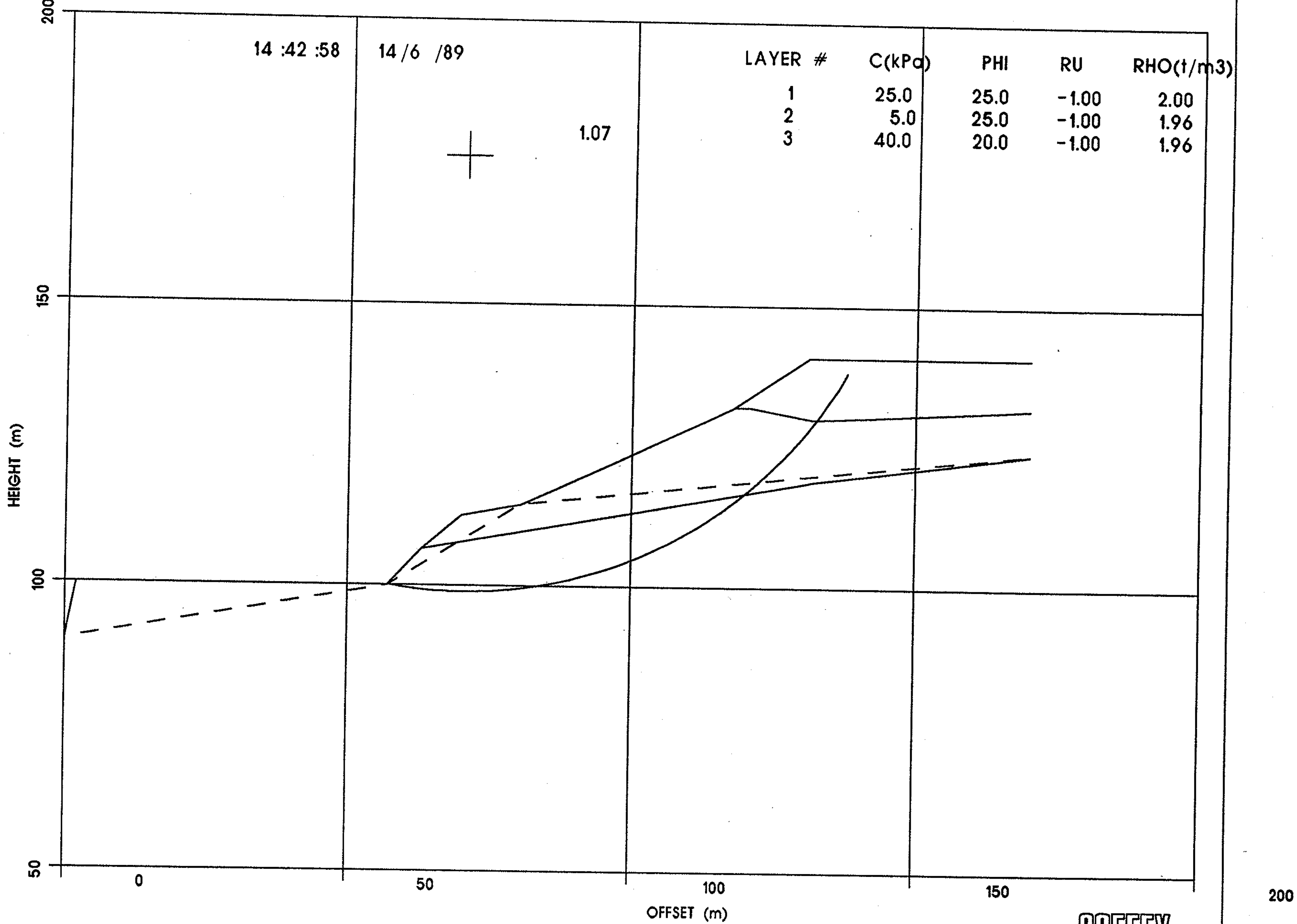
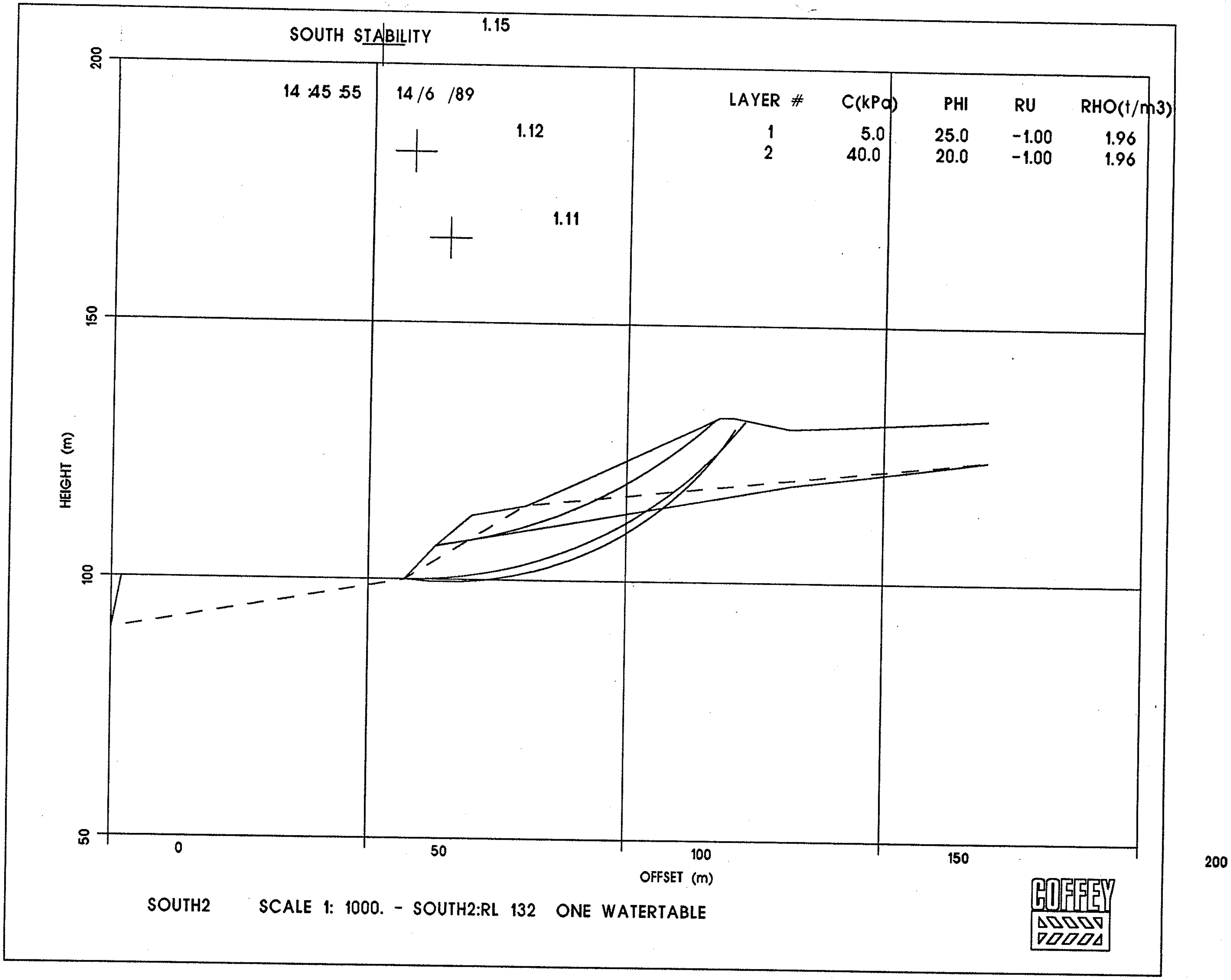
SOUTH STABILITY



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-1.00	1.96

SOUTH1 SCALE 1: 1000. - SOUTH1:RL 140.85 ONE WATERTABLE

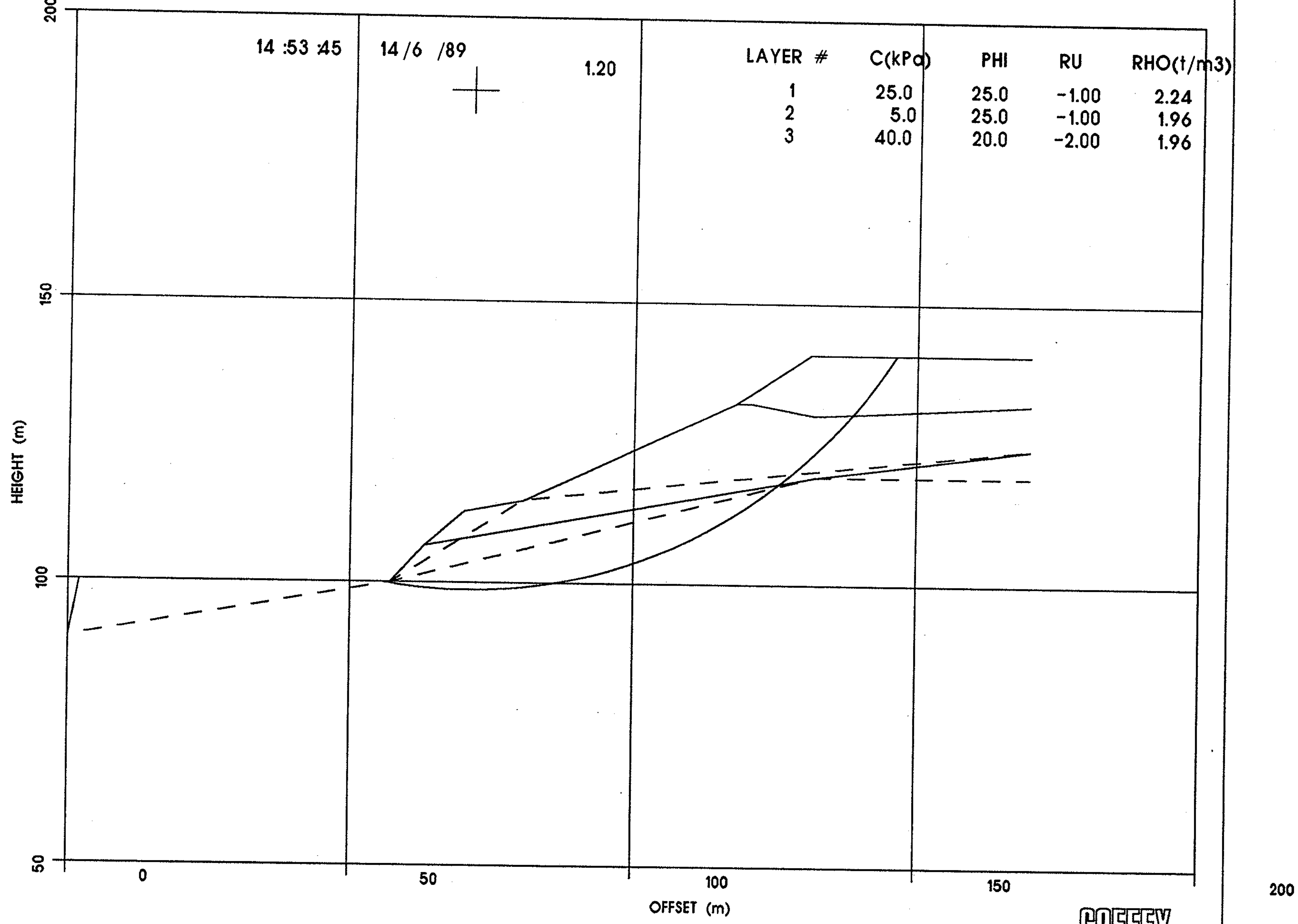
COFFEY



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	5.0	25.0	-1.00	1.96
2	40.0	20.0	-1.00	1.96

