

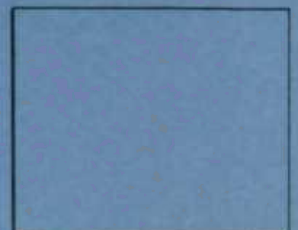
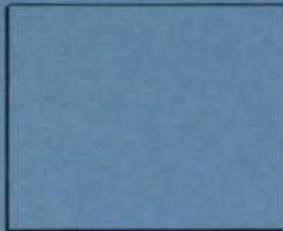
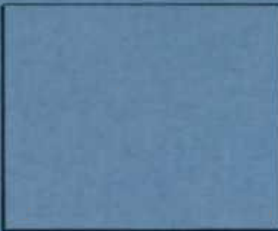
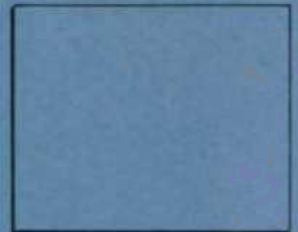
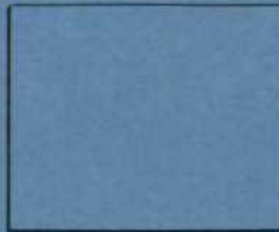
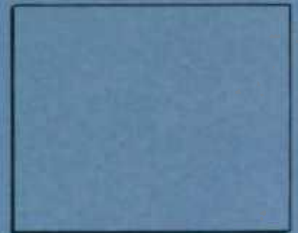
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INSTITUTE of  
HYDROLOGY



Site Investigation of  
Coronation Plantation  
Plylimon - September 1987

## Introduction

A catchment manipulation experiment investigating the recovery from the effects of acid rain has been proposed to take place near the Institute of Hydrology's office at Plynlimon. A site has been chosen at Coronation Plantation (see Fig.1) which seems to satisfy the main site selection criteria. However there was some uncertainty about the nature of the soil at this site and in particular whether the parent material was impermeable. The Institute of Terrestrial Ecology surveyed the site in July 1987 and reported finding a deep peaty gleyed soil. The moist Bg horizon of this soil was considered as 'fairly impermeable' but doubts were raised about the permeability of the underlying dry Bg/Cg horizon.

In order to ascertain the nature of the soil parent material at Coronation Plantation the Institute of Hydrology drilled four boreholes between 25/8/87 and 27/8/87. Casual inspection of the soil under the plantation confirmed the observations made by ITE and the 'bright ochreous mottled' Bg horizon appears to underlie the entire plantation. Furthermore the many ponds of surface water observed, testify to the impermeable nature of this horizon. The IH borehole results indicate that effectively impermeable till occurs as the parent material in the upper part of the plantation and it is this area that is recommended for siting the experiment.

## Method of drilling

Initial hand augering proved inadequate to ascertain parent material and great difficulty was experienced in penetrating down to 1m. Two sites (HA1 and HA2 shown on Fig.2) confirmed the sequence described by ITE. Consequently a jack hammer was used to drive flowthrough bits down to a maximum depth of 6m (at CP2). This method involves drilling at 54mm diameter to give a core in a split liner of 35mm diameter. Cores were cut, photographed and logged on site. Samples were bagged and retained for inspection. Borehole logs were compiled according to BS 5930.1981 and are presented in Appendix I of this report. Borehole sites and selected spot heights were levelled from a spot height of 299m at the road.

## Discussion of drilling results

Parent material proved to be either till or soliflucted till. CP4, towards the upper part of the plantation proved an effectively impermeable unweathered stiff grey till at 2.62m BGL. Above this depth the sequence showed progressive weathering up to the Bg horizon (0.37-0.62 m BGL). Downslope the plantation appears to be mantled with a variable thickness of soliflucted till (see Fig.3). At CP2, 4m of soliflucted till (and soil) overlies till, whereas at CP3 only 2.4m higher but 80m to the NE, soliflucted till is absent and the parent material consists of weathered till. Till was not proved at CP1 where 3.25m of dry soliflucted till (and soil) overlies water bearing fluvioglacial gravels. Difficulty was encountered in measuring water level with electric dippers due to the low conductivity of the groundwater but it seems that this aquifer is slightly artesian. The overlying dry soliflucted till here contrasts with parent material found

elsewhere in the plantation which is moist.

