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DORSET COUNTY COUNCIL

Dinah's Hollow
Melbury Abbas
Dorset

INVESTIGATION AND REPORT INTO STABILITY OF EXISTING ROAD CUTTING

December 2013

ST/TJC/7125A-R-001

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1.0 INTRODUCTION

1.1 Brody Forbes Limited received instructions from Dorset County Council Highways Department to undertake an investigation into the road cutting known as Dinah's Hollow, Melbury Abbas, Dorset. This has now been carried out and our findings are recorded within this report.

1.2 The investigation was carried out to assess the stability of cut steep vegetated slopes predominantly bounding the east and west sides of the road. The aim of the investigation was to provide the Highway Authority with the current state of the cutting stability, and should this be of concern, the feasibility of remedial options with, if possible, budget costing.

1.3 The report generally assumes that the present highway status remains and comments and considerations regarding traffic control, by-passing, calming measures and other possible mitigations are not the main topic of this report.

1.4 It should be noted that ground conditions can vary between points of inspection and as a consequence interpretation and ensuing advice and recommendations may need to be revised accordingly.

1.5 This report provides preliminary recommendations which will need to be developed further to fully specify any remedial scheme and its cost.

1.6 This report is issued to Dorset County Council and does not confer or purport to confer on any third party any benefit or any right pursuant to the Contracts (Rights of Third Parties) Act 1999.

1.7 The report is confidential to the client. It may be disclosed to advisers assisting in this matter but it may not be disclosed to any other party without the prior written approval of Brody Forbes.

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2.0 SITE DESCRIPTION

2.1 Dinah's Hollow is a 350m south/north length of the highway linking the north of Blandford Forum with Shaftesbury. Appended drawings and images will assist the following descriptions. The road, whilst more minor in hierarchy, does seem to provide an alternative route to the A350 which runs parallel, some 6 or so kilometres to the west. The road is busy and traffic control measures are in place where it passes through part of Melbury Abbas village, just to the south. The road then crosses a stream and ascends northwards at up to gradient of 1 in 8 as it passes through the deep steep man-made cutting known as Dinah's Hollow.

2.2 The land through which the cutting is made comprises grass fields to the west and crops in fields to the east, all generally sloping downwards to the south. In the vicinity of the cutting however the contouring suggests that the road cutting exploited a pre-existing small valley feature with lower lying land, probably the result of a larger run-off catchment and consequent erosion, to its east.

2.3 The Hollow slopes reach a height of 14m to the west and 10m to the east side. Average slope gradients tend to 55 degrees to the horizontal mid-way along the cutting. There is however a tendency, on both sides, for steepening to around 75 degrees adjacent to the road and then a corresponding slackening in gradient towards the field boundaries. Digital images taken along the length of both sides of the full length of the highway clearly show the steepening. At the southern limit of the cutting the slope heights reduce to steep vegetated banks terminating at drive ways to private properties. At the upper northern end of the slope the heights again reduce with the last 50m or so at less significant gradients.

2.4 The highway reduces to a single lane through the cutting. Cars have difficulty passing and wider vehicles can cause delays due to the need to reverse tightly into local small wider sections of the road – not describable as passing-places.

2.5 The higher slopes of both cuttings are well vegetated with many mature trees. The larger more prolific are to the west side. Dense vegetation and small trees abound at mid- slope but lower than this the cutting tends to become prone to slippage leaving bare slopes of worrying height – up to 4 or 5m. There was a section on the west side of clearer uniform slope reducing to below 45 degrees to the horizontal.

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2.6 No groundwater was seen issuing anywhere on the cutting slopes. It is noted however that the investigation was carried out at a relatively dry period. Sediments deposited following surface water run off from the eastern side fields was clearly apparent and is discussed below. Digital images attached show this particularly well.

2.7 Near the top northern extent of the steep cutting a significant rock outcrop ("Ragstone") was visible in the western slope. This appeared to have been set back locally and resembled a small quarried area. Mid-way along the Hollow a smaller rock exposure was present – visible in both slope faces. The outcrops appeared to indicate the stratum being laid horizontal or parallel to the ground surface.

2.8 The British Geological Survey map 'Shaftesbury' (Sheet 313) shows the site to be underlain by Cretaceous Age strata of the Upper Greensand Formation. As the road rises north to south it would first cut through the top layers of the "Cann Sand Member", then the "Shaftesbury Sandstone Member" and finally the youngest strata being the "Boyne Hollow Chert Member" at the north end of Dinah's Hollow. The Cann Sand Member is described as a fine grained glauconitic[1] micaceous sand with fine lenses or bioturbated laminae of micaceous, very fine-grained sand and silt. The Shaftesbury Sandstone Member is described as an alternating succession of fine to medium grained glauconitic sand and sandstone, with a massive 2 to 3m thick, shelly calcareous sandstone referred to as the 'Ragstone' sometimes present at its upper boundary. Above this the Boyne Hollow Chert Member typically comprises a glauconitic sand or sandstone with regularly developed nodular and tabular beds of chert. Interbedded chert beds and nodules can be up to 0.4m thick.

1. A greenish mineral of the mica group, a hydrous silicate of potassium, iron, aluminium, or magnesium. It has a crystalline formation ie mildly cementitious, but low weathering resistance and is very friable.

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3.0 INVESTIGATION AND LABORATORY WORK

3.1 The investigation comprised of an initial site walk over to plan the investigation. This was followed up by a comprehensive ground investigation lasting 3 days and some time later a topographical survey was carried out to all the accessible parts of the site. The appended drawings and Ground Investigation appendices will assist regarding the following.

3.2 The ground investigation is fully described by Structural Soils Ltd who, under direction, sank 5 boreholes to depths of 10 to 15m, took disturbed samples and carried out standard penetration tests[2] (SPTs) at intervals averaging around 1m. A standpipe, to record water levels, was also installed in the lowest borehole. The intrusive investigation was supplemented by Dynamic Cone Penetrometer[3] (DCP) testing on the sides of the steep slope.

2 The SPT provides an estimate of material density and corresponding strength ie angle of shearing resistance Ø'.

3 The DCP is a portable device which can be related to the SPT and further provides an estimate of material density and corresponding strength ie angle of shearing resistance.

3.3 The investigation predominantly encountered medium dense and dense green brown fine sand with variable clay content – typical of that anticipated in 2.8 above. Occasional horizons of extremely weak to weak fine grained sandstone were encountered (up to around 200mm thick) with a bed of sandstone encountered within BH1 between 2.00m and 2.70m depth, the base of which was not proven by continued chiselling.

3.4 In addition to the above the slopes of the cuttings were inspected, as far as practical given limitations of copious vegetation and steepness, to understand in some detail the topography and various relevant features. Digital images are appended however the vegetation, being in full leaf, made photography, of and on the slope, of limited use. Drawings 2 and 3 of appendix 2 show the steep slop/slips, scarps, and other evidence of ground movement. Also shown is an approximate distribution of the main trees, stumps rock outcrops and other features.

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4.0 ANALYSIS AND FINDINGS

4.1 In the short term, while ever the cutting remains intact, it has by definition a factor of safety of at least 1.0 at that moment in time. Given the occurrences of slippage to a current angle to the horizontal of about 55 degrees, it suggests that, at this angle, the cutting does not have any greater factor of safety than unity. This postulate is used below in a limiting equilibrium ("back-analysis" see 4.6) analysis approach to confirm site measured and laboratory tested ranges of Ø' and C' to then give, by design, a higher (if necessary) factor of safety.

4.2 The current angle of the cutting is also influenced by both small and large vegetation which will draw moisture from the ground and bind the ground enhancing stability. Empirically it can be noted that a healthy well vegetated slope is significantly enhanced by such vegetation roots. Unfortunately it is not possible to quantify this analytically and the condition where vegetation dies must also be considered. It is therefore necessary to conservatively default to consider only the basic soil properties.

4.3 Rainfall and moisture ingress have 2 notable effects. Firstly, and probably most relevant to the recent local failure, is a combination of surface run-off and infiltration, leading to a erosion and a break down of the residual glauconitic cementing of the surface zone of the cutting face. This clearly is of concern after intense rainfall and on non-vegetated slopes and will result in shallow slumping type failures. Secondly there will be fairly rapid seepage of surface water through the ground, eventually to the water-table. Based on the investigation carried out in the autumn of this year it is believed the water table lies below the lane/lower level of the cutting and only the effects on the soil parameters due to inter-granular moisture seepage are considered.

4.4 Borehole logs and tabulations by Structural Soils appended indicate the range of SPT's recorded. Discounting the non-typical first borehole N values (number blows for 300mm penetration) tend to average 15 when reaching the first 3m below ground level; and increased to an average of about 35 at 10m below ground level. There is considerable variation as was also found by the shear box testing. Four tests were carried out using samples taken at each borehole and encompassing some 30m of continual sedimentary deposit. Phi (Ø') values were consistent in 3 boreholes producing an angle of 35 degrees. Cohesive peak strength varied in all tests and given the nature of loss in shear strength after failure it is probable that the lower value of C' = 3.0 kN/m^2 be adopted for design checks.

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4.5 The findings, with reference to BS8002, indicate a preliminary average design value of effective shearing resistance of Ø' (Phi) = 37.5 degrees. The granular soil has low effective cohesive strength but variable C' values were obtained by laboratory testing as discussed below.

4.6 The back-analysis results are appended and these tend to confirm values of Ø' and C' discussed above. The analysis explores the likely limiting conditions and values for Ø' and C' of 37.5 degrees and 3.0 kN/m^2 seem reasonable. These figures are deployed in calculations to provide safe slopes with a factor of safety of 1.5. At this factor of safety the angle of a regraded new slope would be approximately 30 degrees to the horizontal destroying trees and enveloping private land and is probably not a feasible solution.

4.7 Whilst the basic geology and strata of the east and west sides of the cuttings are near identical but there are differences. The west side is taller by as much as 4m in height above the road level. There are however more active slips noted on the eastern side which seems to coincide with areas of high surface water run-off from the large land catchment area to the north east of the Dinah's Hollow. In addition on the east slope large trees, once standing close to the highway at the southern end of the Hollow, have been removed leaving rotting stumps. In 2 or more places, below tree stumps, 3 to 5m high planar landslips at approximately 60 degrees to the horizontal have occurred revealing rotten root systems. Very dense vegetation and steep slopes limited observations.

4.8 A steep slope of 70 degrees to the horizontal and even greater is near continuous on both sides of the highway. This low-level slope is only 1m high over perhaps 50% of the road edge but often merges with the higher slopes to be a precarious 5m height. The sides of the wheels of heavy vehicle have, over the years, played a major part in the over-steepening and effectively widening the highway. Clearly if this continues slopes will get ever steeper and more precarious.

4.9 On both east and west sides vertical scarps, up to about 1m height could be made out behind vegetation re-establishing on slumped slip surface. The back scarps are the top of slip planes still on view after a ground failure. This near vertical face is likely to be the next point of failure as are the adjacent slopes.

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4.10 Unfortunately the land owner objected to the continued placement of the standpipe within borehole 5 therefore no information on groundwater levels could be collected. It is unlikely, given the position of the stream some 100m distance and 15m lower, that the water table could rise to have been detectable above the base of the borehole. Certainly no groundwater was detected in any borehole during the investigation.

5.0 CONCLUSIONS

5.1 The slopes of the cuttings of Dinah's Hollow are currently in a state of unreliable temporary stability. The natural and safe slope angle for the sandy soil through which the road cutting passes is steeper than that that would be recommended. It tentatively remains stable. In areas particularly where vegetation dies back, for whatever reason, the cutting slope will be subject to surface erosion and shallow slips gradually reducing, in time, to an angle approximating its angle of repose.

5.2 The process of erosion slumping and general degradation of the slopes is very active due to the steep un-vegetated initial slopes of the cutting. Some of these are up to 4m and provide the potential for large quantities of material to slip, unannounced, onto the highway. Sufficient to bury a passing small vehicle. Such occurrences will usually be associated with heavy rainfall events and action to remedy this high risk is essential.

5.3 There is also risk, albeit less likely, of a deep seated failure of even greater impact. As can be seen on the analytical cross sections, it is not until the slopes have reached an angle to the horizontal of about 30 degrees, that it has a factor of safety of in excess of 1.5.

5.4 From a pragmatic view the chance of such complete failure (5.3) is rare; the slope has existed for many years (100's?) with surface erosion and local slippage occurring but without present evidence of a major failure. The problem is that there can, however long the equilibrium has lasted in the past, be changes which could trigger a major collapse eg a prolonged and intense period of rainfall possibly resulting from climate change, changes in surface water area run-off, vegetation condition, further under-cutting of the road edge by vehicles.