SOUTH2 SCALE 1: 1000. - SOUTH2:RL 132 ONE WATERTABLE

SOUTH STABILITY



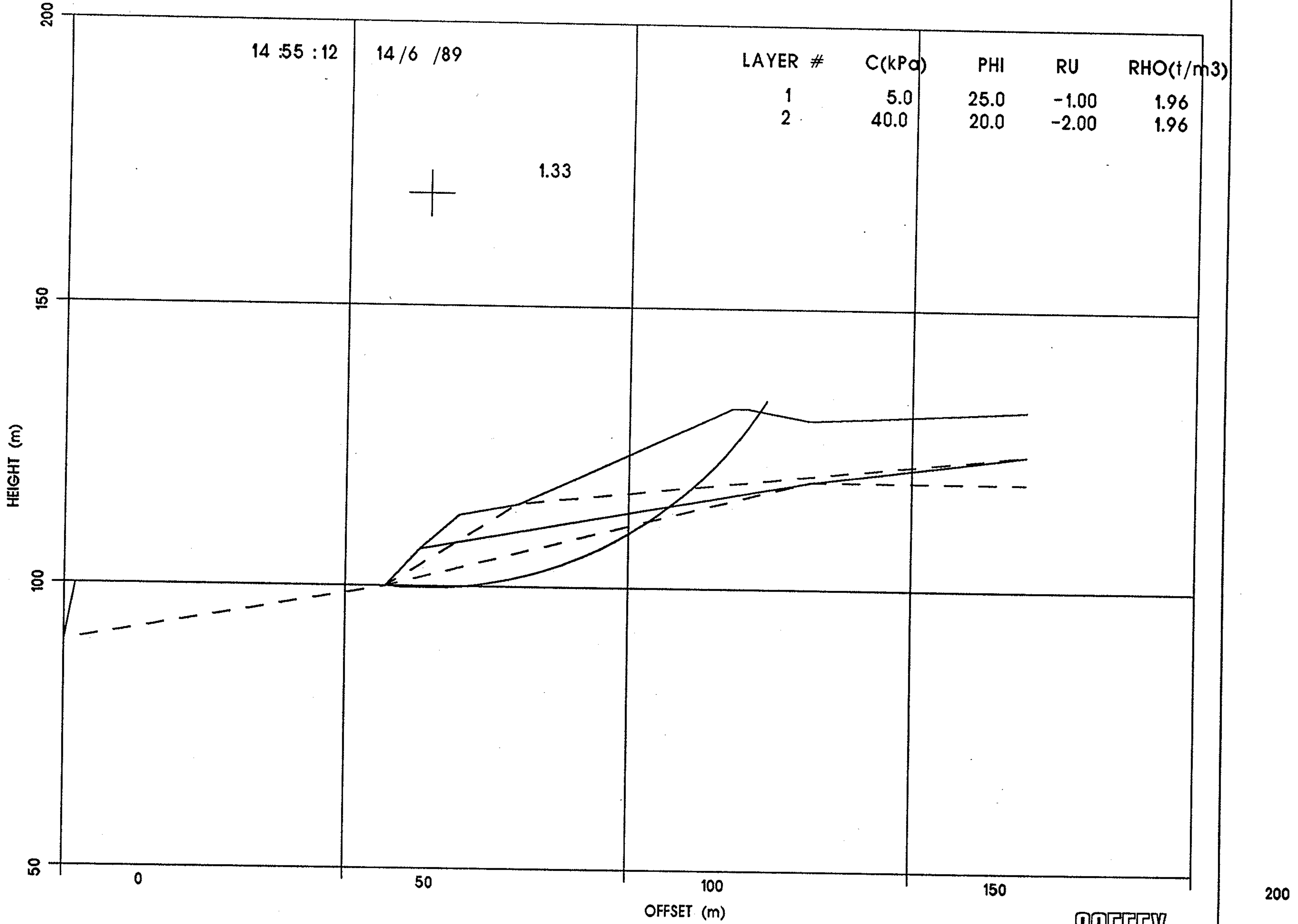
LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.24
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-2.00	1.96

SOUTH3 SCALE 1: 1000. - SOUTH3:RL 140.85 DUAL WATERTABLE

SOUTH STABILITY

14 :55 : 12   14/6 /89

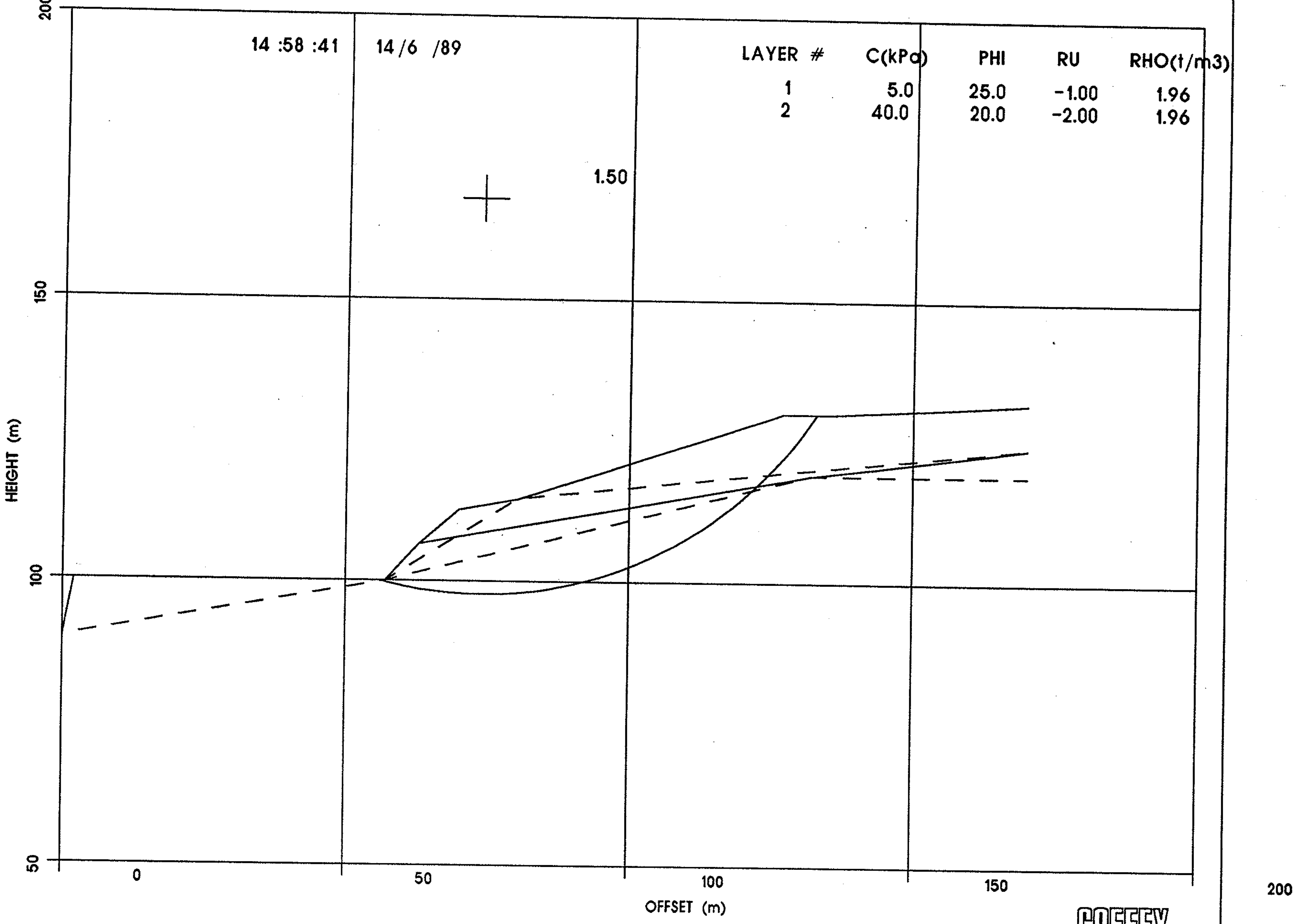
LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	5.0	25.0	-1.00	1.96
2	40.0	20.0	-2.00	1.96