The permeabilities of the parent materials can be summarised as follows:-

Till - effectively impermeable  
Soliflucted till - slightly permeable  
Fluvioglacial gravel - permeable

The following interpretation of these results is offered. Initial deposition of till by an ice sheet was followed by deposition of fluviglacial gravels in the valley bottom (along which the road from Staylitttle to the IH office runs). Finally, solifluction of the till from the upper slopes has resulted in solifluction deposits mantelling the lower slopes of the plantation.

### Conclusions and recommendations

Once the exact site of the experimental plot has been chosen, more boreholes should be drilled to about 2m depth to prove the existence of till under the perimeter of the plot.

Although it is considered here that the till is effectively impermeable there is a slight possibility that it may be fissured. Some infiltration experiments may detect this - narrow diameter borehole cores will not. However it is considered unlikely that any appreciable fissured percolation could occur through this till.

In conclusion it seems that an area of ground in the vicinity of CP4 would provide a suitable soil parent material for the experiment.

A.J. Dixon  
2.9.87

Fig 1. Map Showing Location Of Coronation Plantation

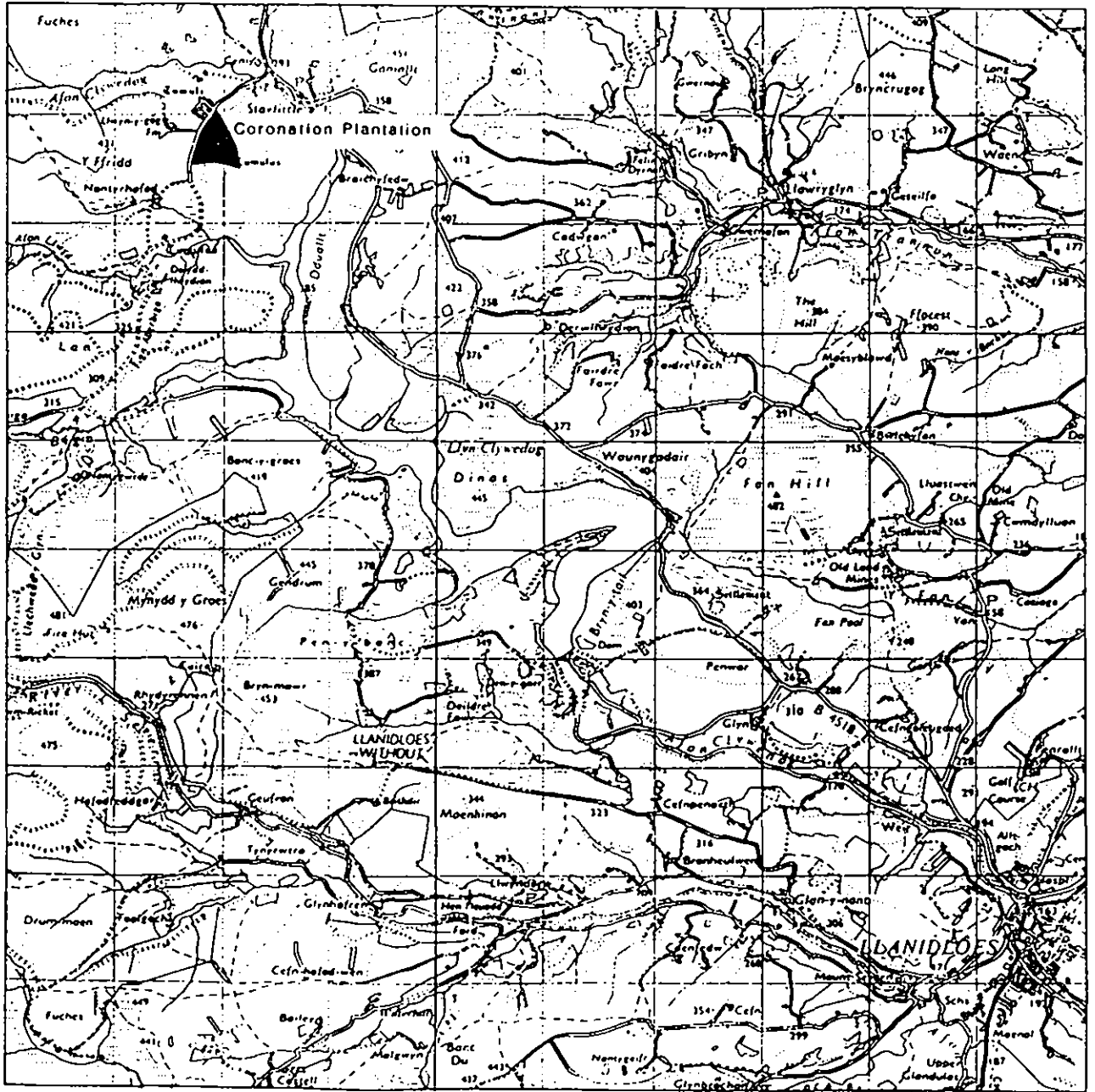
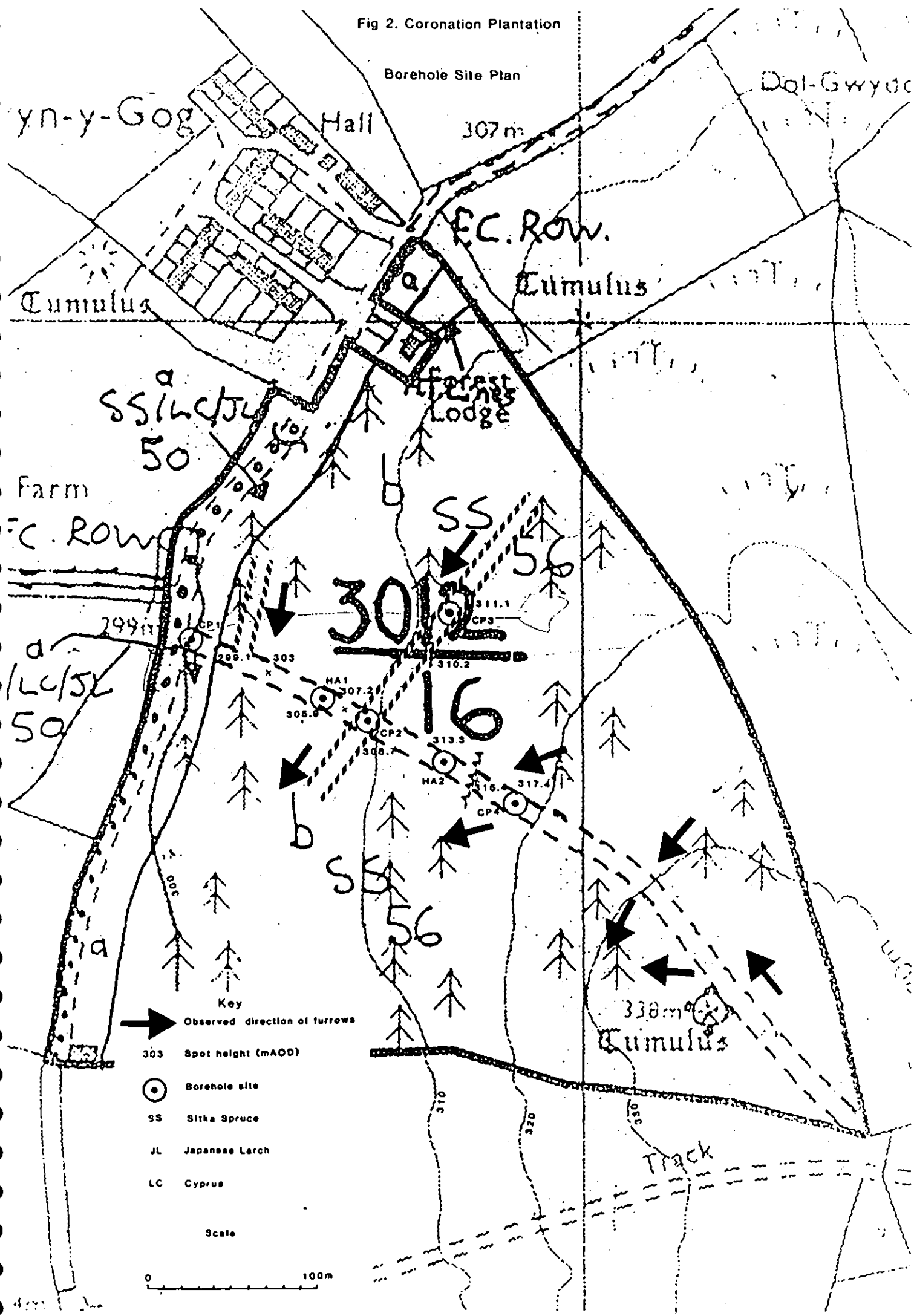