5.5 Given the analysis and findings it is advised that Dorset County Council carry out an engineering scheme to provide an adequate factor of safety for the passage of vehicles through Dinah's Hollow.

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6.0 PRELIMINARY REMEDIATION SCHEME

6.1 Further work, discussed below, is necessary before a scheme can be fully specified but there are 2 main methods which would be suitable:-

- Retaining walls formed by concrete, masonry, sheet/contiguous piling or in some combination and all to a height above which the slope could be graded back to a safe angle of approximately 30 to 35 degrees.

- Using soil nails with a facing panel to provide stability to the existing steep, or even steepened, slope to a point where the top could be again graded back to a safe angle of approximately 30 to 35 degrees.

The latter geotechnical method has been considered in more detail and is discussed in greater detail below. There would be serious construction difficulties with methods other than piling in respect of the retaining wall solution. Even this is problematic but it would be worth pursuing as an alternative to the currently proposed scheme. Again this is discussed further below.

6.2 The specialist geotechnical scheme uses a soil panel and soil nail system, provides a soft and aesthetic method by which the unacceptably steep slope of this picturesque Hollow can be made totally safe with adequate factors of safety. Proprietary Panel Systems exist comprising a mesh face which contains gravel or possibly soil and spans to soil nails, reinforcing the soil of the steep slope. Other similar systems could be adopted.

6.3 Drawing 7125A 4 and 5 are appended and indicate the extent of the preliminary scheme. The cutting would be prepared to an angle of about 70 degrees, soil nails installed on a regular grid then the proprietary panel system installed and infilled. The height of the panel system would be the minimum required to enable the remaining top slope to be graded back to an angle of 30 degrees all with the intention of saving and causing the minimum impact on the trees. The scheme length would extend from the immediate entry to the cutting for a distance of about 300m where the slopes become acceptable. The scheme currently offered rationalizes the slopes and enables the highway to be widened at relatively minimal additional cost. A target width of 6.4m is shown, this being the approximate highway width at the scheme extremities.

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6.4 In addition to the main retention scheme a cut off drain should be laid, ideally just within the field, along the eastern boundary to remove the main fraction of the surface water run-off following a high rain fall event. The drain would be designed to pipe away the majority of flow to an outfall, possibly drains in the highway, but to be such that it also allows water to soakaway to the surrounding soil thereby not continuously robbing vegetation of moisture.

6.5 It could well be logically argued that an increase in width is not necessary and perhaps a limitation on the number of vehicles using this highway is preferred. It would appear that the A350 is particularly available to heavy transport which non-essentially use the Hollow in preference. Discussion on applying traffic limitation is beyond the scope of this report.

6.6 As a precursor to any scheme it would be necessary to re-survey the cutting slopes with particular regard to position and health of existing trees; some of which may be at risk of toppling, and other important vegetation that it is feasible to retain. This should be fairly practical given that most of the trees are located higher up the slope. To further assess surface water run-off and groundwater issues an inspection of the cutting during heavy rainfall and at the end of a particularly wet spell would also be advised. It should be noted that the initial land survey could not penetrate the dense and steep vegetated slopes. Some pre-clearance of low vegetation (including bushes and small trees) will be required together with temporary highway closure to enable the detailed land and arboricultural surveys.

6.7 Detailed design must be carried out to fully specify the works and hence the cost. Preliminarily contact has been made with the Phi Group (part of Keller Group) to discuss feasibility and provide an approximate cost. In addition a civil engineering main contractor is required to carry out earthworks and provide specialist attendances. Details of the Phi Group and Soil Panel System, which it is understood is a Highways Agency "approved system", are appended for information. There are other competing systems and as mentioned above, other options to soil nailing.

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6.8 The approximate costing for the preliminary scheme is as follows;-

Geotechnical specialist detailed design and construction	£1,300,000
Main Contractor earthworks, drainage and attendance to specialist	£850,000[4]
Preparation for scheme design, clearance, re-surveys, tendering and contract administration	£150,000
Approximate grand total (ex VAT) See note 4	£2,300,000

4 This is estimated on the bases of costs provided for smaller schemes and at time of report writing an actual contractor estimate had not been received and was awaited.

6.9 Other possible schemes are steel sheet piling or contiguous reinforced concrete piling. Both may require facing to be aesthetically acceptable. The piling would be vertical to a point where again a top slope could be formed at an angle of 30 degrees to the horizontal. An additional scheme could be developed in parallel with that currently preferred to investigate practicality, cost and appearance factors.

Steve Thompson B.Sc., C.Eng., MICE
for **BRODY FORBES**

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APPENDIX 01
DIGITAL IMAGES

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Our Ref: 7125A Digital Images

Dinah's Hollow, Melbury Abbas

Chainages approximate

Tree identification is tentative

1. General view looking up Dinah's hollow from south (Ch 0 upwards)

2. East side Ch 30 upwards

3. West side Ch 50 upwards

4. East side Ch 90 upwards

5. West side Ch 90 upwards

6. East side Ch 110 upwards

7. West side Ch 110 upwards

8. East side Ch 130 upwards

9. West side Ch 130 upwards

10. East side Ch 150 upwards

11. West side Ch 150 upwards

12. East side Ch 170 upwards

13. West side Ch 170 upwards

14. East side Ch 190 upwards

15. West side Ch 190 upwards

16. East side Ch 210 upwards

17. West side Ch 210 upwards

18. East side Ch 230 upwards

19. West Ch 230 upwards

20. East side Ch 250 upwards

21. West side Ch 250 upwards

22. East side Ch 270 upwards

23. West side Ch 270 upwards

24. East side Ch 290 upwards

25. West side Ch 290 upwards

26. East side Ch 60 land slip

27. West side Ch 100 land slip

28. East/west side Ch 125 rock layer

29. East side Ch 150 land slip

30. East side Ch 200 erosion/landslip

31. East side Ch 210 land slip

32. East side Ch 245 land slip

33. East side Ch 5 Horse Chestnut

34. West side Ch 20 Horse Chestnut

35. West side Ch 50 Tree clump

36. East side Ch 95 Maple clump

37. East side Ch 105 Ash

38. West side Ch 125 Oak (?)

39. East side Ch 130 Maple

40. West side Ch 130 Fir

41. West side Ch 170 Fir - leaning

42. East side Ch 175 Maple

43. West side Ch 185

44. West side Ch 190 Oak

45. East side Ch 185 Maple

46. West Ch 205 Oak

47. West Ch 225 Maple clump

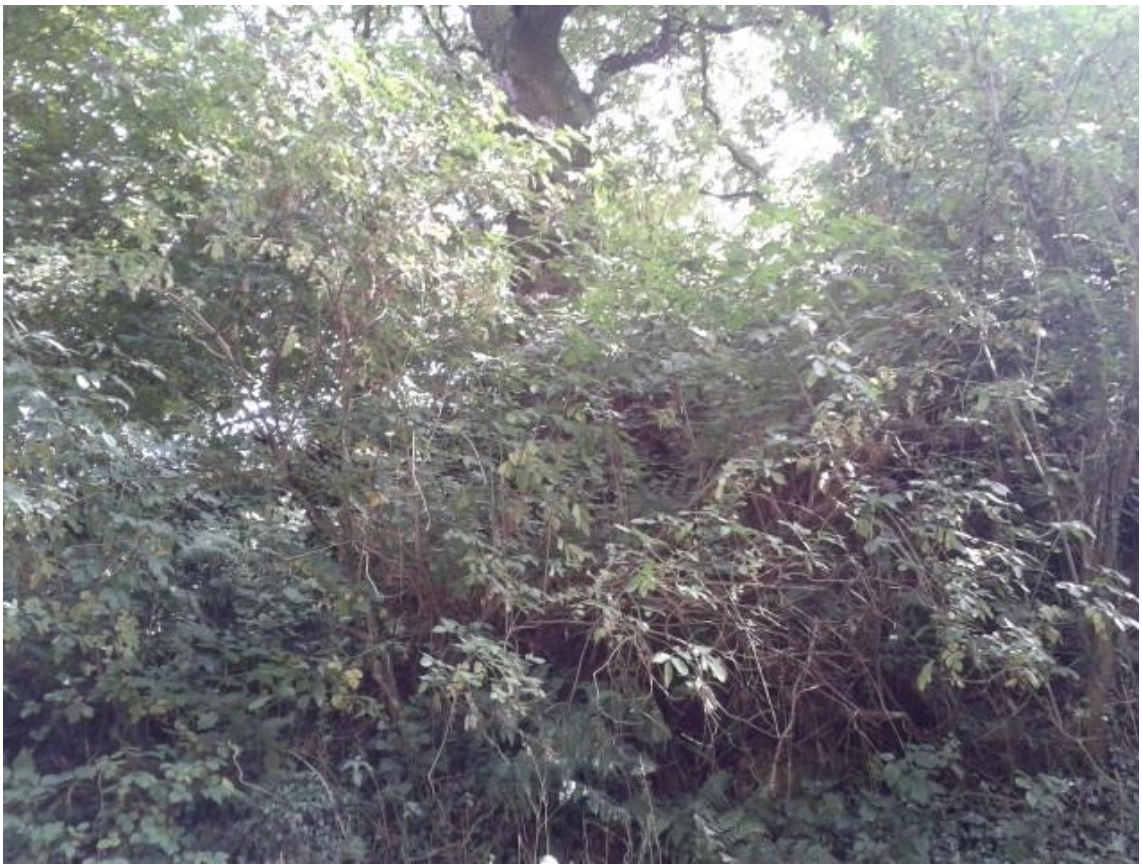
48. East Ch 225 Maple

49. West Ch 230 Fir

50. East Ch 245

51. West Ch 250 - 280

52. East Ch 270 Ash



53. East Ch 280 Oak

54. East Ch 225 Slip back scarp

55. West Ch 250 – 280 Ragstone outcrop

56. West Ch 250 – 280 Ragstone outcrop

57. West side fields BH 2 location

58. West side fields BH3 location

59. West side field BH5 location

60. East side fields

61. East side fields continuation

62. East side fields continuation

63. East side fields BH 4 location

64. East side field erosion sediment

65. East side field erosion sediment

66. East side field erosion sediment

67. East side field erosion gulley

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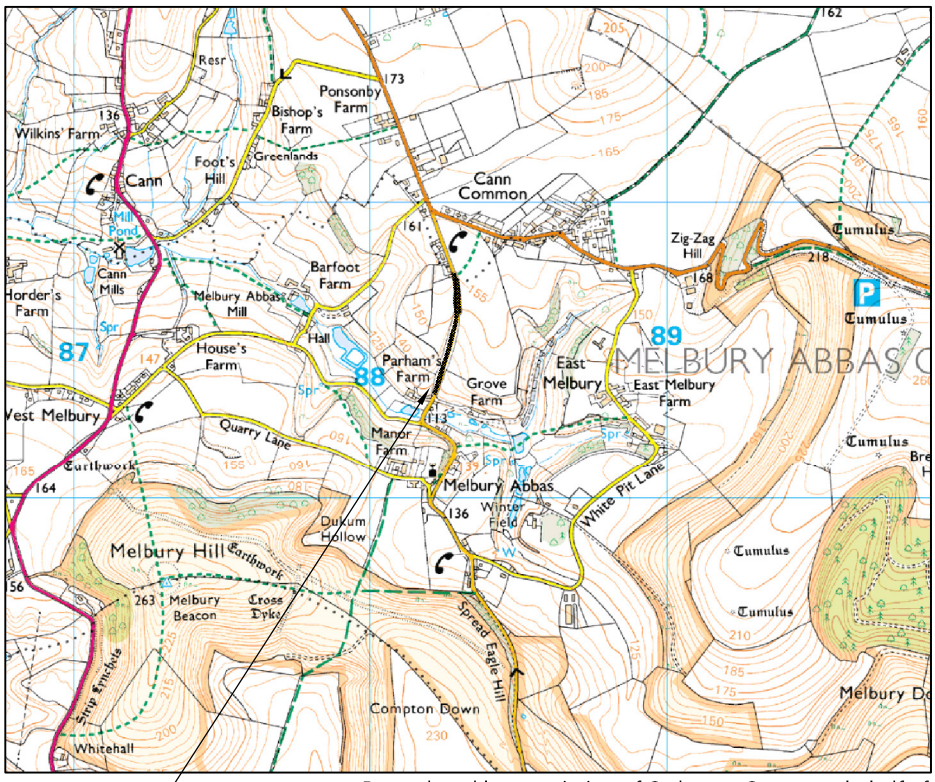
APPENDIX 02

MAPS AND DRAWINGS



Location of Dinah's Hollow

Issue	Description	Date	Drwn	Chkd

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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