SOUTH4   SCALE 1: 1000. - SOUTH4:RL 132 RL DUAL WATERTABLE

COFFEY

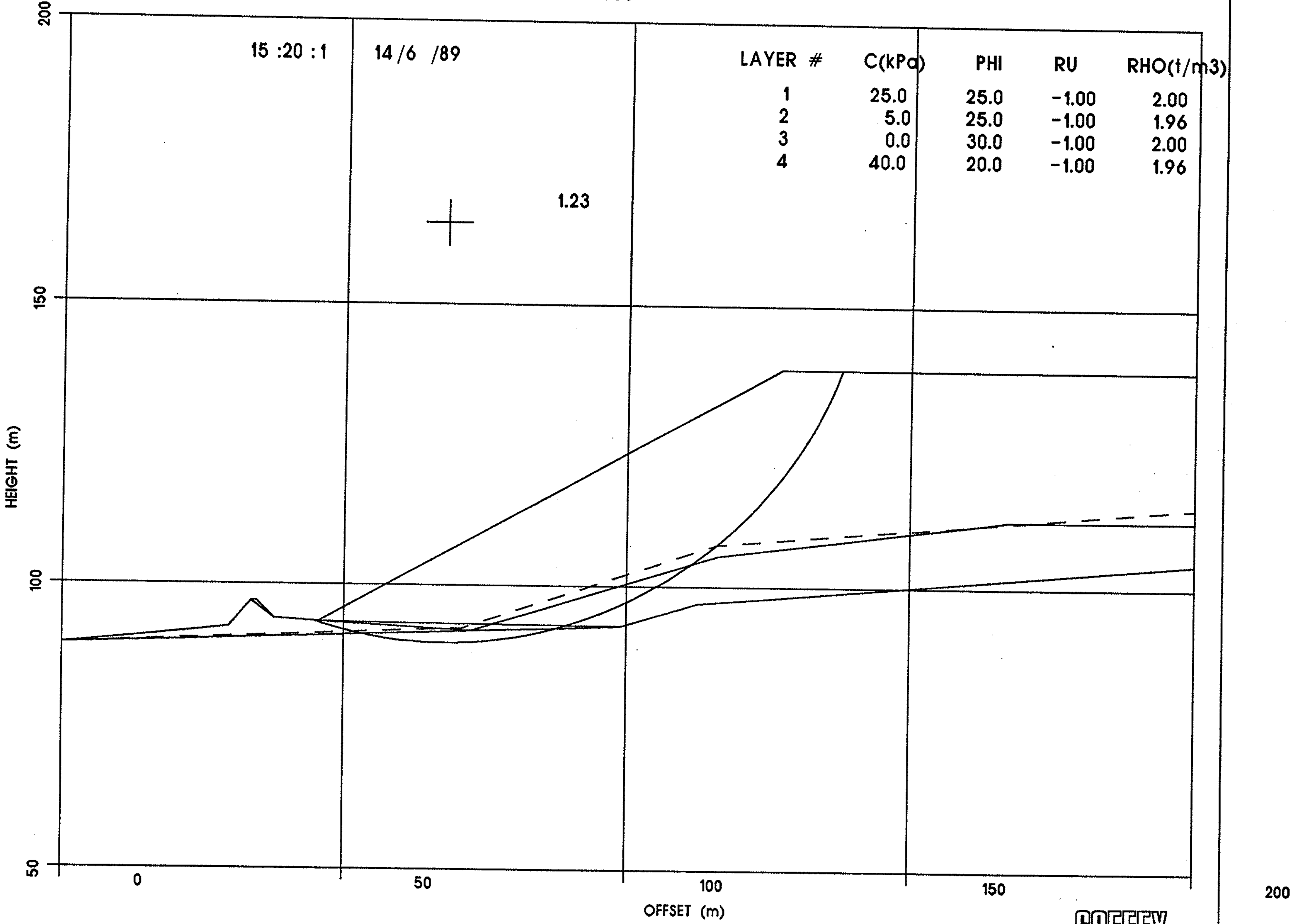
SOUTH STABILITY



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	5.0	25.0	-1.00	1.96
2	40.0	20.0	-2.00	1.96

SOUTH8 SCALE 1: 1000. - SOUTH4:RL 13 RL DUAL 3 to 1

Stability Analysis for section ch350

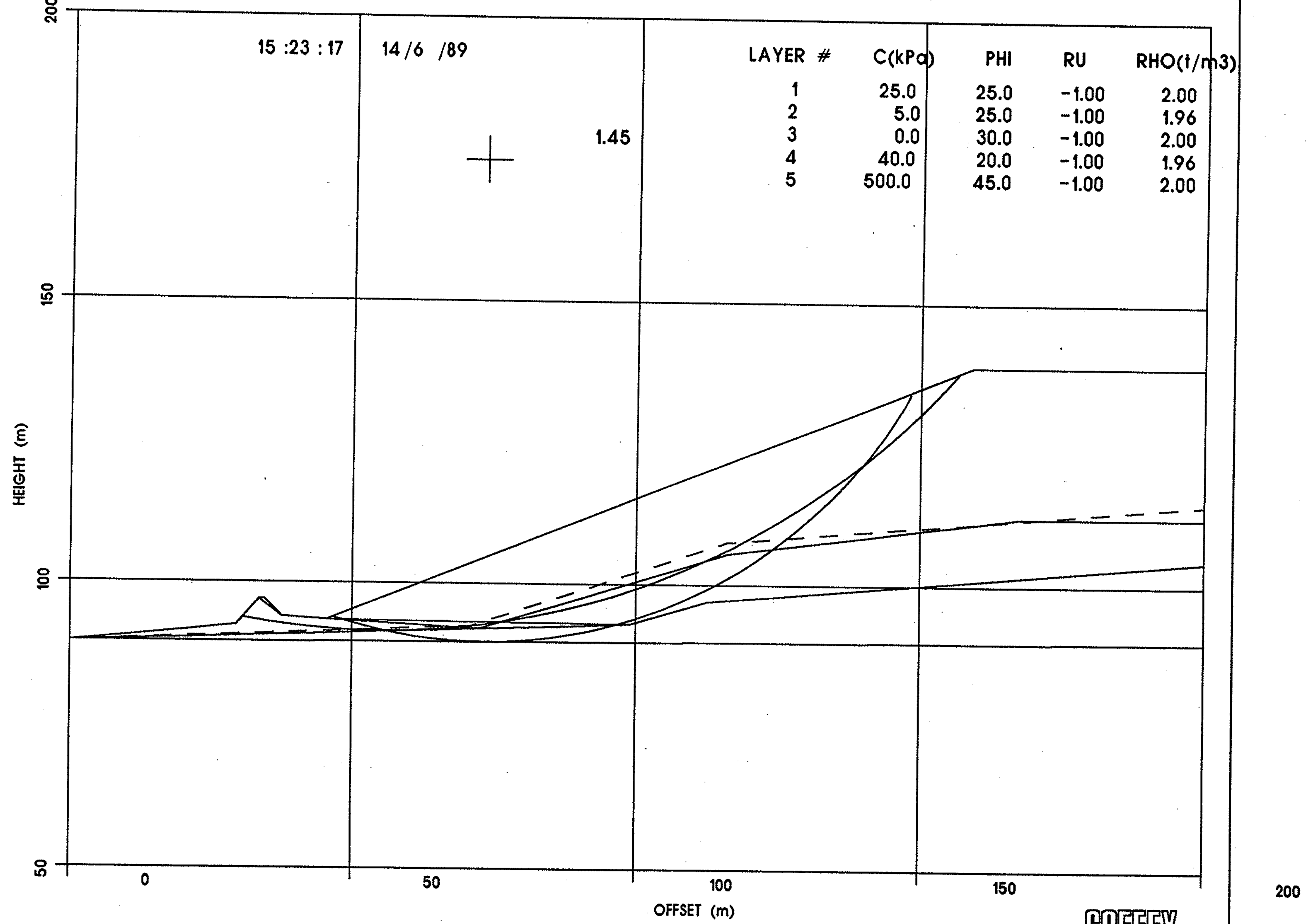


LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	0.0	30.0	-1.00	2.00
4	40.0	20.0	-1.00	1.96

CASE1 SCALE 1: 1000. - 4 layers

COFFEY

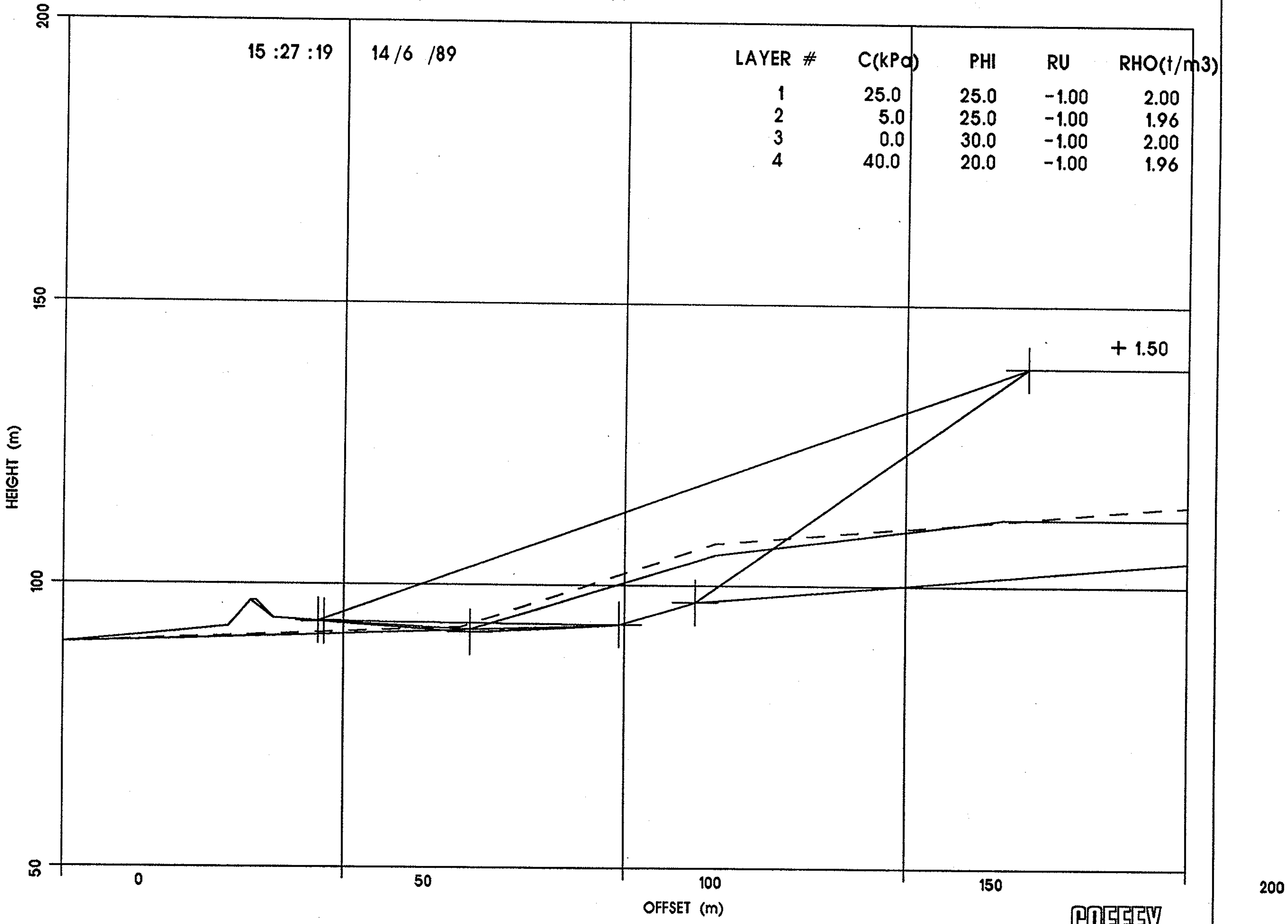
Stability Analysis for section ch350



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	0.0	30.0	-1.00	2.00
4	40.0	20.0	-1.00	1.96
5	500.0	45.0	-1.00	2.00

CASE3R SCALE 1: 1000. - slope 1:2.5

Stability Analysis for section ch350



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	0.0	30.0	-1.00	2.00
4	40.0	20.0	-1.00	1.96