Fig 2. Coronation Plantation

Borehole Site Plan



yn-y-Gog

Hall

307 m

Dol-Gwydd

EC. ROW.

Cwmulus

Cwmulus

SS  
50

Forest Lodge

Farm

EC. ROW.

SS

56

3012

HA1

307.2

16

CP2

308.7

HA2

313.3

CP4

316.4

317.4

LC/SL  
50

338 m  
Cwmulus

Key  
➔ Observed direction of furrows

303 Spot height (mAO)

○ Borehole site

SS Sitka Spruce

JL Japanese Larch

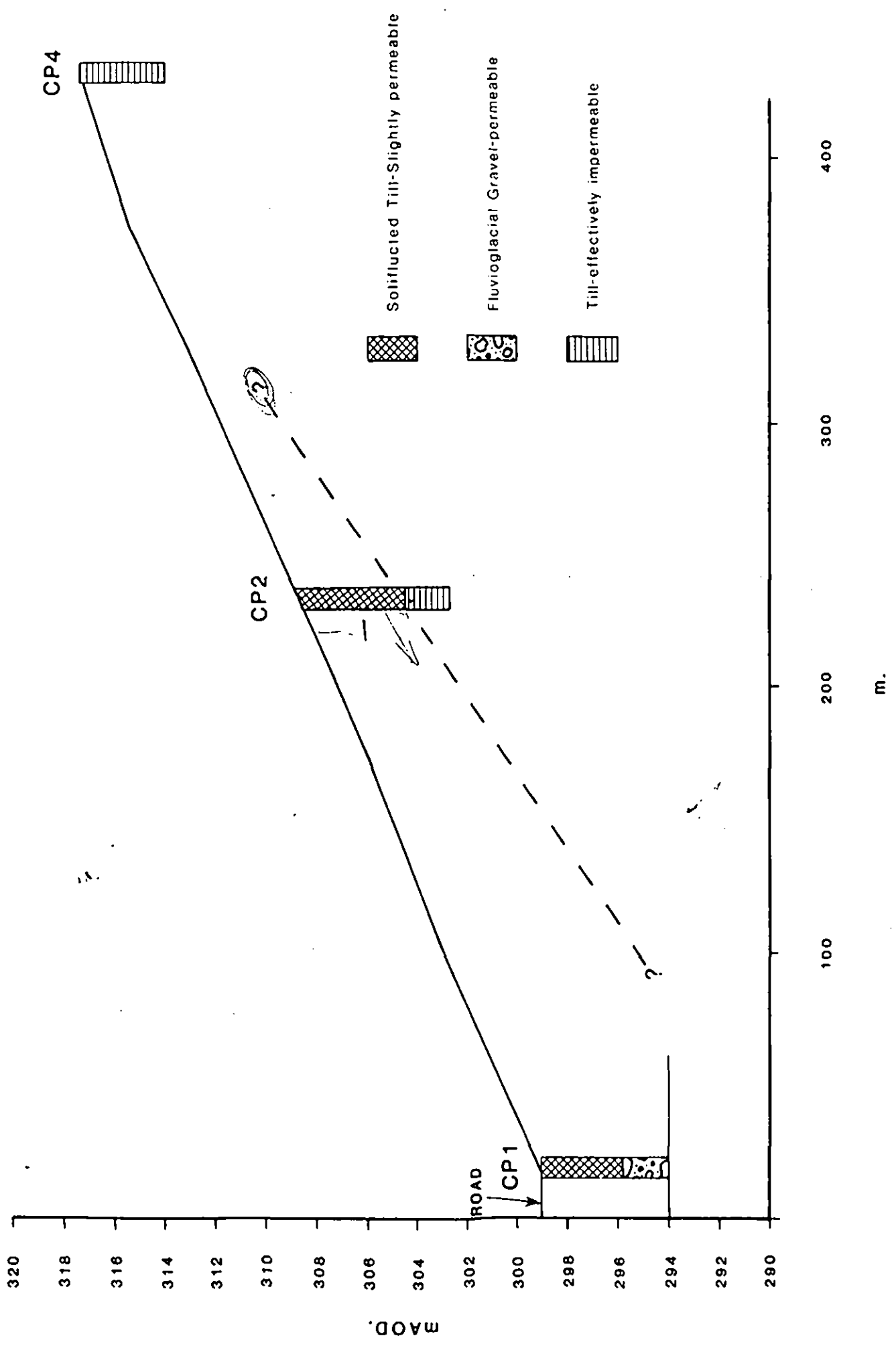
LC Cyprus

Scale

0 100m

Track

Fig 3. Geological section along firebreak of Coronation Plantation



**APPENDIX I**  
**Borehole Logs.**




PROJECT: *Aynlimon Catchment Cover Experiment*

BORHOLE NO: *CP1*

DRILLING METHOD <i>Jack Hammer + flowmeter bit</i> FROM <i>0</i> M. TO <i>5.1</i> M. FROM ... M. TO ... M.		LOCATION <i>Coronation Plantation</i>		G. REF.: .....	
WATER STRUCK. <i>3.25</i> M. BGL. ... M. BGL.		ROSE TO. <i>3.06</i> M. BGL. ... M. BGL.		START DATE: <i>25/8/87</i>	
TOTAL DEPTH: <i>5.1</i> M.		CASING DIAMETER/TYPE: ... MM FROM ... M. TO ... M., TYPE .....		COMPLETION DATE: <i>25/8/87</i>	
DRILLED DIAMETER <i>54</i> MM FROM <i>0</i> M. TO <i>5.1</i> M. ... MM FROM ... M. TO ... M.		SCREEN DIAMETER/TYPE: ... MM FROM ... M. TO ... M; TYPE/SLOT(MM) .....		CONTRACTOR <i>IM</i>	