Scales: 1:25'000 Drawing Size: A4

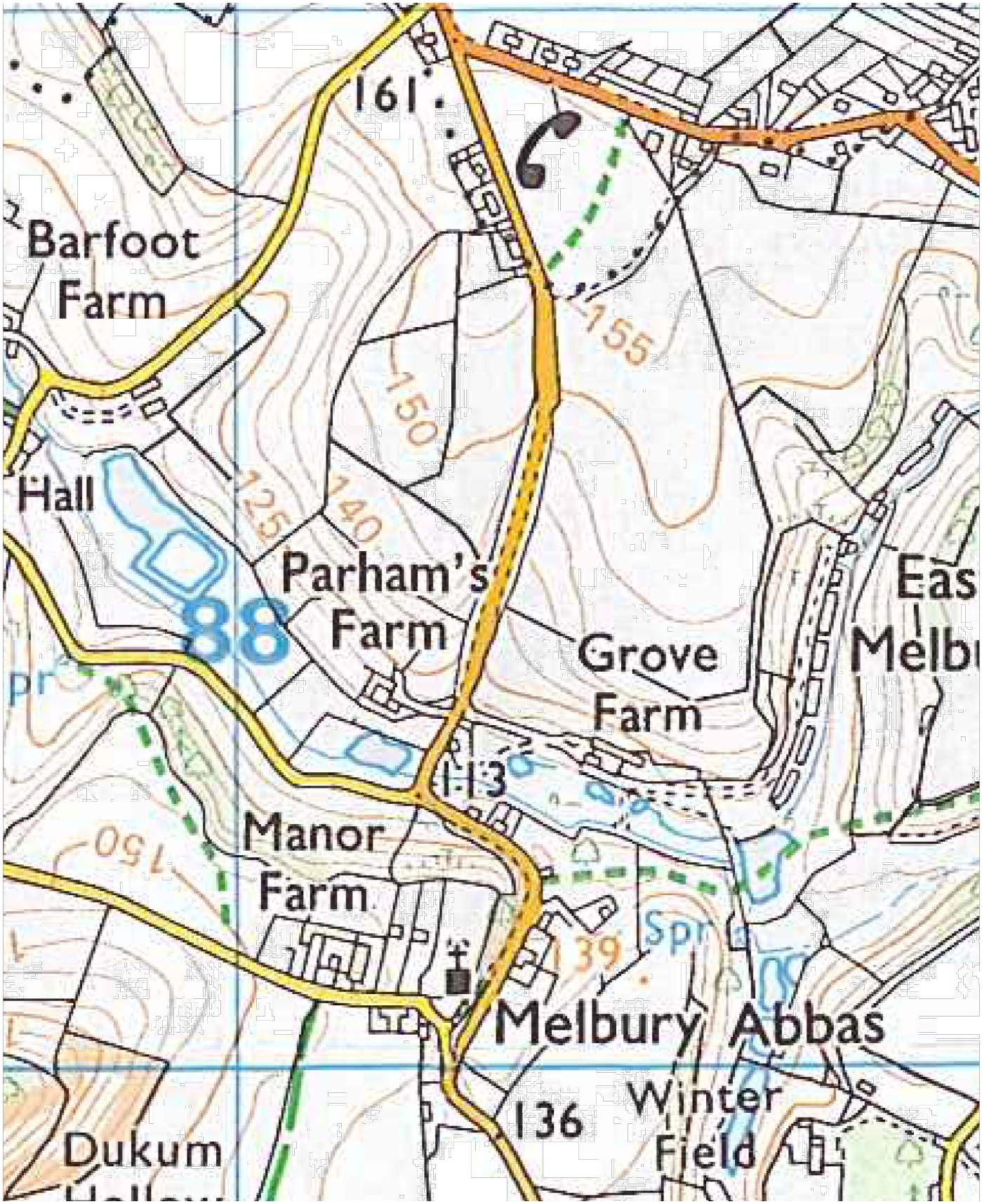
Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: Site Location Plan

Project No.: 7125A - Drawing No.: App2/1 - Revision: R1

100mm on Original



Issue	Description	Date	Drwn	Chkd

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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

Scales: 1:500 Drawing Size: A4

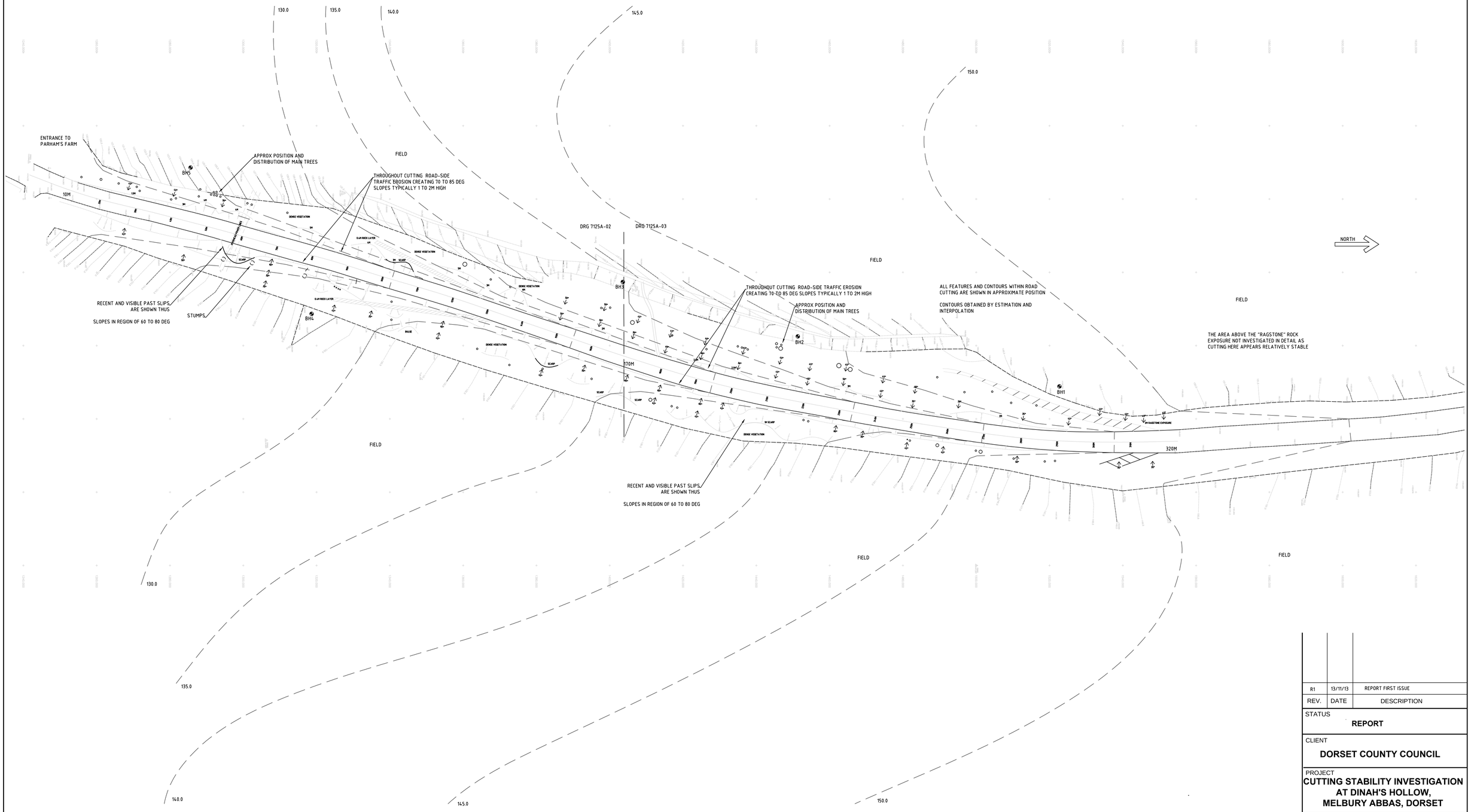
Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: 1:500 Scale (approx) Locality Plan

Project No.: 7125A - Drawing No.: App2/2 - Revision: R1

NOTES



REV.	DATE	DESCRIPTION
R1	13/11/13	REPORT FIRST ISSUE

STATUS
REPORT

CLIENT
DORSET COUNTY COUNCIL

PROJECT
CUTTING STABILITY INVESTIGATION AT DINAH'S HOLLOW, MELBURY ABBAS, DORSET

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SCALE	DATE	DRAWN
1:500 at A1	13/11/13	ST

DRAWING TITLE
GENERAL PLAN ON DINAH'S HOLLOW SURVEY AND FEATURES

DRAWING No.	REVISION
7125A-01	R1

ENTRANCE TO PARHAM'S FARM

BOREHOLE LOCATIONS

BH5

60

APPROX POSITION AND DISTRIBUTION OF MAIN TREES

THROUGHOUT CUTTING ROAD-SIDE TRAFFIC EROSION CREATING 70 TO 85 DEG SLOPES TYPICALLY 1 TO 2M HIGH

NOTES

ALL FEATURES AND CONTOURS WITHIN ROAD CUTTING ARE SHOWN IN APPROXIMATE POSITION

CONTOURS OBTAINED BY ESTIMATION AND INTERPOLATION

NORTH

110

150

DENSE VEGETATION

OVERHEAD POWER LINES

0.4M ROCK LAYER

SCARP

PR7

PR6

BH4

BH3

BULGE

RECENT AND VISIBLE PAST SLIPS ARE SHOWN THUS

SLOPES IN REGION OF 60 TO 80 DEG

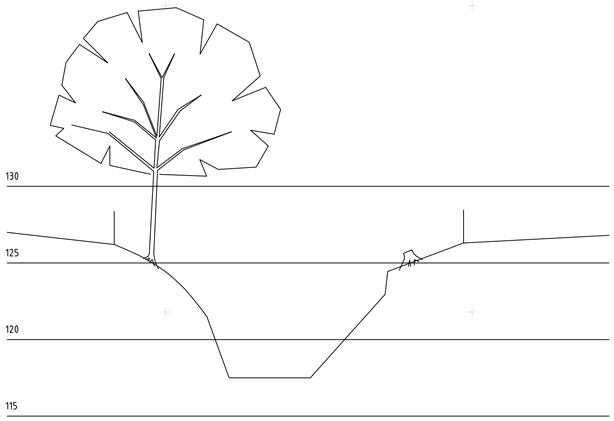
STUMPS

DCP AT LOCATIONS 4, 6 AND 7 INDICATING VERY LOOSE (SLIP PLANES) THEN BECOMING COMPACT

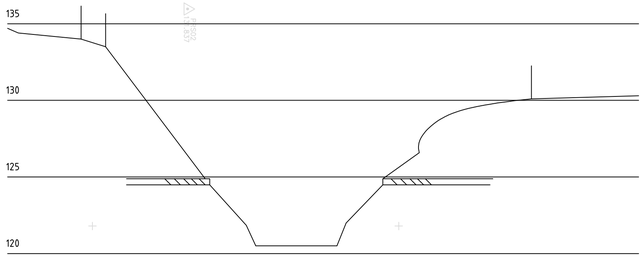
10M 20M 30M 40M 50M 60M 70M 80M 90M 100M 110M 120M 130M 140M 150M 160M 170M

1.5M 2M 3M 4M 5M 6M

45° 50° 60° 35°



SECTION 60



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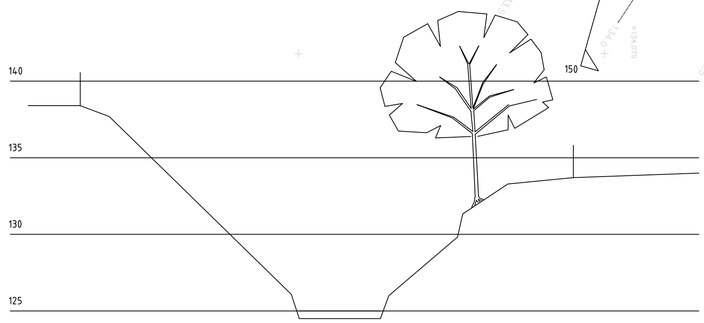

SECTION 150

REV.	DATE	DESCRIPTION
R1	13/11/13	REPORT FIRST ISSUE

STATUS
REPORT

CLIENT
DORSET COUNTY COUNCIL

PROJECT
CUTTING STABILITY INVESTIGATION AT DINAH'S HOLLOW, MELBURY ABBAS, DORSET

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SCALE	DATE	DRAWN
1:200 at A1	13/11/13	ST