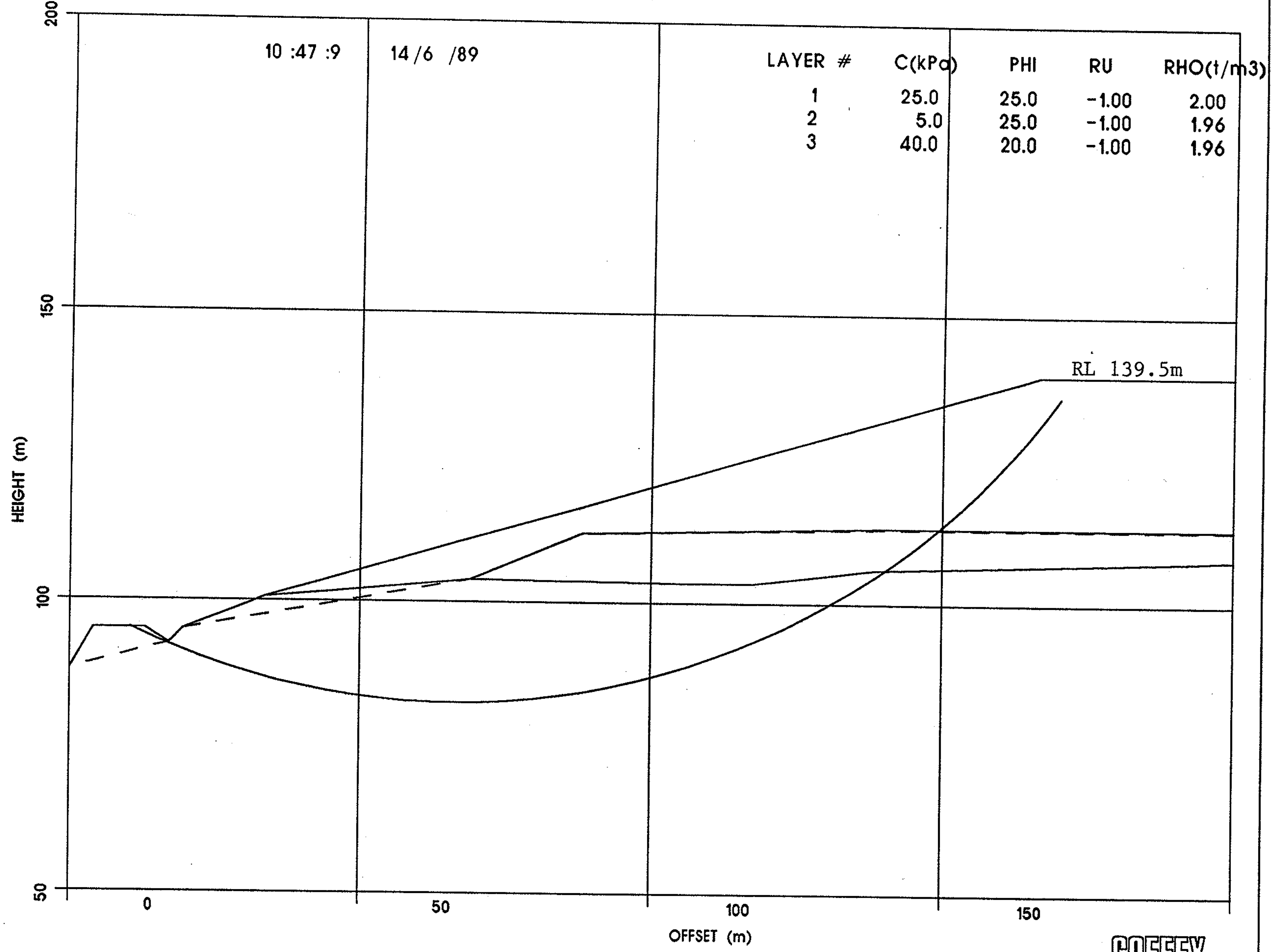
CASE3L SCALE 1: 1000. - slope TO 171.55

COFFEY

1.47

Stability Analysis for section ch310

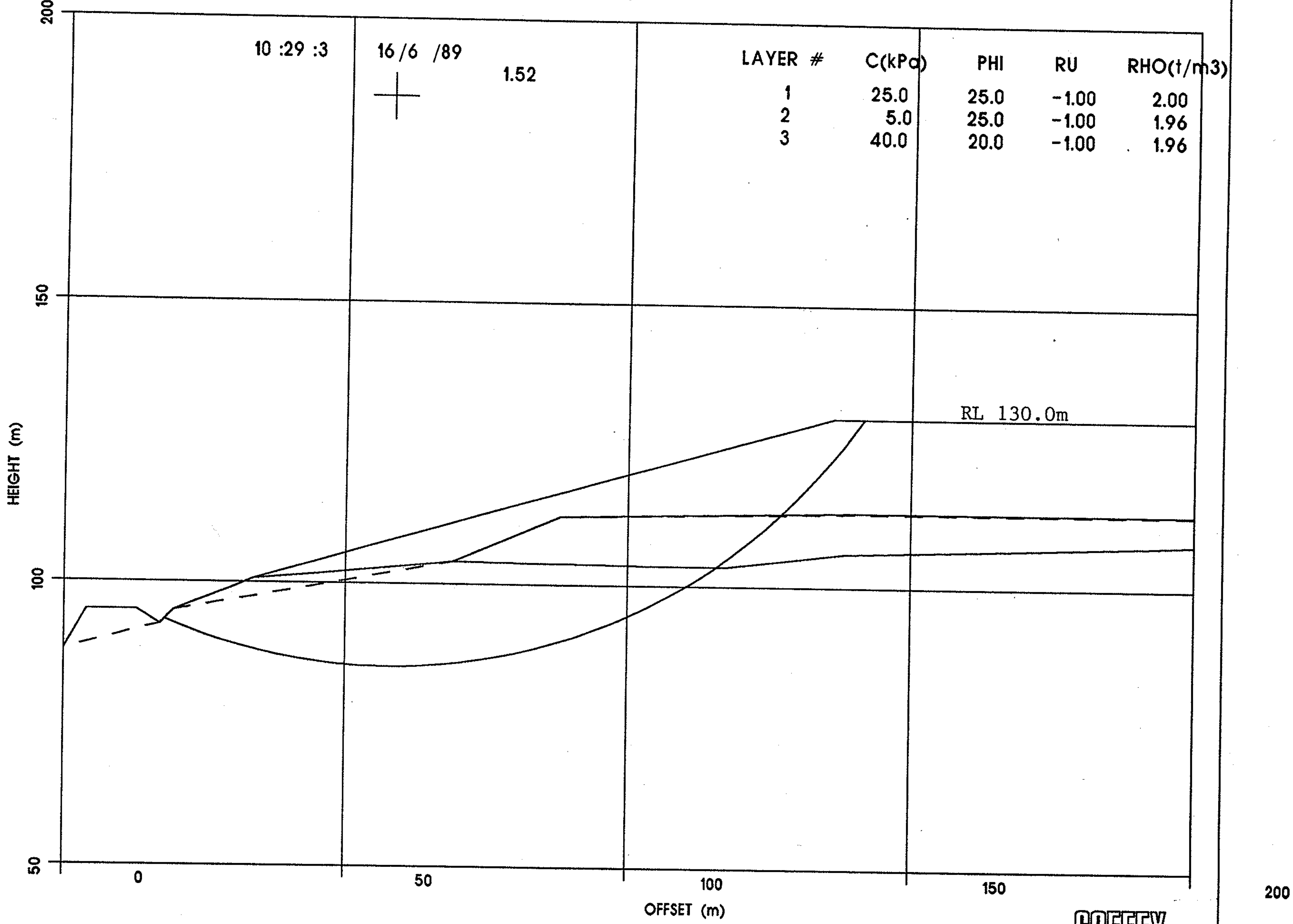
10 :47 :9 14/6 /89



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-1.00	1.96

C310A4 SCALE 1: 1000. - SLOPE 1 in 3.5 (NO ROCK)

Stability Analysis for section ch310

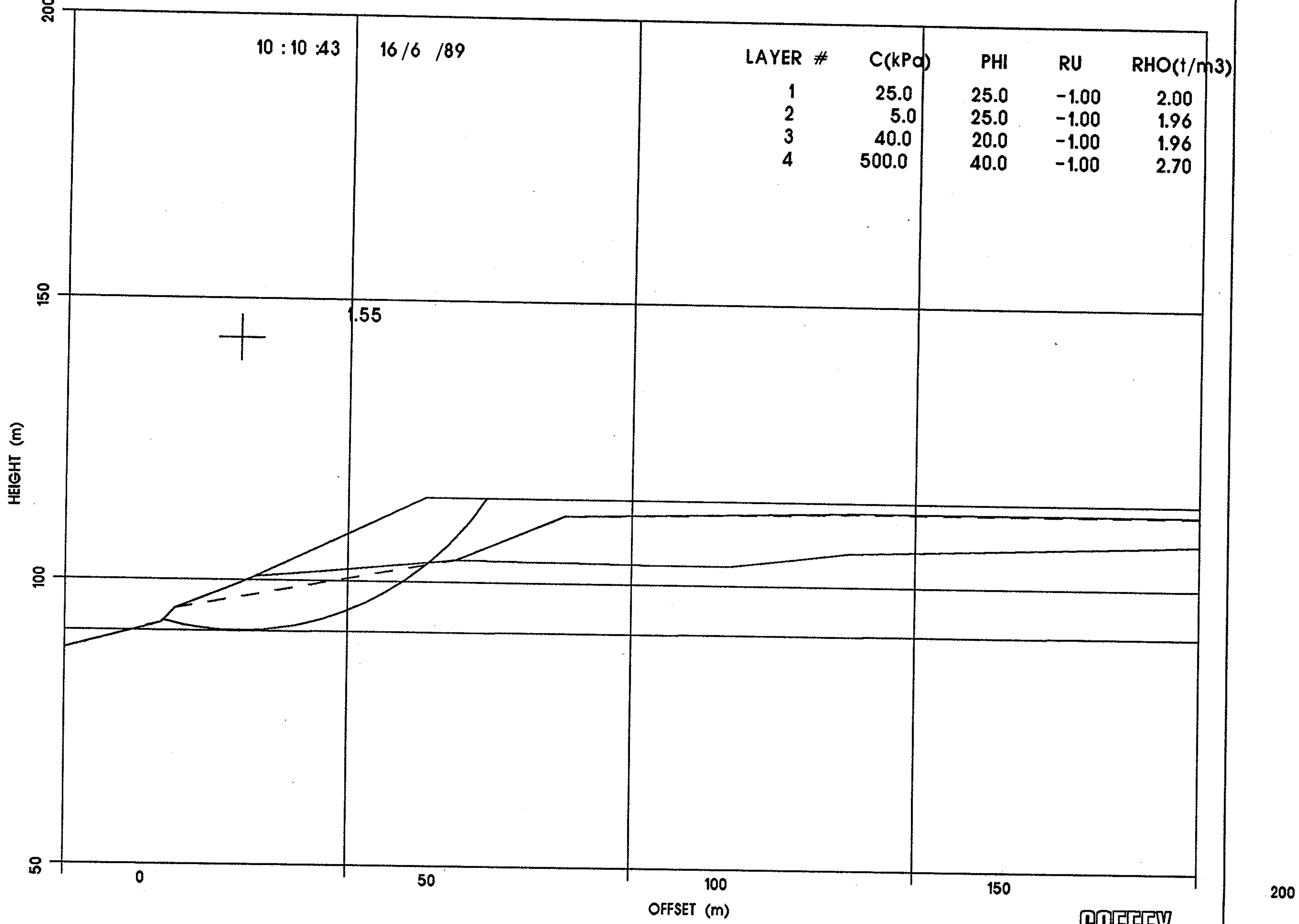


LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-1.00	1.96

C310A4L SCALE 1: 1000. - SLOPE 1 in 3.5 (NO ROCK)