DEPTH (M. BGL)	GRAIN SIZE ANALYSES (Sample No. and location)	SUMMARY OF AQUIFER CONDITIONS	DEPTH (M. BGL)	BORHOLE CONSTRUCTION (Casing/screen (gr. pack))	ELEVATION OF WATER M. AOD	DEPTH TO WATER M. BGL	SYMBOLIC LOC	ELEVATION M. AOD	DEPTH M. BGL.	STRATIGRAPHIC UNITS
		Ground Level = <i>299.1 m AOD.</i>  LITHOLOGY								
		<i>Topsoil (soft-firm, dark yellowish brown (10YR3/4) silty clay</i>						<i>298.9</i>	<i>0.20</i>	
		<i>Firm, moist, brownish yellow (10YR6/6) silty CLAY with strong brown (7.5YR5/8) mottles</i>						<i>298.7</i>	<i>0.40</i>	
		<i>Firm-stiff, dry, light grey (N7) very gravelly silty CLAY with strong brown (7.5YR5/8) mottles. Gravel: fine-med. sst-sr shaly medlt.</i>						<i>298.5</i>	<i>0.80</i>	
<i>1</i>		<i>Firm-stiff, dry, grey (N6) very gravelly silty CLAY Gravel: as above with some ferromang. coating</i>						<i>297.8</i>	<i>1.30</i>	
		<i>Firm-stiff, dry, very pale brown (10YR7/4) gravelly silty CLAY. More clayey than above, no ferromang. coating</i>						<i>297.6</i>	<i>1.51</i>	
		<i>Firm-stiff, dry, v. dark greyish brown (10YR3/2) v. gravelly silty CLAY. Severe ferromang. coating &amp; gravel.</i>						<i>297.4</i>	<i>1.65</i>	
<i>2</i>		<i>Firm-stiff, dry, greyish brown (2.5Y5/2) very gravelly silty CLAY with strong brown (7.5YR5/6) mottling between 2.70-2.80 and ferromang. coated gravel 2.80-2.87.</i>								<i>soliflashed T. cl.</i>
		<i>Dense, olive brown (2.5Y4/4) silty sandy GRAVEL becoming cleaner below 4.20. Indication of hori2</i>	<i>3.06</i>		<i>296.0</i>	<i>4</i>		<i>295.8</i>	<i>3.25</i>	

BOREHOLE NO. *CP1*

DEPTH (M. BGL)	GRAIN SIZE ANALYSES (Sample No. and location)		DEPTH (M. BGL)	BOREHOLE CONSTRUCTION (casing/screen/gr. pack)	ELEVATION OF WATER M. AOD	DEPTH TO WATER M. BGL	SYMBOLIC LOG	ELEVATION M. AOD	DEPTH M. BGL	STRATIGRAPHIC UNITS
4		bedded structure 4.20-5.10 with suggestion of cross bedded coarse sand / fine gravel 4.47 - 4.53.						<i>4.47 - 5.10</i>		<i>Fluvio-lacustrine Gravel.</i>
5		End of borehole.								
6										
7										
8										

PROJECT: Plylimon Catchment Cover Experiment

BOREHOLE NO: CP2

DRILLING METHOD <i>Jack hammer with flourough bit</i> FROM ..... M. TO ..... M. FROM ..... M. TO ..... M.		LOCATION <i>Coronation Plantation</i>	G. REF.: ..... START DATE: <i>26/8/87</i> COMPLETION DATE: <i>26/8/87</i>	
WATER STRUCK. <i>water not struck</i> ROSE TO. ..... M. BGL. .... M. BGL. ..... M. BGL. .... M. BGL.			CONTRACTOR <i>IH.</i>	
TOTAL DEPTH: <i>6.0</i> M.		CASING DIAMETER/TYP: ..... MM FROM ..... M. TO ..... M. TYPE ..... ..... MM FROM ..... M. TO ..... M. TYPE .....		
DRILLED DIAMETER <i>54</i> MM FROM <i>0</i> M. TO <i>6.0</i> M. ..... MM FROM ..... M. TO ..... M.		SCREEN DIAMETER/TYP: ..... MM FROM ..... M. TO ..... M; TYPE/SLOT(MM) ..... ..... MM FROM ..... M. TO ..... M; TYPE/SLOT(MM) .....		