DRAWING TITLE
CUTTING DETAIL PLAN CH 10 TO 170

DRAWING No.	REVISION
7125A-02	R1

DCP AT LOCATIONS 1, 2, 3 AND 5 INDICATING TOP 500 TO 750 OF LOOSE SAND BECOMING COMPACT AT 1M

THROUGHOUT CUTTING ROAD-SIDE TRAFFIC EROSION CREATING 70 TO 85 DEG SLOPES TYPICALLY 1 TO 2M HIGH

APPROX POSITION AND DISTRIBUTION OF MAIN TREES

ALL FEATURES AND CONTOURS WITHIN ROAD CUTTING ARE SHOWN IN APPROXIMATE POSITION

CONTOURS OBTAINED BY ESTIMATION AND INTERPOLATION

NORTH

THE AREA ABOVE THE "RAGSTONE" ROCK EXPOSURE NOT INVESTIGATED IN DETAIL AS CUTTING HERE APPEARS RELATIVELY STABLE

2M RAGSTONE EXPOSURE

1M SCARP

DENSE VEGETATION

RECENT AND VISIBLE PAST SLIPS ARE SHOWN THUS

SLOPES IN REGION OF 60 TO 80 DEG

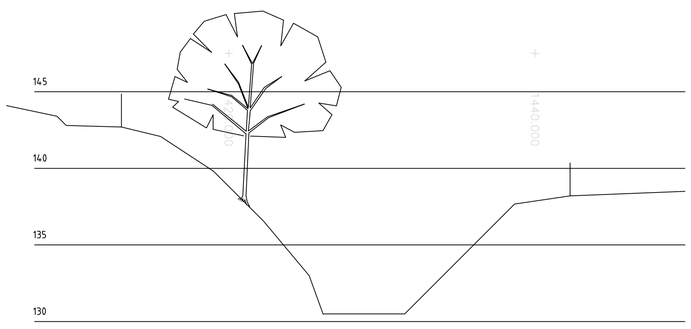
BH1 BH2 BH3 PR1 PR2 PR3 PR4 PR5 SCARP

200 250 290

170M 180M 190M 200M 210M 220M 230M 240M 250M 260M 270M 280M 290M 300M 310M 320M

2.5M 3M 2M

NOTES



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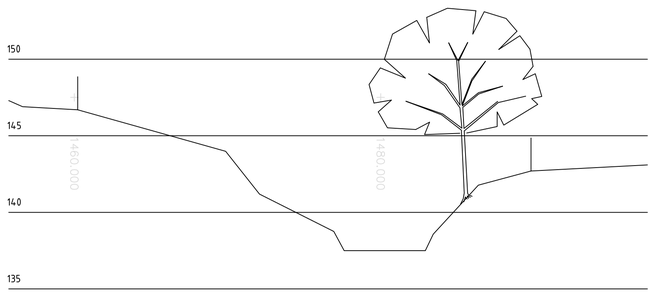

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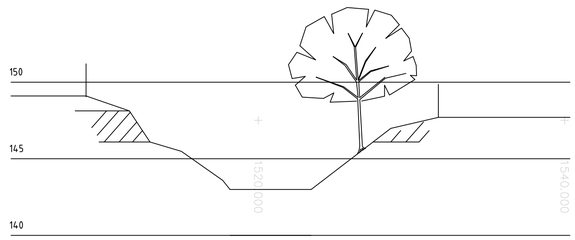

SECTION 290

REV.	DATE	DESCRIPTION
R1	13/11/13	REPORT FIRST ISSUE

STATUS
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DORSET COUNTY COUNCIL

PROJECT
CUTTING STABILITY INVESTIGATION AT DINAH'S HOLLOW, MELBURY ABBAS, DORSET

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SCALE	DATE	DRAWN
1:200 at A1	13/11/13	ST

DRAWING TITLE
CUTTING DETAIL PLAN CH 170 TO 320

DRAWING No.	REVISION
7125A-03	R1

ENTRANCE TO PARHAM'S FARM

BH5

BH4

BH3

STUMPS

OVERHEAD POWER LINES

10M 20M 30M 40M 50M 60M 70M 80M 90M 100M 110M 120M 130M 140M 150M 160M 170M

60

110

150

DRAWING INDICATES HIGHWAY WIDTH INCREASED WITHIN CUTTING TO THAT AT SCHEME LIMITS OF APPROXIMATE WIDTH (6.4M)

HIGHWAY AND CUTTING WITH MAIN TREES TO BE SURVEYED FOLLOWING REMOVAL OF LOW VEGETATION

LINE AND GRADIENTS OF REGRADING TO BE OPTIMIZED TO MINIMIZE REMOVAL OF TREES (GENERALLY ON UPPER SLOPES)

APPROXIMATE OUTLINE OF REGRADING OF SLOPE AND SOIL NAILING SOIL PANEL FACE

UPPER SLOPE REGRADING TO REMOVE SCARPS AND BULGES BUT LANDSCAPING TO SUIT TREES

NOTES

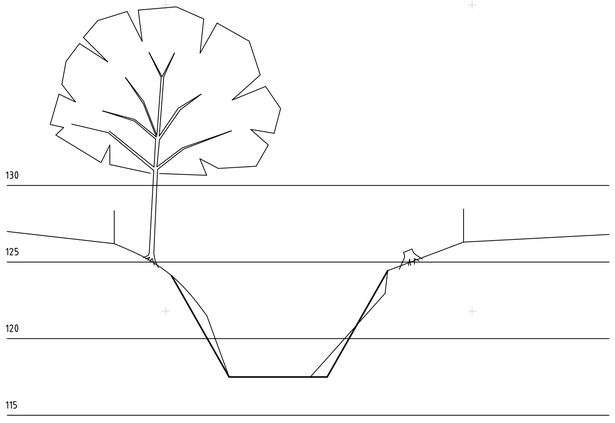
NORTH

ALL FEATURES AND CONTOURS WITHIN ROAD CUTTING ARE SHOWN IN APPROXIMATE POSITION

CONTOURS OBTAINED BY ESTIMATION AND INTERPOLATION

ALL CROSS SECTIONS ARE APPROXIMATE AND REQUIRING FULL TOPOGRAPHICAL SURVEY TO REDRAW AND SCHEME DESIGN

SURVEY TO INCLUDE TREE POSITION AND SPECIES - SHOWN ILLUSTRATIVELY HERE ONLY



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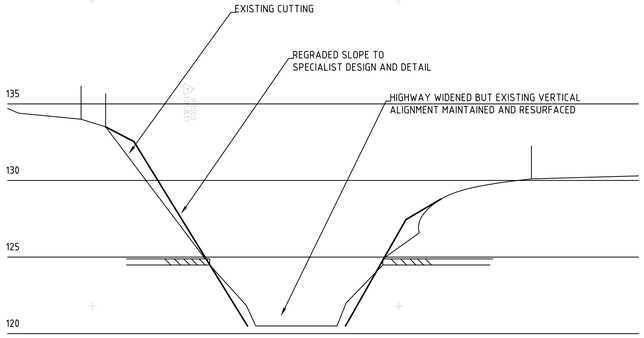

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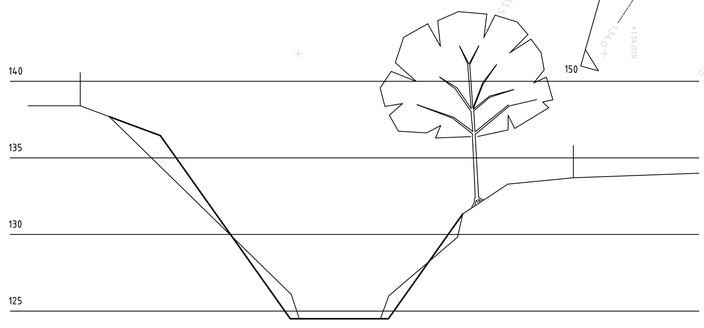

SECTION 150

REV.	DATE	DESCRIPTION
R1	13/11/13	REPORT FIRST ISSUE

STATUS
REPORT

CLIENT
DORSET COUNTY COUNCIL

PROJECT
CUTTING STABILITY INVESTIGATION AT DINAH'S HOLLOW, MELBURY ABBAS, DORSET

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SCALE	DATE	DRAWN
1:200 at A1	13/11/13	ST

DRAWING TITLE
PROPOSED REGRADING PLAN CH 10 TO 170

DRAWING No.	REVISION
7125A-04	R1

NOTES

ALL FEATURES AND CONTOURS WITHIN ROAD CUTTING ARE SHOWN IN APPROXIMATE POSITION

CONTOURS OBTAINED BY ESTIMATION AND INTERPOLATION

DRAWING INDICATES HIGHWAY WIDTH INCREASED WITHIN CUTTING TO THAT AT SCHEME LIMITS OF APPROXIMATE WIDTH (6.4M)

ALL TREES TO BE SURVEYED FOR POSITION AND SPECIES

TREES TO BE INSPECTED BY ARBORICULTURALOGIST TO REPORT ON CONDITION , SAFETY AND SCHEME IMPACT

APPROX POSITION AND DISTRIBUTION OF MAIN TREES

HIGHWAY AND CUTTING WITH MAIN TREES TO BE SURVEYED FOLLOWING REMOVAL OF LOW VEGETATION

LINE AND GRADIENTS OF REGRADING TO BE OPTIMIZED TO MINIMIZE REMOVAL OF TREES (GENERALLY ON UPPER SLOPES)

APPROXIMATE OUTLINE OF REGRADING OF SLOPE AND SOIL NAILING SOIL PANEL FACE

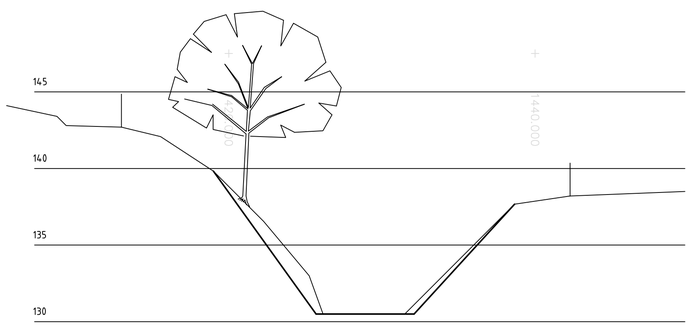
NORTH

THE AREA ABOVE THE "RAGSTONE" ROCK EXPOSURE NOT INVESTIGATED IN DETAIL AS CUTTING HERE APPEARS RELATIVELY STABLE

UPPER SLOPE REGRADING (WHERE NECESSARY) TO REMOVE SCARPS AND BULGES BUT LANDSCAPING TO SUIT TREES

ALL CROSS SECTIONS ARE APPROXIMATE AND REQUIRING FULL TOPOGRAPHICAL SURVEY TO REDRAW AND SCHEME DESIGN

SURVEY TO INCLUDE TREE POSITION AND SPECIES - SHOWN ILLUSTRATIVELY HERE ONLY



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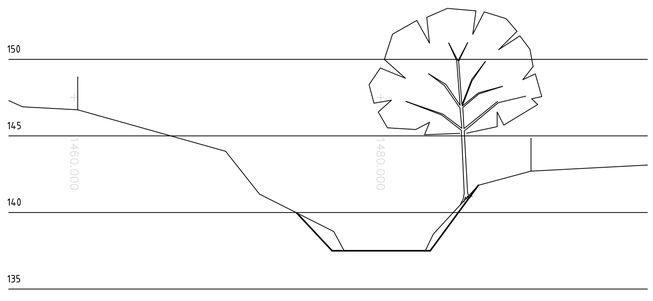

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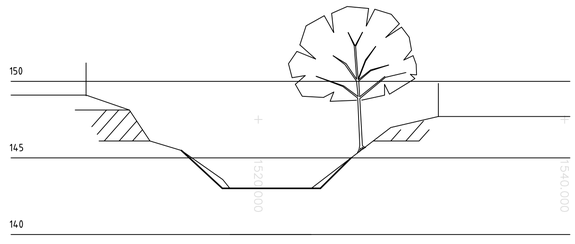