COFFEY

Stability Analysis for section ch310



LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-1.00	1.96
4	500.0	40.0	-1.00	2.70

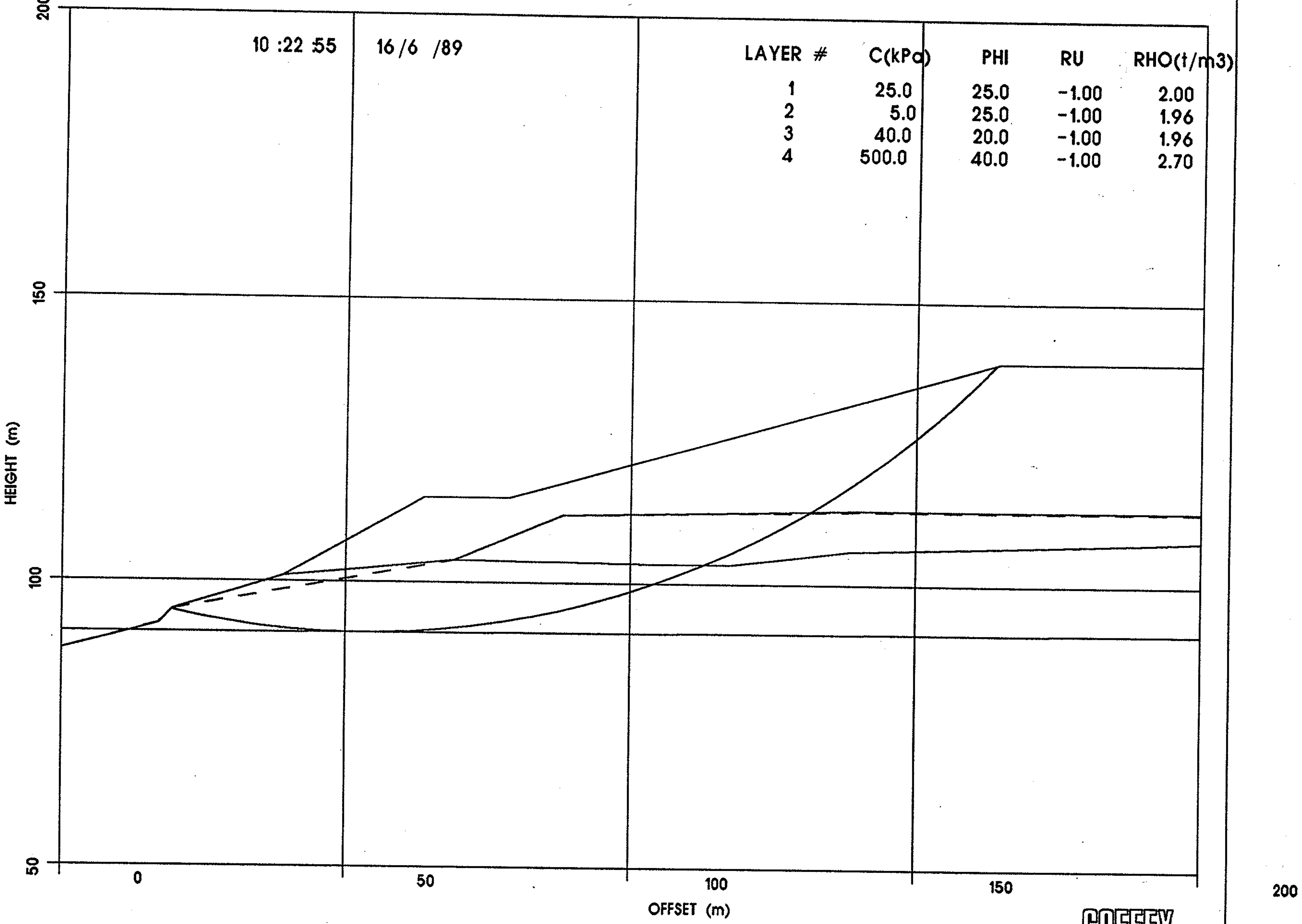
C310C9 SCALE 1: 1000. - SLOPE 1:1.75 TO RL115.0

COFFEY

Stability Analysis for section ch310

10 :22 :55   16 /6 /89

LAYER #	C(kPa)	PHI	RU	RHO(t/m3)
1	25.0	25.0	-1.00	2.00
2	5.0	25.0	-1.00	1.96
3	40.0	20.0	-1.00	1.96
4	500.0	40.0	-1.00	2.70



C310C10   SCALE 1: 1000. - SLOPE 1:1.75(BOTTOM) 1:3.5 (TOP)

COFFEY

APPENDIX D

This appendix provides our estimate of costs and fees for undertaking additional geotechnical work as outlined in the report.

The proposed work comprises:

- Drilling, Pitting and sampling (See attached schedule 1)
- Installation of piezometers (See attached schedule 2)
- Test pit excavation
- Observation of piezometers for 1 month after installation
- Laboratory shear testing of fill and natural ground
- Analysis of Data
- Reporting

It is assumed that a water supply will be available on site for drilling water and that an excavator will be available for the recovery of bulk and block samples.

It is envisaged that interaction with Council personnel will be required to arrive at design profiles.

All work would be undertaken in accordance with our Standard Terms of Agreement, a copy of which is included. This estimate does not allow for advice or testing on site during construction.

FURTHER GEOTECHNICAL INVESTIGATION WORK
ESTIMATE OF COSTS AND FEES

1.0 Field Work

Including continuous site attendance, drilling expenses and monitoring of water levels for 1 month- see attached schedule 1.	54 450.00

2.0 Laboratory Testing

3 Large Shear tests on HW Breccia - allow		9 000.00
6 Triaxial tests on EW Breccia }		
3 Triaxial tests on existing fill}	12 @ 706	8 472.00
3 Triaxial tests on new fill }		
12 Atterberg limits on EW Breccia and fill	@ 95	1 140.00
6 Compaction tests on fill	@ 93	558.00
6 Grading tests on fill	@ 68.50	411.00
Preparation of samples for triaxial testing	10 @ 63	630.00

3.0 Analysis and Reporting

Principal	120 hours @ 105.00/hr	12 600.00
Senior Geologist	105 hours @ 65.00/hr	6 825.00
Engineer	80 hours @ 55.00/hr	4 400.00
Tracing/Typing etc	54 hours @ 50.00/hr	2 700.00
Costs (Photography etc)		200.00
Mileage - allow		200.00
Computing - allow		3 000.00
		$104 586.00

SCHEDULE 1

FIELD WORK - DRILLING PITTING AND SAMPLING

Assumes total metres to be drilled approximately 500m
Assuming average 20m/10hr day = 25 days drilling

1.1 Drilling

*Drilling	250hrs @ 105.00	26 250.00
Core Boxes	90 @ 25.00	2 250.00
PVC - piezometers	Allow	2 000.00
Bentonite Pellets	Allow	500.00
U50 samples	30 @ 15.00	450.00
Geologist/Engineer	250hrs @ 65.00	16 250.00
Travel	Allow	300.00
Borehole Logs	70 pages @ 35.00/pg	2 450.00
		50 450.00

*Note: Provision needs to be made for water for drilling. Either Council provide water chart or Drilling Contractor provide water chart at extra cost not included above.

1.2 Monitoring Water Levels

Allow 2 x 5hr visits/week for 1 month

Geologist/Engineer 40hrs @ 65.00		2 600.00	
Travel	Allow	100.00	
			2 700.00

1.3 Test Pitting for Bulk and Block Samples

Geologist/Engineer	Allow 2 x 10hrs @ 65.00	1 300.00

*Note: assumes use of excavator is available from Council free of charge.

SCHEDULE 2
BOREHOLE LOCATIONS - PIEZOMETER LOCATIONS & LEVELS

(see Plan)

Note: Fresh rock assumed to be approximately RL90m

Ch 105m
Piezometer in residual soil - say 2m deep } both at toe of
Piezometer in HW Breccia - say 8-10m deep } existing fill embankment

Ch 150m
Piezometer in fill - say 6 - 8m deep }
Piezometer in HW Breccia - say 10 - 12m deep } all drilled on existing field
Piezometer in Fr Breccia - say 60 -65m* deep }

Piezometer in residual soil - say 2m deep } both at toe of existing
Piezometer in HW Breccia - say 8-10m deep } fill embankment

Ch 190m
Piezometer in residual soil - say 2m deep } both at toe of existing
Piezometer in HW Breccia - say 8 - 10m deep } fill embankment

Ch 230m
Piezometer in fill - say 6 - 8m deep }
Piezometer in HW Breccia - say 10 - 12m deep } all drilled on existing field
Piezometer in Fr Breccia - say 60 - 65m* deep }

Piezometer in residual soil - say 2m deep } drilled adjacent to existing
Piezometer in Fr Breccia - say 30 - 35m deep } BH8.