DEPTH (M. BGL)	GRAIN SIZE ANALYSES (Sample No. and location)	SUMMARY OF AQUIPER CONDITIONS	DEPTH (M. BGL)	BOREHOLE CONSTRUCTION (Casing/screen (gr. pack))	ELEVATION OF WATER M. AOD	DEPTH TO WATER M. BGL	SYMBOLIC LOG	ELEVATION M. AOD	DEPTH M. BGL.	STRATIGRAPHIC UNITS
		GROUND LEVEL = <i>308.7 m AOD</i>  LITHOLOGY								
		<i>Topsoil: (9.09 m of humus over soft greyish brown (10YR5/2) silty CLAY.)</i> <i>Firm, moist, brownish yellow (10YR6/6) silty CLAY with strong brown (7.5YR5/8) mottles</i>						<i>308.50</i>	<i>0.16</i>	
		as above becoming gravelly <i>Gravel: fine-med. SA-SR grey shaly medt</i>						<i>308.2</i>	<i>0.50</i>	
1		<i>Firm, moist, brown (10YR4/3) and light olive brown (2.5Y5/4) very gravelly silty CLAY</i> <i>Gravel: fine-med. SA-SR grey shaly medt with some ferromang. coatings.</i>						<i>308.0</i>	<i>0.70</i>	
2										
3		on above, but light olive brown (10YR5/4).						<i>305.6</i>	<i>3.10</i>	<i>Sol. Plucked T. 14</i>



PROJECT: *Phyllimon Catchment Cover Experiment*

BOREHOLE NO: *CP3*

DRILLING METHOD <i>Jack hammer with flowthrough bit</i> FROM <i>0</i> M. TO <i>4:20</i> M. FROM ... M. TO ... M.		LOCATION <i>Coronation Plantation.</i>		G. REF.: ..... START DATE: <i>27/8/87</i> COMPLETION DATE: <i>27/8/87</i> CONTRACTOR: <i>IH.</i>	
WATER STRUCK <i>Water not struck</i> M. BGL. .... M. BGL. M. BGL. .... M. BGL.		ROSE TO. M. BGL. .... M. BGL. M. BGL. .... M. BGL.		CASING DIAMETER/TYPE: MM FROM ... M. TO ... M. TYPE ..... MM FROM ... M. TO ... M. TYPE .....	
TOTAL DEPTH: <i>4.20</i> M.		SCREEN DIAMETER/TYPE: MM FROM ... M. TO ... M; TYPE/SLOT(MM) ..... MM FROM ... M. TO ... M; TYPE/SLOT(MM) .....			
DRILLED DIAMETER <i>54</i> MM FROM <i>0</i> M. TO <i>4.2</i> M. MM FROM ... M. TO ... M.		SCREEN DIAMETER/TYPE: MM FROM ... M. TO ... M; TYPE/SLOT(MM) ..... MM FROM ... M. TO ... M; TYPE/SLOT(MM) .....			

DEPTH (M. BGL.)	GRAIN SIZE ANALYSES (Sample No. and location)	SUMMARY OF AQUIFER CONDITIONS		DEPTH (M. BGL.)	BOREHOLE CONSTRUCTION (Casing/screen (8" pack))	ELEVATION OF WATER M. AOD	DEPTH TO WATER M. BGL.	SYMBOLIC LOG	ELEVATION M. AOD	DEPTH M. BGL.	STRATIGRAPHIC UNITS
		LITHOLOGY									
		Ground level = 311 m AOD.									
		<i>Topsoil (0.19 m of very soft, v moist black FEAT over very soft, v. moist, grayish brown (10YR5/2) silty CLAY) soft, moist, light grey (2.5Y 7/2) and brownish yellow (10YR 6/8) mottled silty CLAY.</i>							<i>30.8</i>	<i>0.28</i>	
		<i>Firm, moist light grey (N7) and yellowish brown (2.5Y 5/4) granular silty CLAY Gravel: fine-med SA-SR grey shaly med</i>							<i>30.4</i>	<i>0.68</i>	
		<i>Firm-stiff, moist, grey (NS), gravelly silty CLAY becoming light olive brown (5Y 5/4) at 1.20 Gravel: on above</i>							<i>30.1</i>	<i>1.01</i>	
		<i>Stiff, dark grey (5Y 4/1) slightly gravelly silty CLAY. Gravel: on above with cobbles at base.</i>							<i>30.9</i>	<i>2.20</i>	
		<i>Stiff, moist, olive grey (5Y 4/2) slightly gravelly silty CLAY.</i>							<i>30.7</i>	<i>3.20</i>	