SECTION 290

REV.	DATE	DESCRIPTION
R1	13/11/13	REPORT FIRST ISSUE

STATUS
REPORT

CLIENT
DORSET COUNTY COUNCIL

PROJECT
CUTTING STABILITY INVESTIGATION AT DINAH'S HOLLOW, MELBURY ABBAS, DORSET

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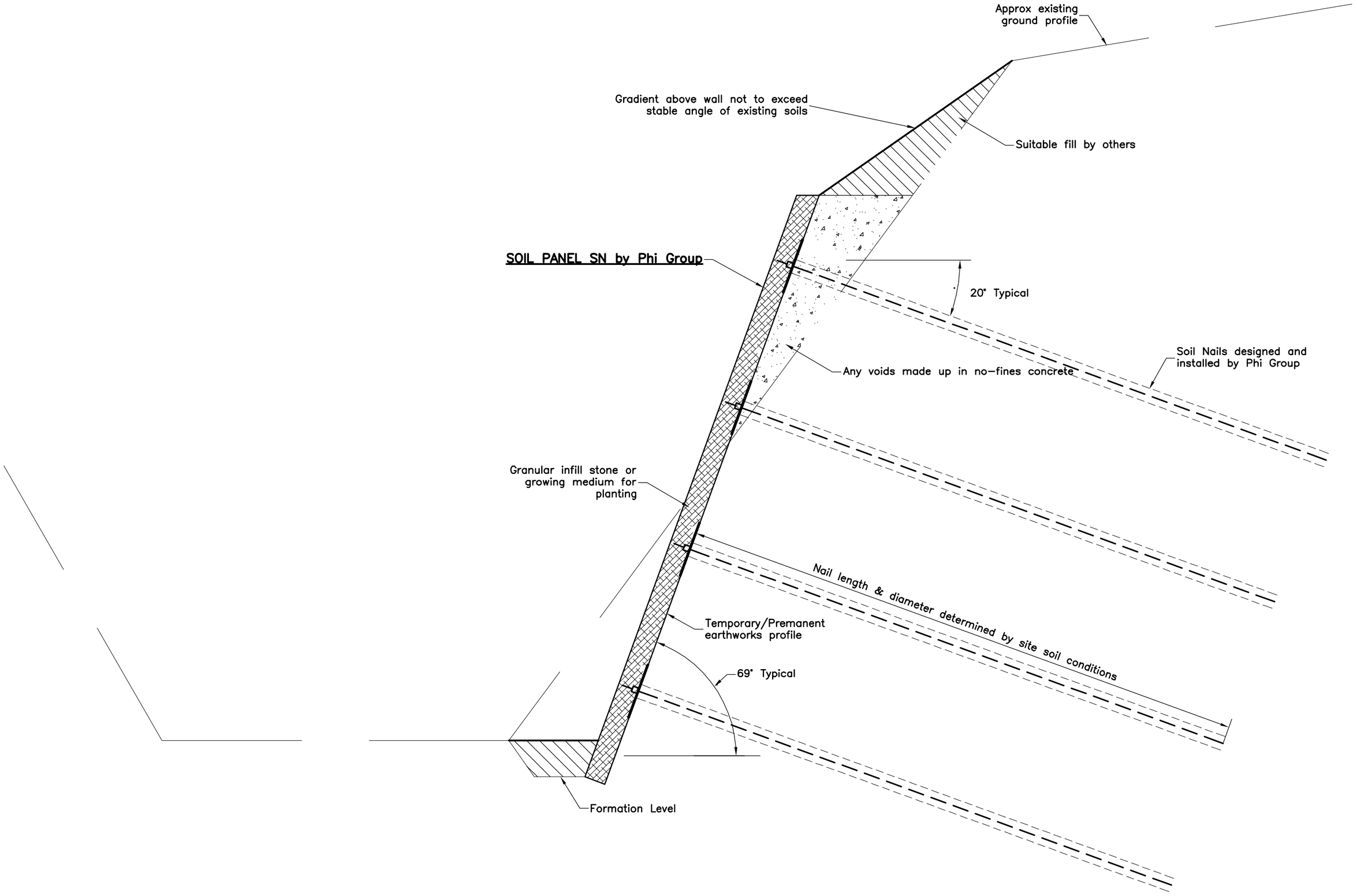
SCALE	DATE	DRAWN
1:200 at A1	13/11/13	ST

DRAWING TITLE
PROPOSED REGRADING PLAN CH 170 TO 320

DRAWING No.	REVISION
7125A-05	R1



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E-mail: scotland@phigroup.co.uk

For full details visit www.phigroup.co.uk

Title
[illegible] DORSET

Description
PRELIMINARY SECTION OF SOIL PANEL SN WALL

Drawing No. 28693-417356-SK1

Rev. –

Scale 1:25

Drn. DRP

Date 12.11.13

Brody Forbes
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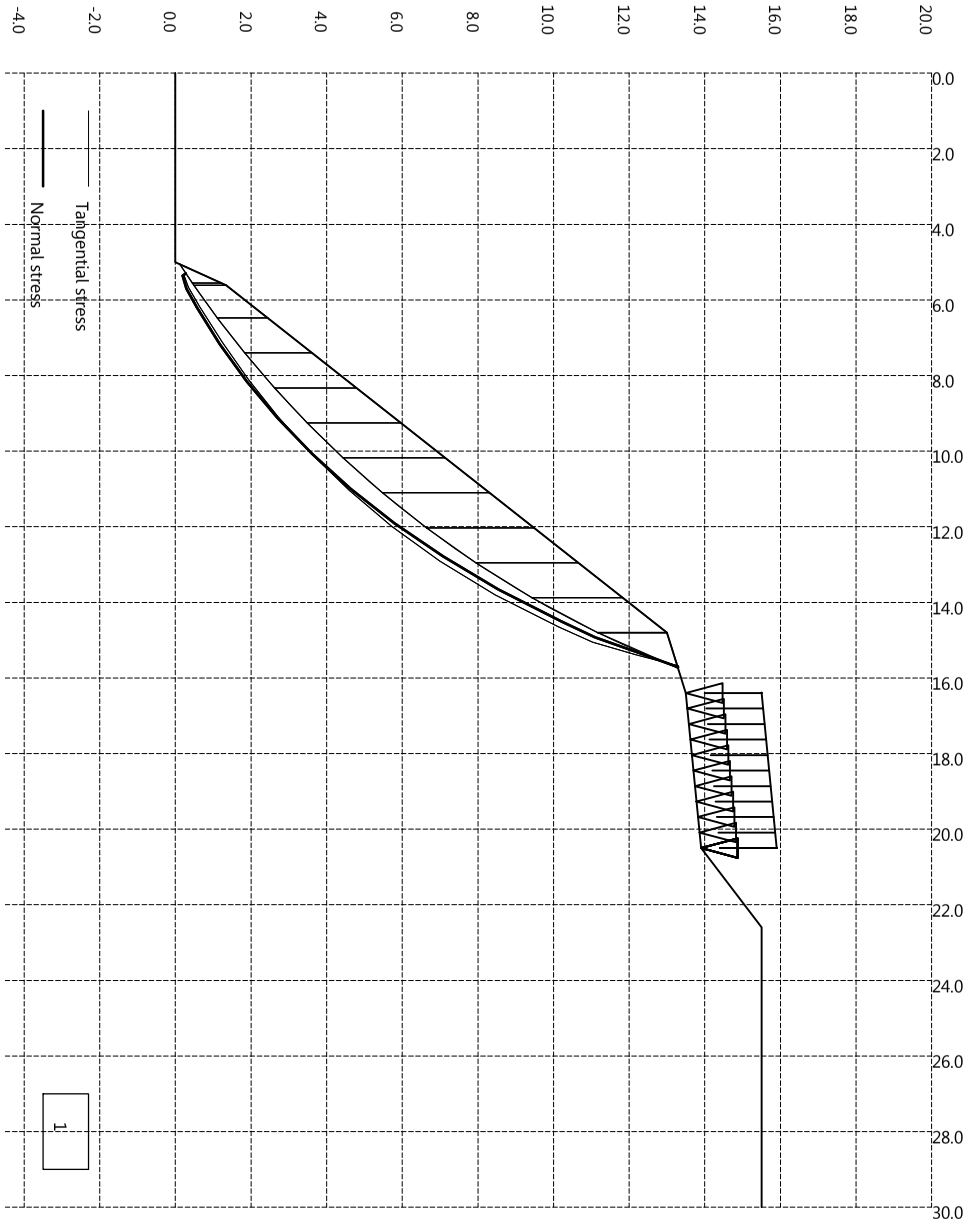
APPENDIX 03

CALCULATIONS AND PROBE RESULTS



Issue	Description	Date	Drwn	Chkd

Brody Forbes
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Plymouth 01752 896 961
enquiries@brodyforbes.co.uk
www.brodyforbes.co.uk

Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

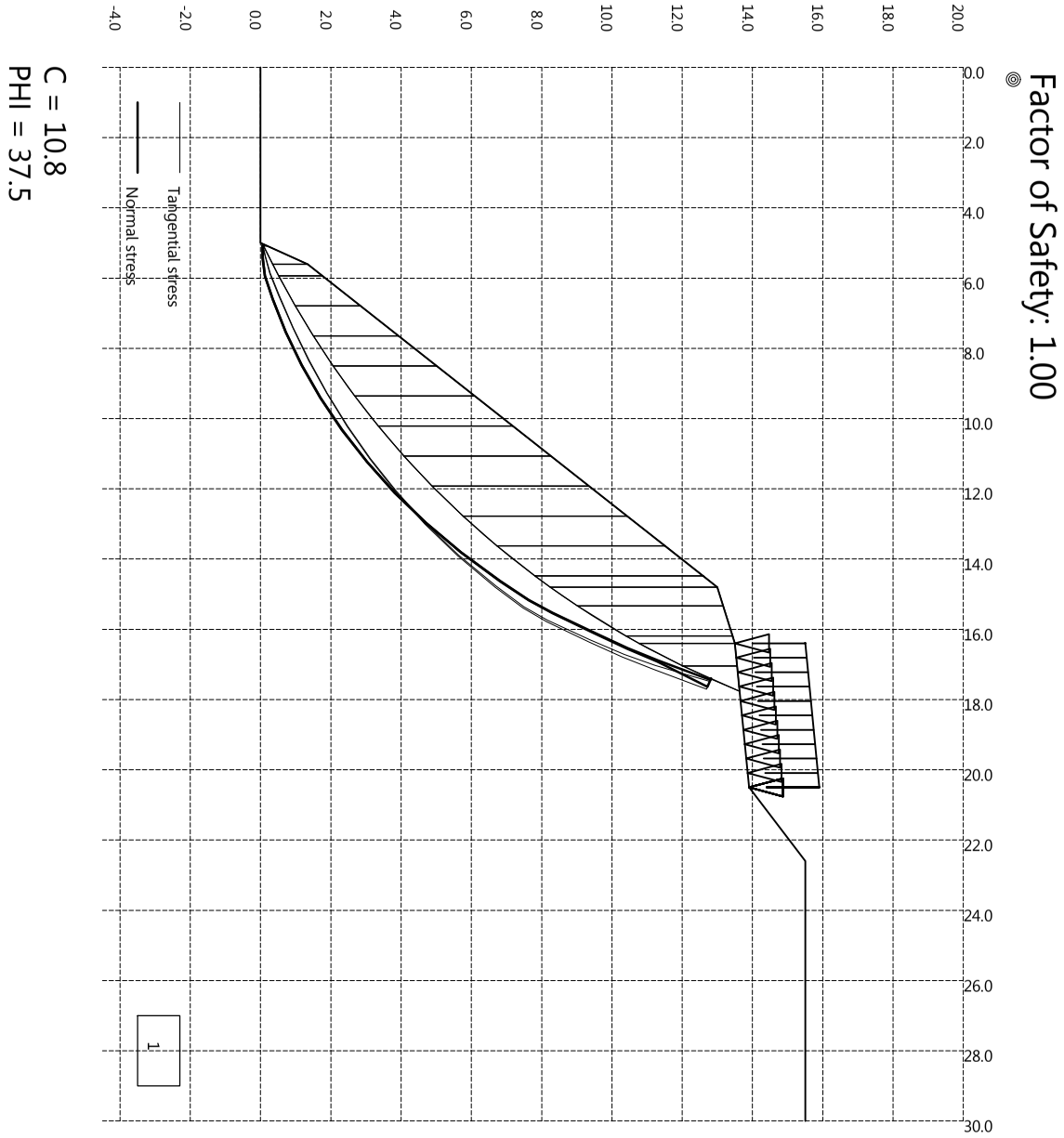
Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: West Slope Stability Analysis C=3, Phi=48.8, FOS =1

Project No.: 7125A - Drawing No.: App3/1 - Revision: R1



Issue	Description	Date	Drwn	Chkd

Brody Forbes
Consulting Civil, Structural & Geotechnical Engineers
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enquiries@brodyforbes.co.uk
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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