Piezometer in HW Breccia - say 8 - 10m deep - } drilled at toe of existing fill downhill of BH7

Piezometer in alluvium - say 1 - 2m deep } drilled in creek bed - proline

Piezometer in Fr Breccia - say 12 - 15m+ deep }

Ch 270m
Piezometer in HW Breccia - say 4 - 8m deep - }near north west toe of existing fill embankment

Ch 310m
3 Piezometers in Fill - say 4 - 8m deep } all drilled on existing
Piezometer in HW Breccia - say 10 -12m deep } filled area
Piezometer in Fr Breccia - say 45 - 50m* deep }

Piezometer in EW/Residual soil - say 2m deep } both to be drilled
Piezometer in HW Breccia - say 6 - 8m deep } adjacent to TP3

Piezometer in HW Breccia - say 4 - 6m deep - }adjacent to creek

Ch 330m/Existing Creek
3 Piezometers in Fill - say 4 - 6m deep } all drilled on existing
Piezometer in HW Breccia - say 10 - 12m deep } filled area

Piezometer in EW Breccia/Residual soil - say 2m deep } drilled south of creek
Piezometer in MW Breccia - say 4 - 6m deep }approx. 15m east of BH6

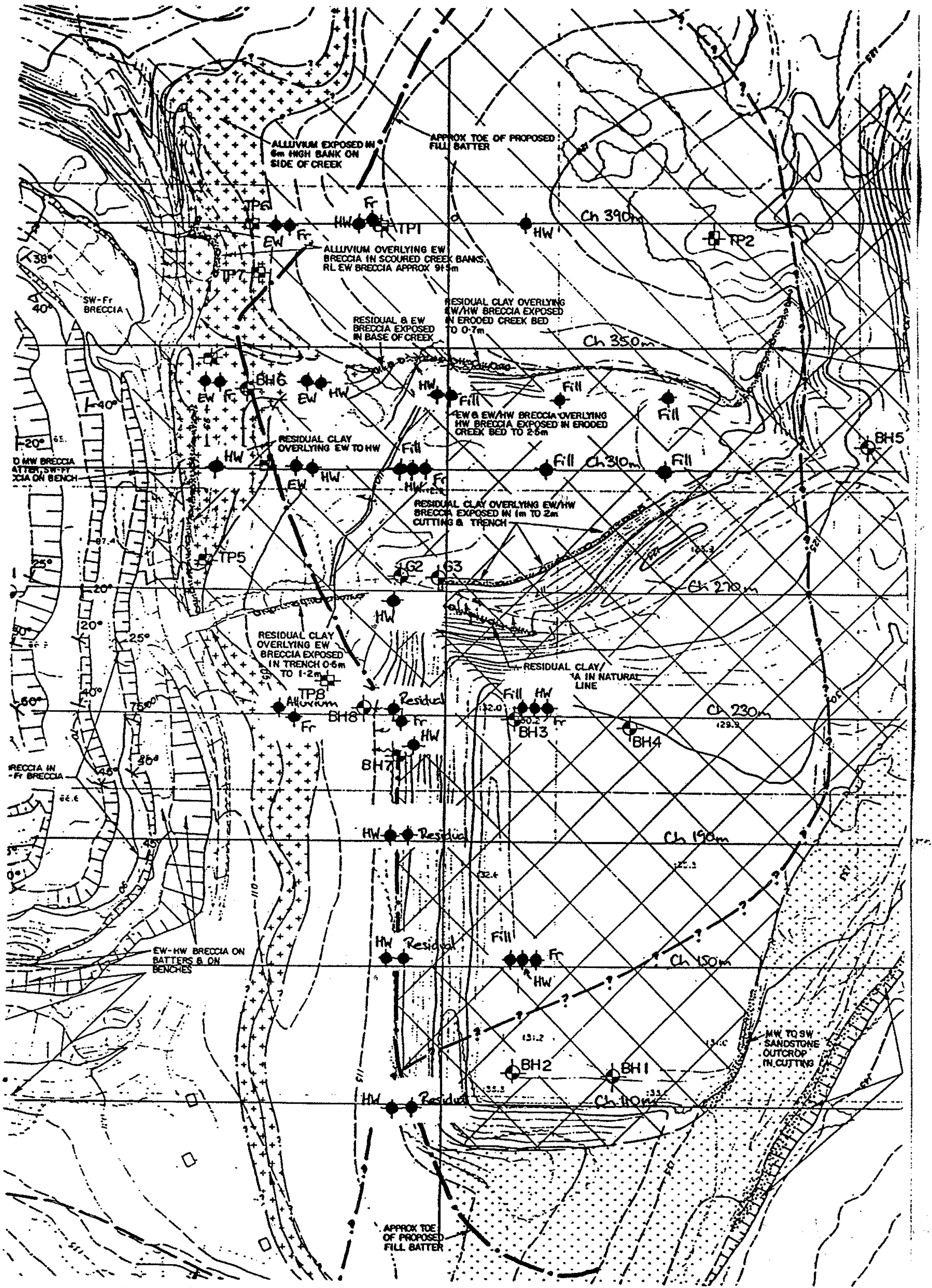
Piezometer in EW Breccia - say 3m deep } drilled adjacent to N/S
Piezometer in Fr Breccia - say 30 - 35m# deep } Creek near TP4

Ch 350m
Piezometer in HW Breccia - say 4 - 8m deep - }Approximately midway TP1 & TP2

Piezometer in HW Breccia - say 4 - 8m deep }drilled on knoll near TP1
Piezometer in Fr Breccia - say 15 - 20m deep }

Piezomater in Ew Breccia - say 2m deep }drilled on alluvial
Piezometer in Fr Breccia - say 25 - 30m* deep } floodplain near TP6

* 20-25m into Fresh Breccia
# 15-20m into Fresh Breccia
\+ 2-5m into Fresh Breccia



HW Proposed Borehole/Piezometer location including rock/soil material in which piezometer will be installed.

Coffey & Partners Pty Ltd Consulting Engineers in the geotechnical sciences

drawn	AS	HORNSBY SHIRE COUNCIL OLD MANS VALLEY PROPOSED GEOTECHNICAL BOREHOLE/ PIEZOMETER LOCATION	COFFEY	drawing no: D1
approved				
date				
scale	1:2000			job no: S8463/2

APPENDIX E

This appendix provides our estimate of costs and fees for undertaking a rock mechanics study of the eastern quarry face area.

The proposed work includes:

- Geological and structural mapping of the eastern face and portion of the adjoining faces of the quarry over the full height. This would extend and support the work done to date.
- Drilling four inclined cored boreholes and orientation of core. The number and locations should be reviewed after the mapping.
- Measurement of water levels in boreholes.
- Analysis and reporting of data.

Work would be undertaken in accordance with our Standard Terms of Agreement (Rev 89/3), a copy of which is given in Appendix D.

It is assumed that a single proposed quarry plan is to be analysed.

ROCK MECHANICS STUDY FOR QUARRY FACE

1.0 Field Work

1.1 Line Mapping of Eastern Quarry Face

Allow 6 x 10 hr days for geologist and technician

Geologist	60 hrs @ 65.00	3,900.00	
Technician	60 hrs @ 45.00	2,700.00	
Travel	allow	70.00	
			6,670.00

1.2 Drilling 4 inclined and oriented boreholes

For planning purposes assume two holes each at Ch 190m and Ch 310m. Assume at each location one hole inclined to east and one to west. Assume total drilling at Ch 190m of 200m and Ch 310 of 180m.

Assume 15m/10 hr day drilling and orienting core.

380m @ 15m/day = 25 days

Drilling	250 hrs @ 105.00	26,250.00	
Core boxes	72 boxes @ 25.00	1,800.00	
PVC - piezometers	allow	1,500.00	
Geologist	250 hrs @ 65.00	16,250.00	
Travel	allow	300.00	
Borehole logs	45 pages @ 35.00	1,575.00	
			47,675.00

2.0 Processing field data

Line Mapping

Engineer/Geologist	32 hrs @ 60.00	1,920.00	
Report Production Staff	24 hrs @ 50.00	1200.00	
			3,120.00

Drilling

Engineer/Geologist	32 hrs @ 60.00	1,920.00	
Report Production Staff	24 hrs @ 50.00	1,200.00	
			3,120.00

3.0 Reporting and Analysis

Principal	30 hrs @ 105.00	3,150.00
Senior Engineer/ Senior Geologist	50 hrs @ 85.00	4,250.00
Engineer/Geologist	35 hrs @ 65.00	2,275.00
Report Preparation and Tracing etc	30 hrs @ 50.00	1,500.00

11,175.00

TOTAL 71,760.00

NOTE: An arrangement for provision of water for drilling will have to be made. Either Council provide water chart or Drilling Contractor provide water chart at extra cost. No provision for this has been made above.

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drawn:	CPT/SW
approved:	B
date:	March 89
scale:	1:1000

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
SITE PLAN

COFFEY

FIGURE 1

job no: S8463/2

FIGURE 2

GUTTERIDGE HASKINS & DAVEY
CONSULTING ENGINEERS
123-125 CLARENCE ST, SYDNEY.

SPORTS GROUND PROPOSAL
HORNSBY

Designed: J.W.S.	Approved:	11427/1/3
Drawn: J.W.S.	Date: 21-7-70	

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date	16/6/84
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HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
PRESENT CONDITIONS &
RESULTS OF GEOLOGICAL MAPPING

COFFEY

FIGURE 3

job no: S8463/2

LEGEND

- APPROXIMATE TEST PIT LOCATION } C&P 1989
- APPROXIMATE BOREHOLE LOCATION } C&P 1989
- ● APPROXIMATE BOREHOLE LOCATION - GOLDER ASSOCIATES 1982

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date:	16/6/89
scale:	1:500

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
RECENT GROUND SURVEY & SECTIONS

COFFEY

FIGURE 4

job no: S8463/2

NOTE- THE GROUND SURFACE AS SURVEYED 21/7/70 HAS BEEN SCALED FROM AN IMPERIAL CONTOUR PLAN. SOME DISCREPANCIES BETWEEN THIS SURFACE & THE EXISTING GROUND SURFACE LEVELS ARE NOTED IN AREAS WHERE NO FILL HAS BEEN PLACED. THESE DISCREPANCIES ARE PROBABLY DUE TO SCALING & CONVERSION DIFFICULTIES. THEREFORE, THE 1970 GROUND SURFACE LEVELS PROVIDE INDICATIVE PROFILES ONLY.