BOREHOLE NO. CP3

DEPTH (M. BGL)	GRAIN SIZE ANALYSES (Sample No. and location)
2	
5	
6	
4	
00	
End of borehole.	
DEPTH (M. BGL)	BOREHOLE CONSTRUCTION (casing/screen/gr. pack)
	ELEVATION OF WATER M. AOD
	DEPTH TO WATER M. BGL
	SYMBOLIC LOG
	ELEVATION M. AOD
	DEPTH M. BGL
	STRATIGRAPHIC UNITS

2069 420

7.66

PROJECT: *Phyllimon Catchment Cover Experiment*

BOREHOLE NO: *CP4*

DRILLING METHOD  
*Talk hammer and flowthrough bit*  
FROM *0* M. TO *3.26* M.  
FROM ... M. TO ... M.

LOCATION  
*Coronation Plantation*

C. REF.: .....

START DATE: *27/8/87*

COMPLETION DATE: *27/8/87*

WATER STRUCK.  
*Water not struck*  
ROSE TO.  
..... M. BGL. .... M. BGL.  
..... M. BGL. .... M. BGL.

CASING DIAMETER/TYPE:  
..... MM FROM ..... M. TO ..... M. TYPE .....

CONTRACTOR *IF*

TOTAL DEPTH: *3.26* M.

..... MM FROM ..... M. TO ..... M. TYPE .....

DRILLED DIAMETER  
*54* MM. FROM *0* M. TO *3.26* M.  
..... MM. FROM ..... M. TO ..... M.

SCREEN DIAMETER/TYPE:  
..... MM FROM ..... M. TO ..... M; TYPE/SLOT(MM) .....

DEPTH (M. BGL.)	GRAIN SIZE ANALYSES (Sample No. and location)	SUMMARY OF AQUIFER CONDITIONS		DEPTH (M. BGL.)	BOREHOLE CONSTRUCTION (Casing/screen (gr. pack))	ELEVATION OF WATER M. AOD	DEPTH TO WATER M. BGL.	SYMBOLIC LOG	ELEVATION M. AOD	DEPTH M. BGL.	STRATIGRAPHIC UNITS
		LITHOLOGY									
		<i>Ground level = 317.4 m AOD.</i>									
		<i>Topsoil. (0.17m of very soft, moist, black (10YR2/1) PEAT over soft, moist, brown (10YR5/5) silty CLAY.</i>							<i>317.00.39</i>		
		<i>Soft, light grey (2.5Y7/2 silty CLAY</i>							<i>316.80.62</i>		
		<i>Soft, moist, white (2.5Y8/2) &amp; strong brown (7.5YR5/6) chilled, slightly gravelly silty CLAY</i>							<i>316.70.74</i>		
		<i>Firm, moist, brownish yellow (10YR6/8) slightly gravelly silty CLAY.</i>							<i>316.40.95</i>		
		<i>Firm, moist brownish yellow (10YR6/6) silty CLAY becoming grey (NS) with depth</i>							<i>315.91.48</i>		
		<i>Stiff, moist, olive grey (5Y4/2) gravelly silty CLAY.</i>									
		<i>Gravel: fine-med SAR gray shaly medt.</i>									
		<i>Stiff, moist, grey (NS) silty CLAY with some gravel</i>							<i>314.82.62</i>		
		<i>Gravel: as above.</i>									
		<i>End of borehole.</i>							<i>314.13.26</i>		

*T.C.*