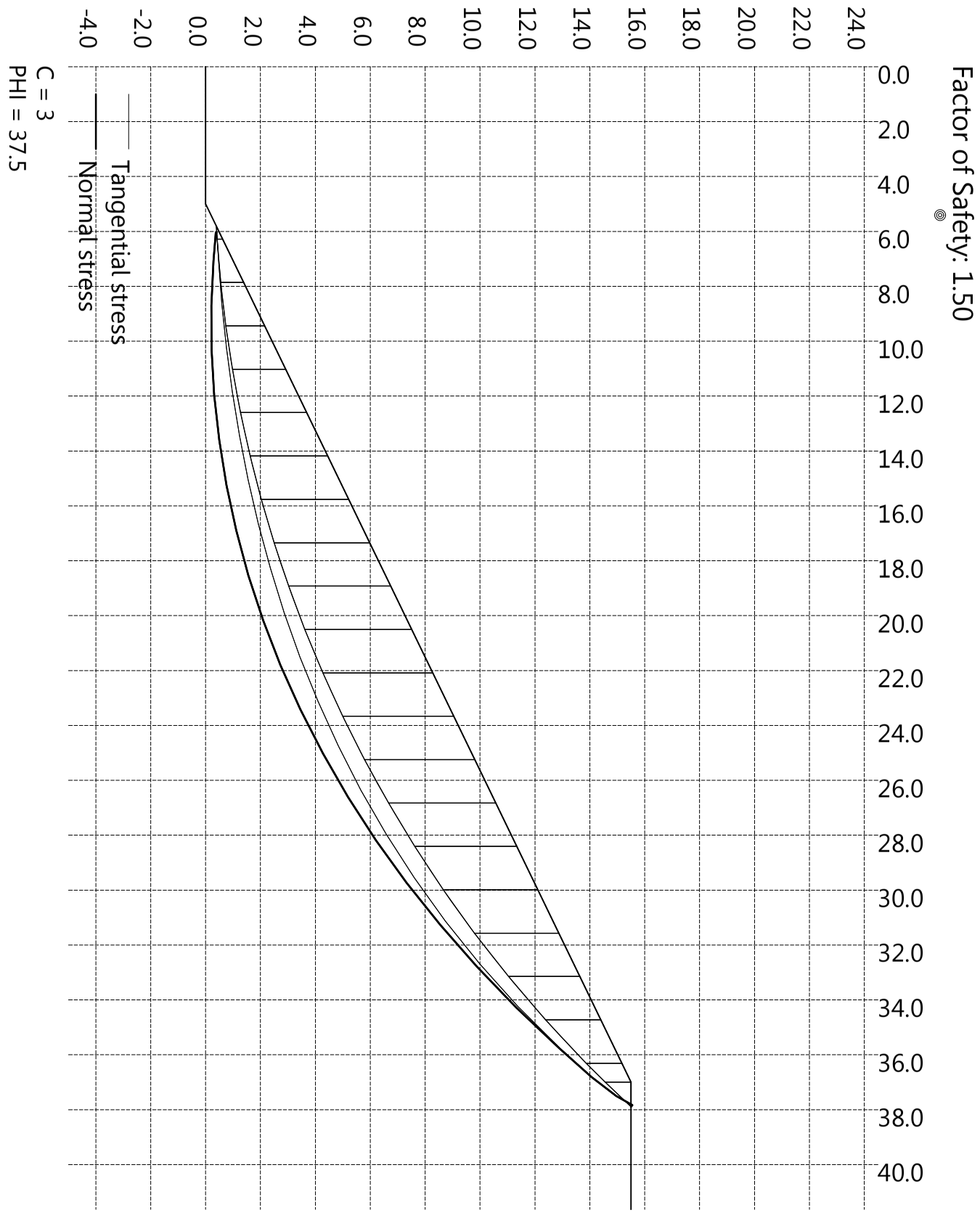
Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: West Slope Stability Analysis C=10.8, Phi=37.5, FOS =1

Project No.: 7125A - Drawing No.: App3/2 - Revision: R1



Issue	Description	Date	Drwn	Chkd

Brody Forbes
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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

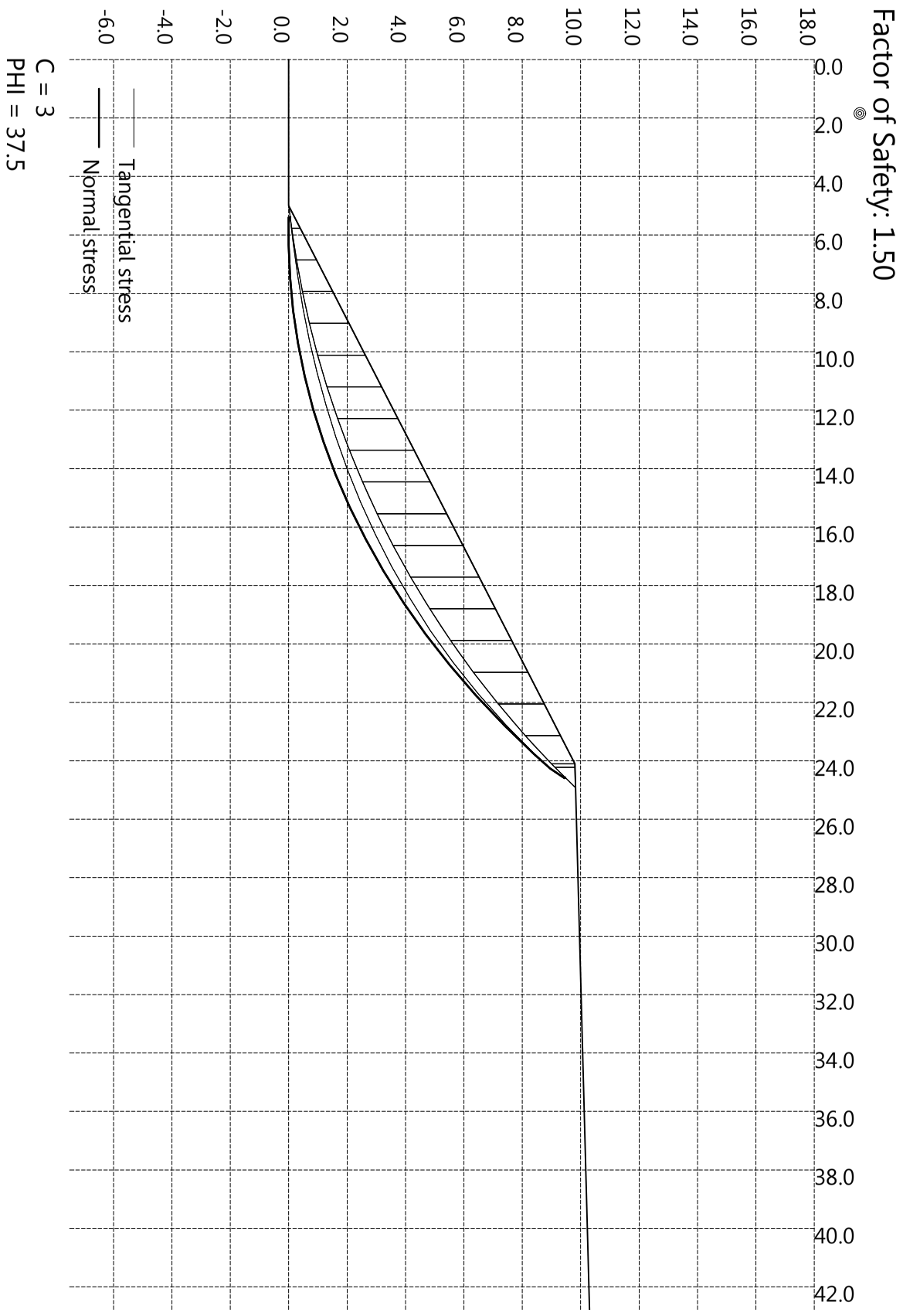
Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: West Slope Stability Analysis C=3, Phi=37.5, FOS =1.5

Project No.: 7125A - Drawing No.: App3/3 - Revision: R1



Issue	Description	Date	Drwn	Chkd

Brody Forbes
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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: East Slope Stability Analysis C=3, Phi=37.5, FOS =1.5

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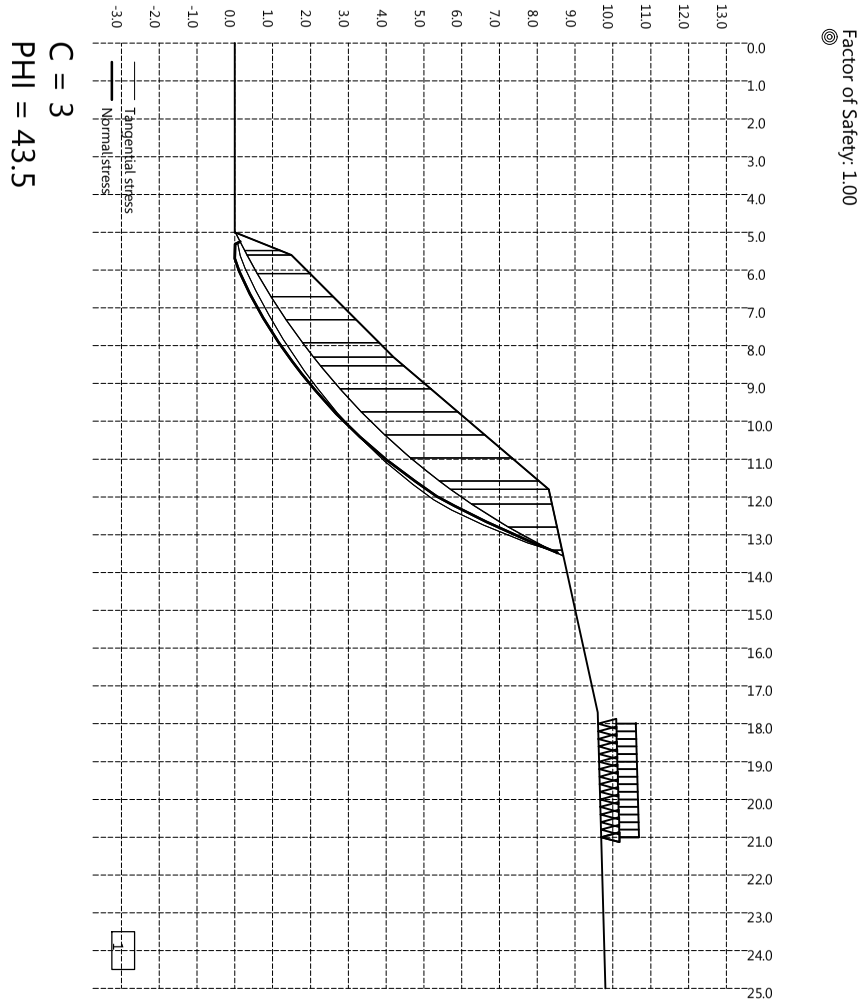

Issue	Description	Date	Drwn	Chkd

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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

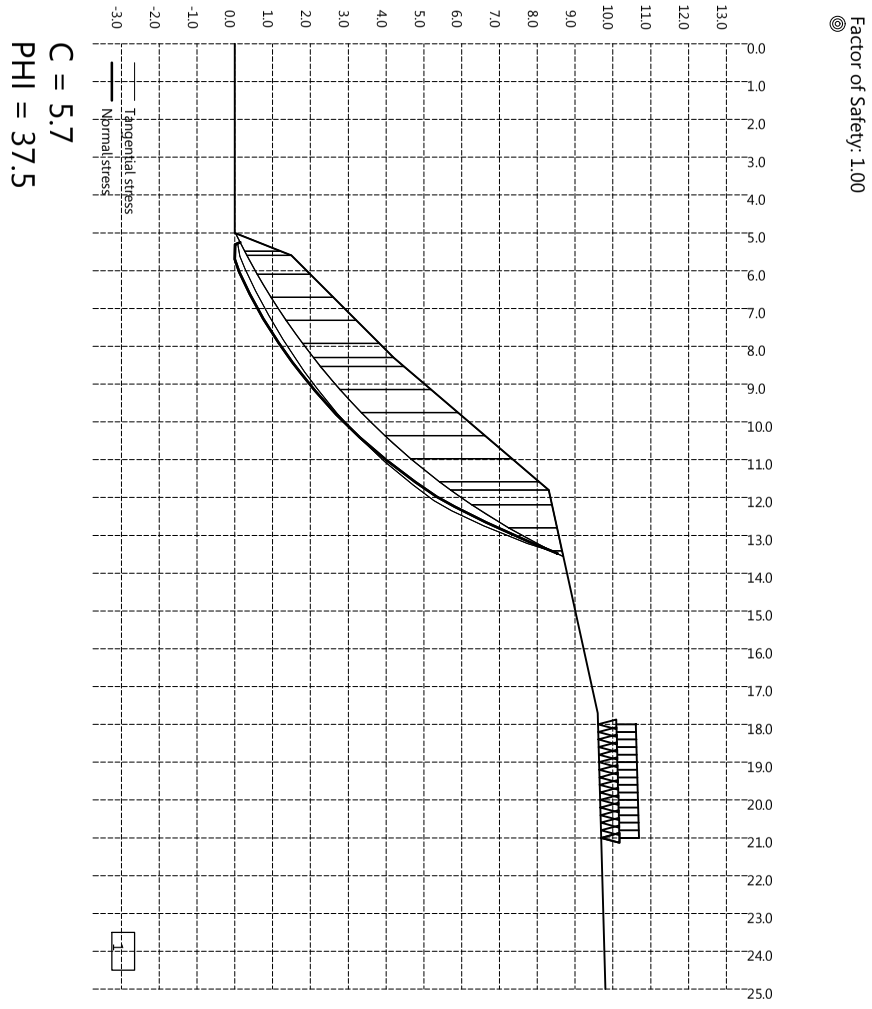
Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: East Slope Stability Analysis C=3, Phi=43.5, FOS =1

Project No.: 7125A - Drawing No.: App3/5 - Revision: R1



Issue	Description	Date	Drwn	Chkd

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Issue Status: ☐ Tender ☐ Construction ☐ Preliminary ☐ H&S File Issue

Scales: NOT TO SCALE | Drawing Size: A4

Client: Dorset County Council

Project: Investigation Into Slope Stability at Dinahs Hollow, Melbury Abbas, Dorset

Title: East Slope Stability Analysis C=5.7, Phi=37.5, FOS =1

Project No.: 7125A - Drawing No.: App3/6 - Revision: R1

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APPENDIX 04

LABORATORY TESTING

BRODY FORBES LIMITED

FACTUAL REPORT

on

GROUND INVESTIGATION

at

DINAH'S HOLLOW

MELBURY ABBAS

DORSET

DECEMBER 2013

REPORT NO: 728347

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DOCUMENT ISSUE RECORD

Contract No:	728347
Client:	Brody Forbes Limited
Contract:	Dinah's Hollow, Melbury Abbas, Dorset
Document:	Factual Report on Ground Investigation

Prepared by:		W Allwood
Approved by:		A Cattell
Date:		December 2013

REVISION RECORD

Revision	Date	Description	Prepared by
0	13/11/13	Draft report for comment	WA
1	02/12/13	Final report	WA

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Table of Contents

1 INTRODUCTION

This investigation was carried out for and on the instructions of Brody Forbes Limited.