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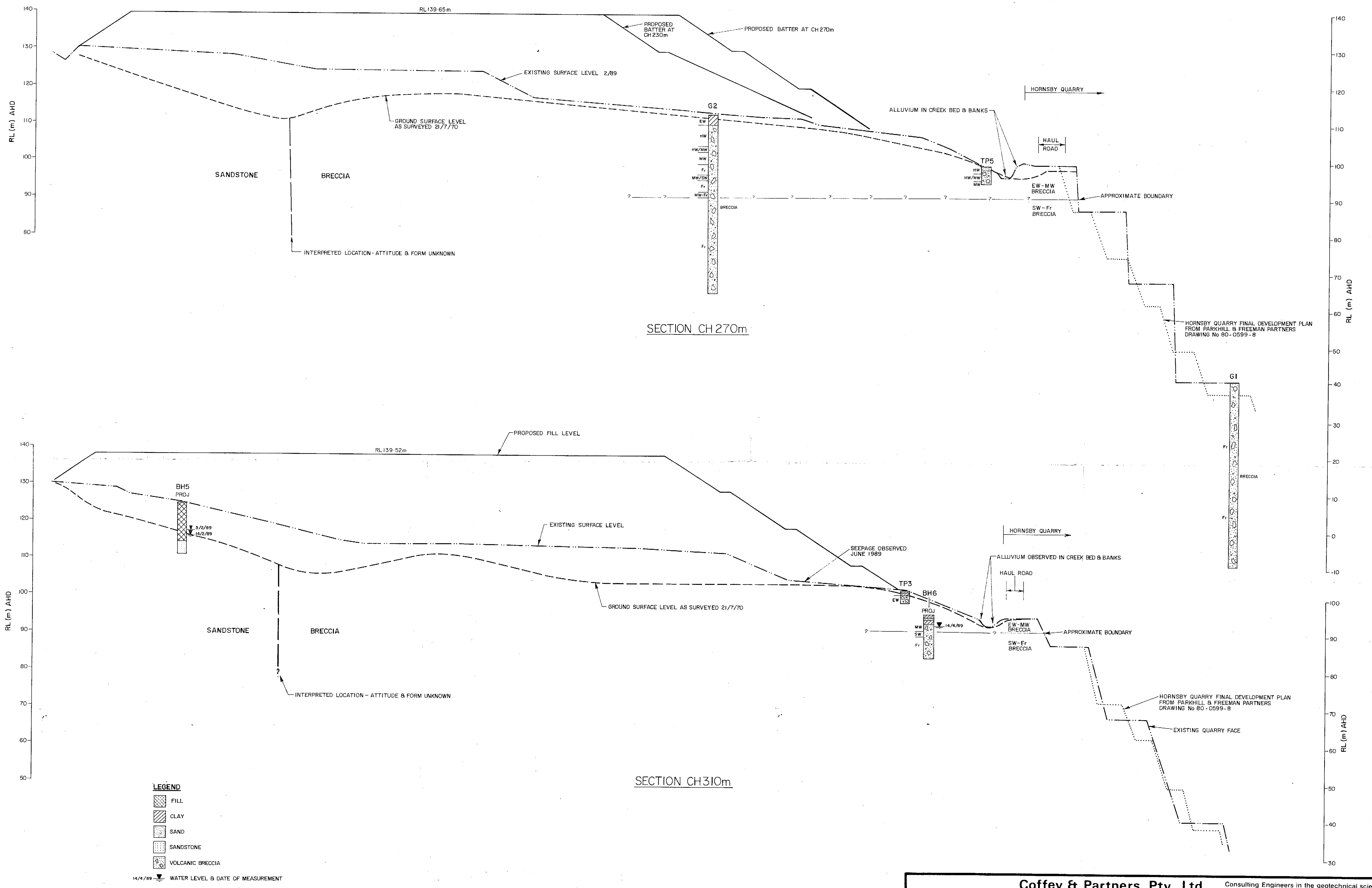
date:	16/6/89
scale:	1:500 H&V

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
CH170m, CH190m & CH215m

COFFEY

FIGURE 5

job no: S8463/2



NOTE - THE GROUND SURFACE AS SURVEYED 21/7/70 HAS BEEN SCALED FROM AN IMPERIAL CONTOUR PLAN. SOME DISCREPANCIES BETWEEN THIS SURFACE & THE EXISTING GROUND SURFACE LEVELS ARE NOTED IN AREAS WHERE NO FILL HAS BEEN PLACED. THESE DISCREPANCIES ARE PROBABLY DUE TO SCALING & CONVERSION DIFFICULTIES. THEREFORE, THE 1970 GROUND SURFACE LEVELS PROVIDE INDICATIVE PROFILES ONLY.

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approved: AS
date: [illegible]
scale: 1:500 H&V

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
CH270m & CH310m

COFFEY

FIGURE 6

job no: S8463/2

LEGEND

▨	FILL
▨	CLAY
▒	SAND
⁞	SANDSTONE
⁘	VOLCANIC BRECCIA
14/4/89 ▼	WATER LEVEL & DATE OF MEASUREMENT

EW	EXTREMELY WEATHERED
HW	HIGHLY WEATHERED
MW	MODERATELY WEATHERED
SW	SLIGHTLY WEATHERED
Fr	FRESH

NOTE- THE GROUND SURFACE AS SURVEYED 21/7/70 HAS BEEN SCALED FROM AN IMPERIAL CONTOUR PLAN. SOME DISCREPANCIES BETWEEN THIS SURFACE & THE EXISTING GROUND SURFACE LEVELS ARE NOTED IN AREAS WHERE NO FILL HAS BEEN PLACED. THESE DISCREPANCIES ARE PROBABLY DUE TO SCALING & CONVERSION DIFFICULTIES. THEREFORE, THE 1970 GROUND SURFACE LEVELS PROVIDE INDICATIVE PROFILES ONLY.

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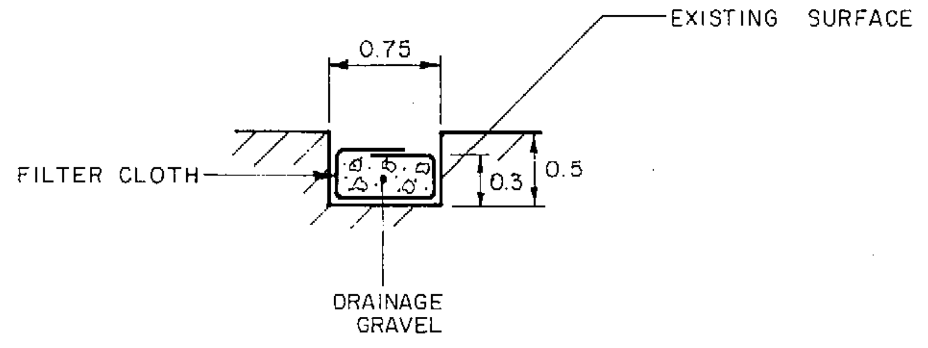
drawn: AS / AB
approved: AS.
date: 16/6/89
scale: 1:500 H&V

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
STABILITY OF PROPOSED FILL
CH350m & CH390m