The purpose of the work was to investigate ground conditions to provide information for the design of slope stability remediation measures. The work included an intrusive investigation, laboratory testing and the preparation of this report.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and laboratory testing results.

The ground investigation has been carried out using cable percussive techniques, in general accordance with the recommendations of BS5930: 1999 *Code of Practice for Site Investigations.* Whilst every attempt is made to record full details of the strata encountered in the exploratory holes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

A comprehensive desk study, other than an inspection of geological maps, has not been requested or undertaken as part of this investigation. The chemical testing of samples of soil and water for contamination has not formed part of this investigation.

All information given in this report is based on the ground conditions encountered during the site work, and on the results of laboratory and field tests performed during the investigation. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those measured during the investigation.

This report was prepared by Structural Soils Limited for the sole and exclusive use of Brody Forbes Limited in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SITE DESCRIPTION

2.1 Location and Topography

The site is located around 2km south-east of Shaftesbury town, Dorset within fields which lie either side of a minor road known as Dinah's Hollow. Dinah's Hollow lies immediately to the north of the small village of Melbury Abbas (see Site Location Plan in Appendix A). The British National Grid Reference of the site is ST 882 204.

Dinah's Hollow is a single carriageway road that runs north-south, set within a cutting that is up to approximately 10-12m deep at its maximum. The road runs down hill from the north to the south. The cutting is vegetation and tree covered along its length, with field boundary hedges lining the top of either side.

No services were identified on the site during the course of the investigation.

2.2 Geology

The British Geological Survey map 'Shaftesbury' (sheet 313, scale 1:50,000, published 1994) shows the main of the site to be underlain by the Boyne Hollow Chert Member which over lies the Shaftsbury Sandstone Member. According to the BGS Lexicon of Named Rocks Units the Boyne Hollow Chert Member typically comprises a glauconitic sand or sandstone with regularly developed nodular and tabular beds of chert. Interbedded chert beds and nodules can be up to 0.4m thick.

The Shaftsbury Sandstone Member is said to comprise *an alternating succession of fine to medium grained glauconitic sand and sandstone, with a massive 2 to 3m thick, shelly calcareous sandstone referred to as the 'Ragstone' sometimes present at the its upper boundary.*

The Melbury Sandstone Member is mapped immediately to the north of the site and is described as *a fossiliferous glauconitic fine grained sand or weakly cemented sandstone with a considerable coccolith fossil content.*

The Cann Sand Member is mapped towards and beyond the southern fringes of the site and typically comprises *a fine grained glauconitic micaceous sand with fine lenses or bioturbated laminae of micaceous, very fine-grained sand and silt.*

The Melbury Sandstone Member, Boyne Hollow Chert, Shaftesbury Sandstone Member and Cann Sand Member are all part of the Upper Greensand Formation and are of Cretaceous Age.

3 FIELDWORK

3.1 Scope of Works

5 no. cable percussion boreholes (BH1 to BH5) were completed between 9 and 11 October 2013 at locations shown on the Exploratory Hole Location Plan in Appendix A.

The scope of investigation and choice of investigation equipment was decided by Structural Soils Limited in consultation with Brody Forbes Limited. Sampling and in-situ testing details were specified by Brody Forbes Limited.

The positions were selected by Brody Forbes Limited and set out by Structural Soils Limited in conjunction with Brody Forbes Limited, and adjusted where necessary to take account of buried or overhead services, or other restrictions.

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS5930: 1999 (2010 Amendment 2, which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1). Detailed descriptions, together with relevant comments, are given in the logs included in Appendix B.

Prior to the commencement of the exploratory holes a cable avoidance scan was carried out using a cable avoidance tool (CAT) and signal generator ('genny'). Inspection pits were hand dug at all exploratory hole locations prior to the commencement of drilling.

3.2 Cable Percussion Boreholes

The boreholes were drilled using a cable tool percussion drilling rig and were 150mm in diameter. The depths of the boreholes were between 2.70m to 15.00m and they predominantly encountered medium dense and dense green brown fine sand with a variable clay content. Occasional horizons of extremely weak to weak fine grained sandstone were encountered (up to around 200mm thick) with a bed of sandstone encountered within BH1 between 2.00m and 2.70m depth, the base of which was not proven.

100mm diameter undisturbed samples were recovered from the cohesive strata in the boreholes. Standard Penetration Tests (SPT) were carried out at regular intervals in the boreholes (see Section 3.4, In-Situ Testing and Surveying). Small disturbed and bulk soil samples were taken from the boreholes at regular intervals.

3.3 Backfill, Monitoring Wells and Installations

On completion a 19mm diameter standpipe piezometer was installed in BH5, the design having been decided by Brody Forbes Limited. The installation details are shown on the exploratory hole log in Appendix B.

The well details are also summarised below:

TABLE 1: SUMMARY OF MONITORING WELL INSTALLATIONS					
Location	**Well Diameter (mm)**	**Well Depth (m bgl)**	**Well Response Zone (m bgl)**	**Type of Cover**	**Notes**
BH5	19	10.00	7.00-10.00	Flush	

On completion the remaining boreholes were backfilled with bentonite pellets.

3.4 In-Situ Testing and Surveying

Standard Penetration Tests (SPT) were carried out in the exploratory holes, where noted in the preceding sections, in accordance with BS EN ISO 22476-3 using a hammer which had been calibrated for efficiency. The calibration certificate is included in Appendix C.

The SPT N-values are reported on the exploratory hole logs, on which the serial number of the hammer used is recorded. The full results are presented in tabular format on the Summary of Standard Penetration Tests in Appendix C, on which the normalised N_{60} values are also reported (equivalent N-value for a hammer delivering 60% of the theoretical drop energy). Plots showing both N and N_{60} values versus depth are also included.

4 LABORATORY TESTING

Samples for potential geotechnical testing were returned to the company's laboratory in Bristol. Geotechnical tests were scheduled by Brody Forbes Limited.

Geotechnical laboratory testing was generally carried out in accordance with BS1377: 1990, *Methods of Test for Soils for Civil Engineering Purposes*, Parts 1 to 8, unless indicated otherwise. Where non-standard procedures have been undertaken, this is recorded on the report sheet. The results are reported in tabular and/or graphical form and included as Appendix D of this report. Chemical testing (e.g. for concrete classification) results are contained in the same appendix.

4.1 Direct Shear Test (Small Shear Box Apparatus)

4 no. sets of consolidated drained direct shear tests were undertaken in accordance with BS1377: Part 7: 1990, on remoulded samples. Each set comprised the consolidation and shearing of three specimens, each nominally 60mm x 60mm and 20mm thick at vertical normal stresses of between 100kPa and 400kPa. Results of the test allow peak values of c' and ϕ' to be derived for the soil.

The results are tabulated and represented graphically as consolidation and shearing curves, together with a plot of shear stress at failure and normal stresses applied, defining peak effective cohesion and effective angle of friction.

4.2 Measurement of Resistivity

4 no. measurement of resistivity tests were undertaken using the disc electrode method in accordance with BS1377: Part3: 1990.

4.3 Chemical Analyses

4 no. soil samples were tested to determine their pH values, water soluble sulphate, total acid soluble sulphate, total sulphur contents and chloride contents.

STRUCTURAL SOILS LIMITED

W Allwood BSc (Hons) FGS

A Cattell BSc PhD CGeol FGS

5 REFERENCES

5.1 BS 5930:1999 *Code of Practice for Site Investigation,* including amendment A2 (2010).

5.2 British Geological Survey sheet 313 scale 1:50,000, published 1994.

5.3 BS EN ISO 14688-1:2002 *Geotechnical investigation and testing – Identification and classification of soil: Part 1: Identification and description.*

5.4 BS EN ISO 14688-1:2004 *Geotechnical investigation and testing – Identification and classification of soil: Part 2: Principles for a classification.*

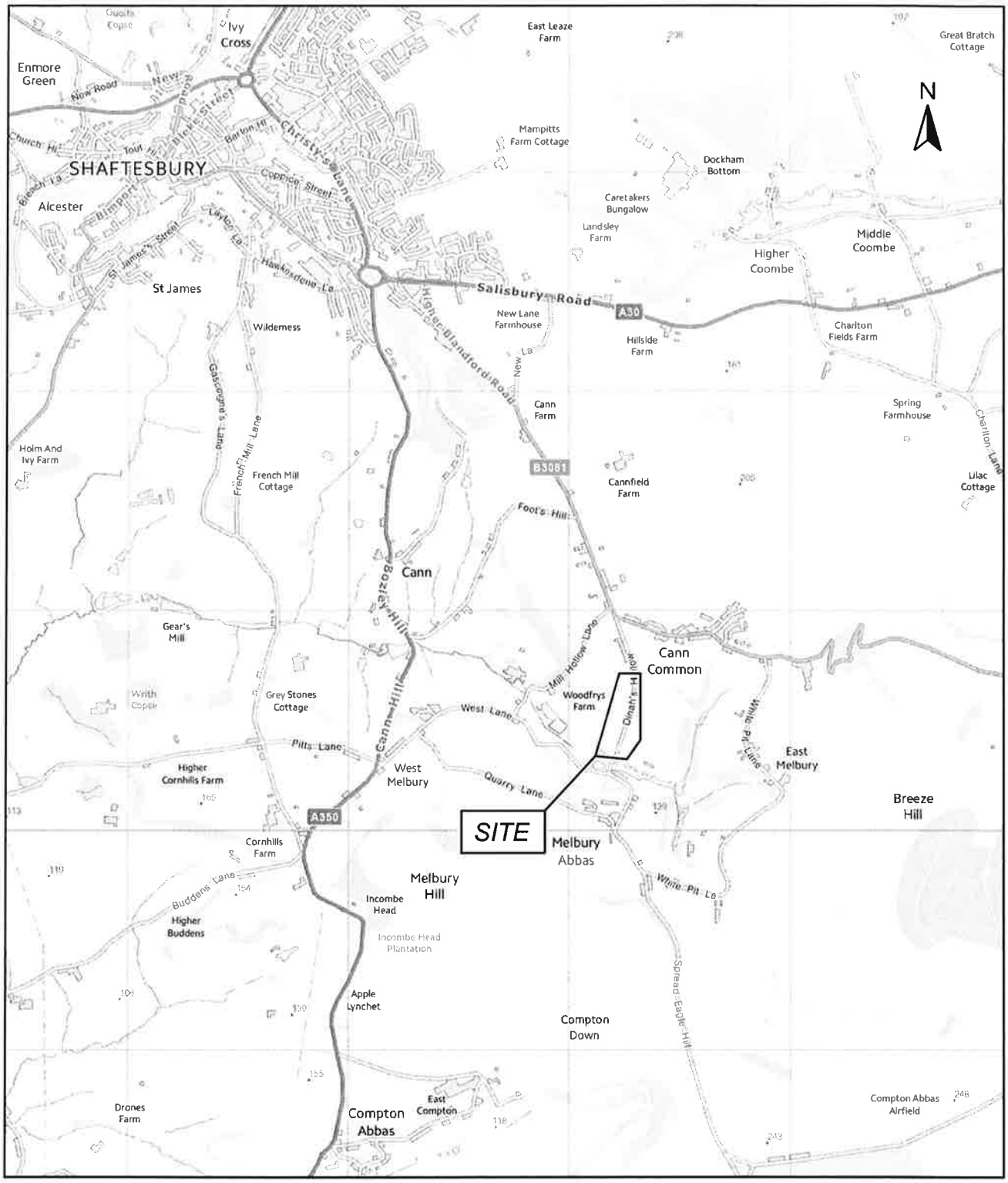
5.5 BS EN ISO 14689-1:2003 *Geotechnical investigation and testing – Identification and classification of rock: Part 1: Identification and description.*