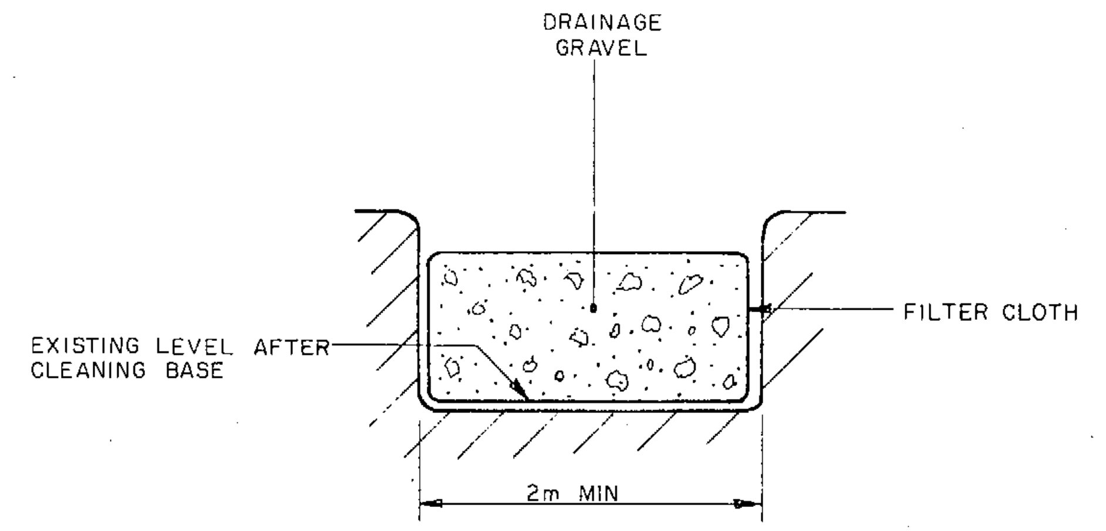
COFFEY

FIGURE 7

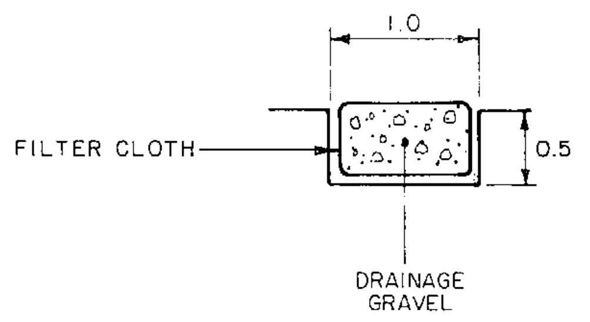
job no: S8463/2



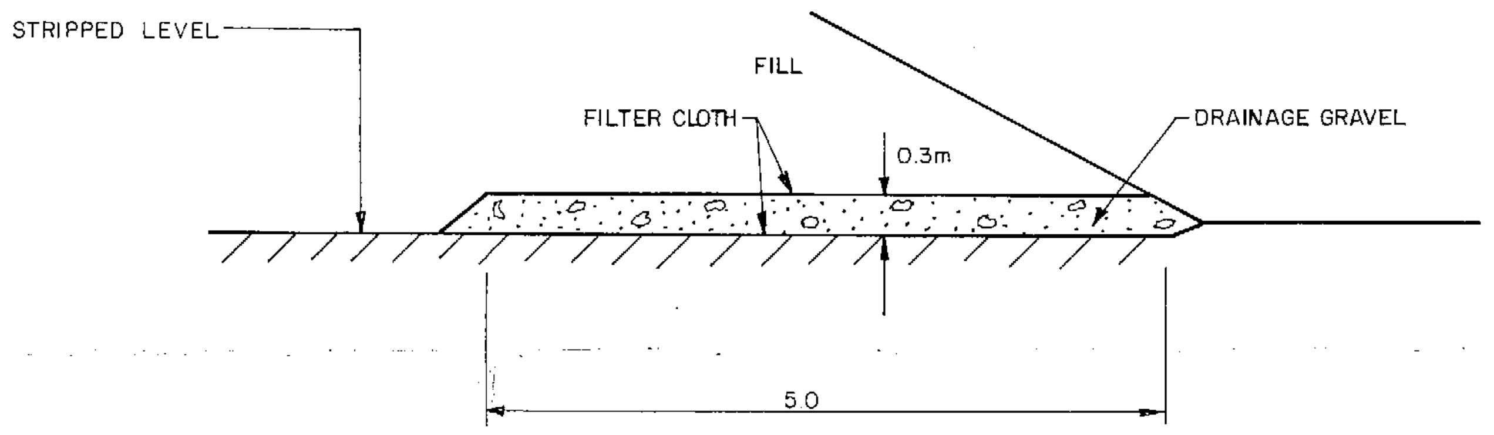
SECTION A-A
HERRINGBONE DRAINS
TYPICAL



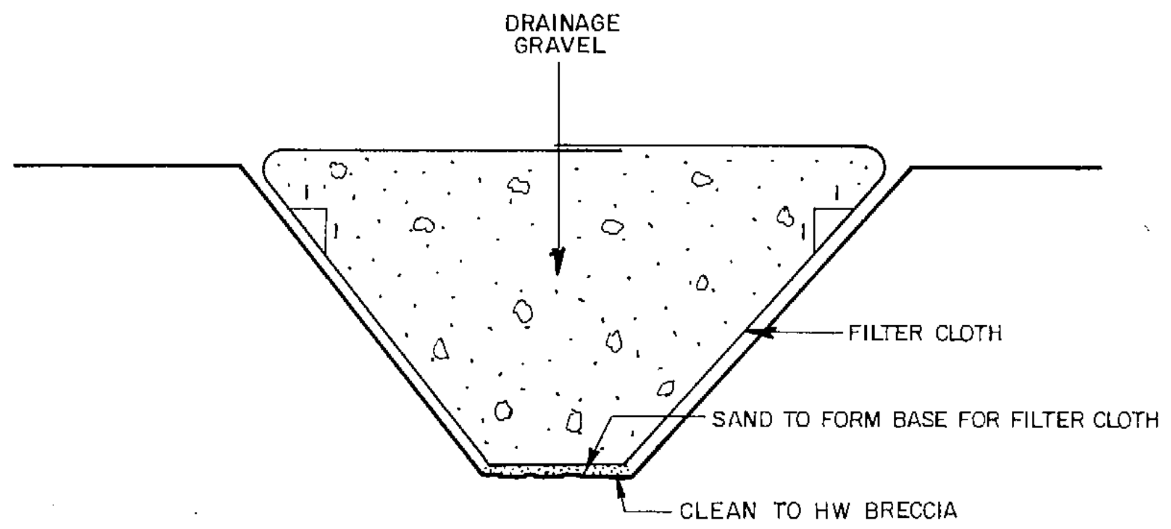
SECTION B-B
FROM F to J (approx)



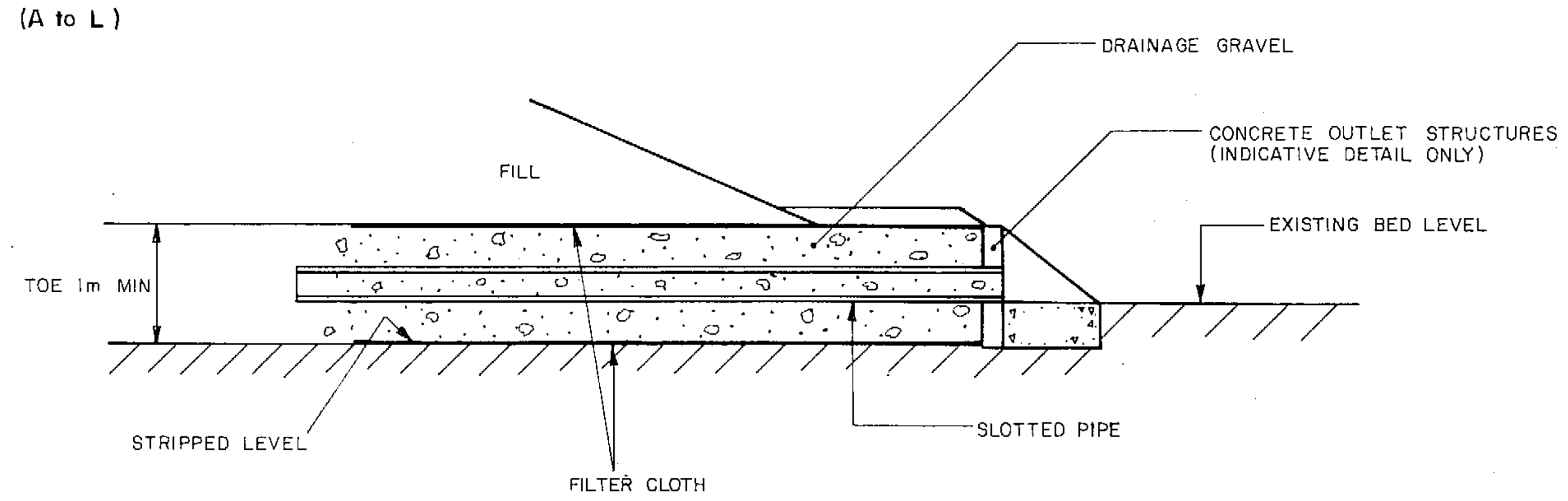
SECTION C-C
(D & C to A, K to I, E & G to F)



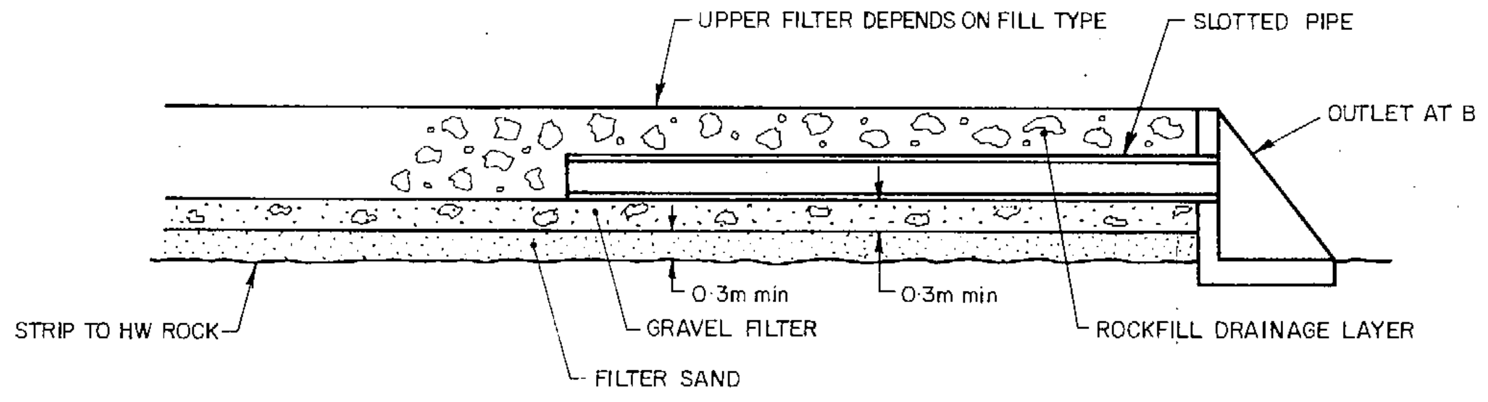
SECTION D-D
TOE DRAIN (H to M, F to N)



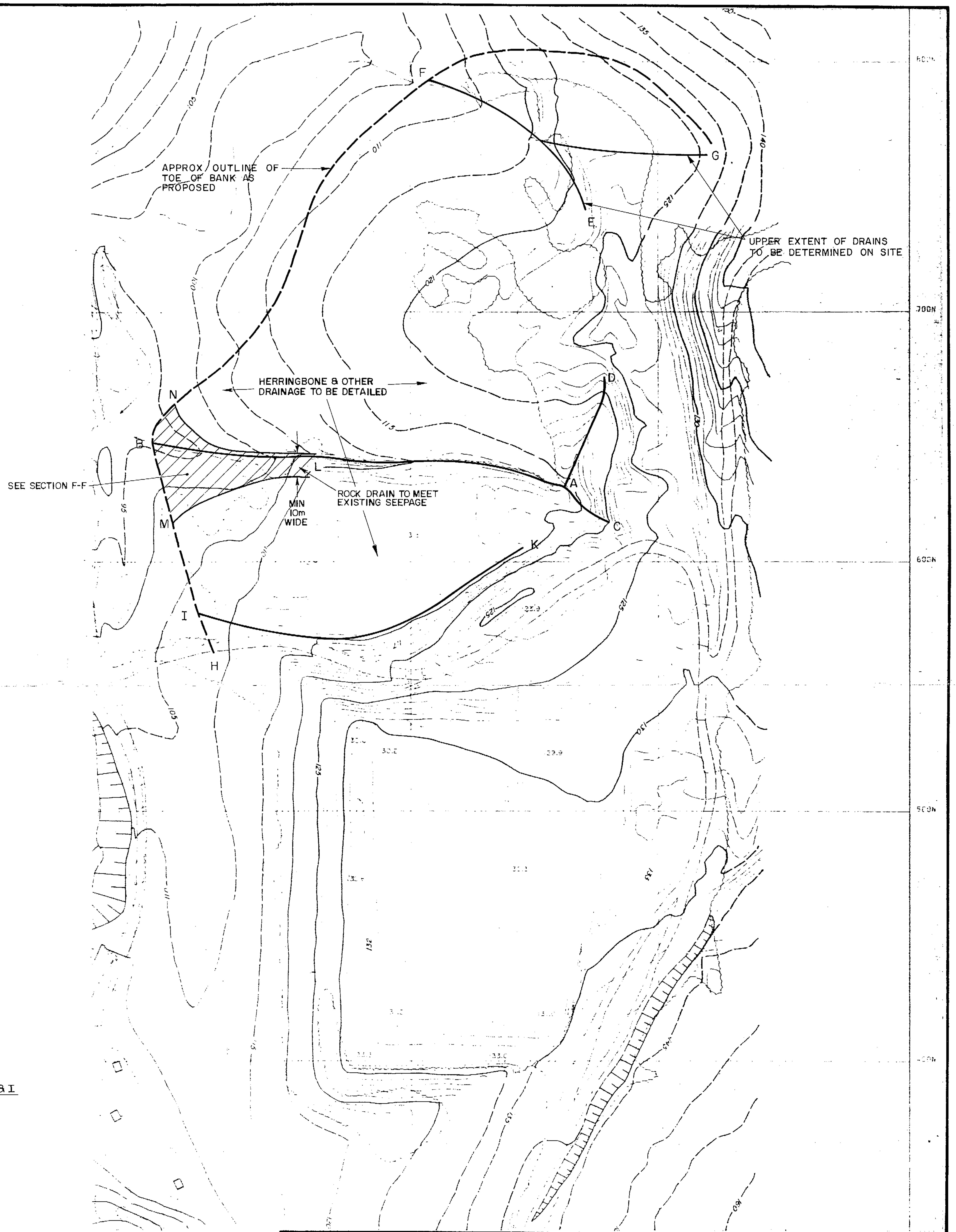
SECTION E-E
(A to L)



OUTLET STRUCTURE AT F & I



SECTION F-F
NOTE - FILTER LAYERS WRAP UPWARDS AT EDGES TO PROTECT AGAINST PIPING INTO ROCKFILL



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drawn. CPT/AB
approved:
date.
scale. 1:1000

HORNSBY SHIRE COUNCIL
OLD MAN'S VALLEY
INDICATIVE DRAINAGE DESIGN

FIGURE 13
job no: S8463/2