5.6 BS 1377:1990 Methods of Test for Soils for Civil Engineering Purposes.

APPENDIX A

(i) Site Location Plan

(ii) Exploratory Hole Location Plan



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REV.	DATE	DESCRIPTION	BY	CHD.	APR.
00	04.10.2013	-	JAH	WA	AD

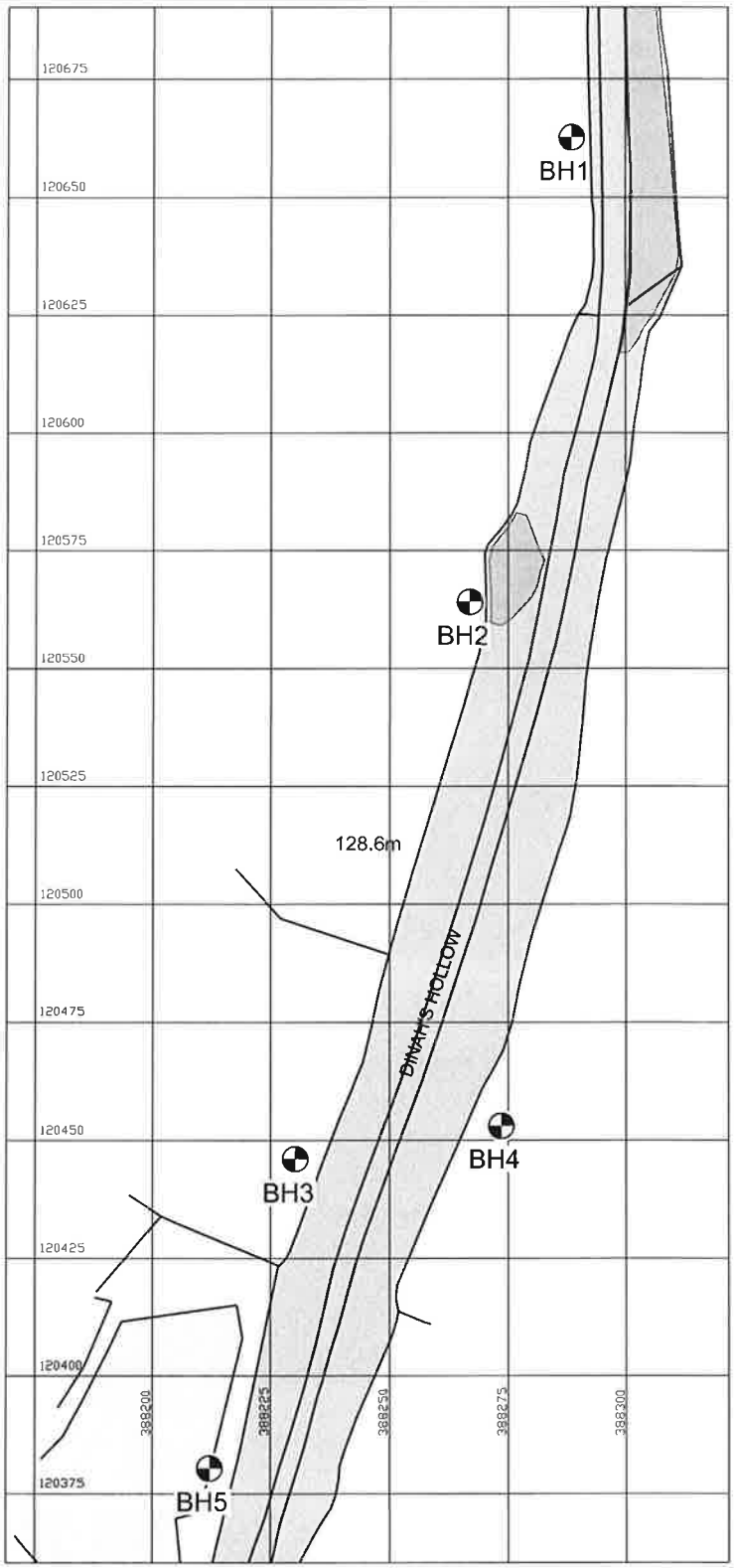
DIMENSION	SCALE	DRAWING STATUS
m	1:25,000	-

CLIENT: Dorset County Council

PROJECT: Melbary Abbas, Dorset

TITLE: SITE LOCATION MAP

CONTRACT No	GRID REFERENCE	SCALE BAR	ORIGIN SIZE	FIGURE No
728347	ST 882 204	0 250 500 750 1000m	A4	1



NOTE

Locations are approximate.

LEGEND

Borehole Location

STRUCTURAL SOILS LIMITED

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Stillhouse Lane
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REV.	DATE	DESCRIPTION	BY	CHD.	APR.
00	04.10.2013	-	JAH	WA	-

CLIENT: Dorset County Council

PROJECT: Melbary Abbas, Dorset

TITLE: EXPLORATORY HOLE LOCATION PLAN

DIMENSION	SCALE	DRAWING STATUS	JOB NO.	SCALE BAR	ORIGIN SIZE	FIGURE
m	1:1500	-	728347	0 20 40 60 80m	A4	2

APPENDIX B

(i) Key to Exploratory Hole Logs

(ii) Borehole Logs

KEY TO EXPLORATORY HOLE LOGS - SUMMARY OF ABBREVIATIONS

SAMPLING

Sample type codes

B	=	Bulk disturbed sample.
D	=	Small disturbed sample.
DSPT	=	Small disturbed sample originating from SPT test.
U	=	Undisturbed driven tube sample - Number of blows indicated. % recovery reported.

IN-SITU TESTING

SPT	=	Standard Penetration Test using split spoon sampler. ($SPT_{(NR)}$ indicates 'No Sample Recovery').

ADDITIONAL NOTES

1. All soil and rock descriptions and legends in general accordance with BS EN ISO 14688-1, 14688-2, 14689-1, and BS5930:1999 including Amendment 2 (2010).
2. Material types divided by a broken line (- - -) indicates an unclear boundary.
3. The data on any sheet within the report showing the AGS icon is available in the AGS format.

GINT_LIBRARY_V8_05.GLB!GrfcText G - LEGEND - 1 OF 2 | 728347_MELBURY_ABBAS_DORSET.GPJ - v8_05 | 4/11/13 - 09:30 | AD.
Structural Soils Ltd, Head Office - Bristol: The Old School, Stillhouse Lane, Bedminster, Bristol, BS3 4EB. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email:admin@soils.co.uk.

STRUCTURAL SOILS

Contract Reference: **728347**

KEY TO EXPLORATORY HOLE LOGS - SUMMARY OF GRAPHIC SYMBOLS

WATER COLUMN SYMBOLS

First water strike, second water strike etc.

Standing water level following first strike, standing water level following second strike etc.

Seepage.

Standing water level recorded at documented date.

MATERIAL GRAPHIC LEGENDS


Clayey gravelly SAND


Gravelly clayey SAND


Clayey SAND


Sandstone


Gravelly sandy CLAY


Sandy gravelly CLAY


Silty gravelly SAND

INSTRUMENTATION SYMBOLS


Bentonite seal


Concrete


Gravel filter


Stopcock cover


Plain pipe


Slotted pipe

GINT_LIBRARY_V8_05.GLB:GrfcText G - LEGEND - 2 OF 2 | 728347_MELBURY_ABBAS_DORSET.GPJ - v8_05 | 4/11/13 - 09:30 | AD.
Structural Soils Ltd. Head Office - Bristol: The Old School, Stillhouse Lane, Bedminster, Bristol, BS3 4EB. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk. Email:admin@soils.co.uk.

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH1**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**09.09.13** End: **09.09.13**	---	---	**1** of **1**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.30	1	B				Light brown slightly silty locally clayey slightly gravelly fine SAND. Gravel is angular to subrounded fine to coarse sandstone and occasional flint.	0.30	
0.70	2	D				Light brown clayey gravelly fine SAND with occasional pockets of soft to firm light brown to light green grey sandy slightly gravelly clay (<60mm diameter). Gravel is subangular to subrounded fine to coarse sandstone and occasional flint.	(1.70)	
1.20-1.20	3	B				. . . Sand is dense below 1.20m depth.		
1.20-1.65	4	SPT	N=32				2.00	
2.00	5	D				Extremely weak up to weak light grey brown fine grained SANDSTONE with frequent interbeds/horizons of light green grey clayey gravelly fine sand. Gravel is angular to subrounded fine to medium chert. Recovered as light grey green silty gravelly fine sand with frequent pockets/fragmented laminae of clayey gravelly fine sand containing chert gravels. Gravel is subangular to subrounded fine to coarse extremely weak upto weak light grey brown fine grained sandstone.	(0.50)	
2.20-2.52	6	SPT	N=94*				2.50	
2.20-2.50	7	B					2.70	
2.70-2.80	8	SPT	N=214*			Weak locally very weak light grey brown fine grained SANDSTONE. Possibly thinly laminated (<10mm thick).		
						Borehole terminated at 2.70m depth.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
09/09/13		2.70	-	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)
2.50	2.70	00:30

General Remarks

1. Hand dug inspection pit to 1.20m depth prior to drilling.
2. Borehole remained dry.
3. Borehole backfilled on completion.
4. SPT hammer EQU856-2013 E_t = 68.26%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	AD

AGS

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH2**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**9.9.13**	**---**	**---**	**1** of **2**
	End: **9.9.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Grass over dark greenish brown clayey slightly gravelly fine SAND with occasional pockets/horizons of soft to firm dark greenish brown sandy clay (less than 40mm).	(0.50)	
							0.50	
0.50-1.00	1	B				Loose to medium dense dark greenish brown occasionally orange brown clayey locally very clayey slightly gravelly fine SAND with occasional pockets/horizons of firm to stiff dark greenish brown mottled orange brown subangular clay (less than 60mm diameter). Gravel is subangular fine to medium very weak sandstone.		
1.20-1.65	2	SPT	N=12					
1.20-1.65	3	B					(2.50)	
2.20	4	D						
2.20	5	B						
							3.00	
						Loose light clayey slightly gravelly fine SAND. Gravel is subangular to subrounded fine to medium very weak fine gravel sandstone.	(1.00)	
3.50-3.95	6	SPT	N=7					
3.50-3.95	7	B						
							4.00	
4.00-4.45	8	SPT	N=22			Medium dense light greenish brown slightly clayey slightly gravelly fine SAND. Gravel is subangular to subrounded fine to medium extremely weak up to very weak fine grained sandstone. Sand is predominantly slightly clayey with occasional clayey horizons (less than 10mm thick).		
4.00-4.45	9	B						
5.00-5.45	10	SPT	N=17					
5.00-5.45	11	B					(3.50)	
6.00-6.45	12	SPT	N=22					
6.00-6.45	13	B						
7.00	14	D						
							7.50	
7.50-7.95	15	SPT	N=38			Dense greenish brown occasionally light greenish brown clayey fine SAND. Sand is predominantly clayey with occasional slightly clayey horizons (less than 400mm).		
7.50-7.95	16	B						
8.50	17	D					(2.00)	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
09/09/13		7.00	1.20	150	Dry
09/09/13		10.00	7.50	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Hand dug inspection pit to 1.20m depth prior to drilling.
2. Borehole remained dry.
3. Borehole backfilled on completion.
4. SPT hammer EQU856-2013 E_r = 68.26%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH2**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**9.9.13**	**---**	**---**	**2** of **2**
	End: **9.9.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00-9.45	18	SPT	N=38			. . . between 9.00m and 9.45m depth sand thinly laminated and extremely weakly cemented in places (less than 10mm thick horizons).	9.50	
9.00-9.45	19	B						
9.50-9.95	20	SPT	N=22			Medium dense greenish brown slightly clayey fine SAND with occasional clayey horizons (less than 10mm).	(0.50)	
9.50-10.00	21	B					10.00	
						Borehole terminated at 10.00m depth.		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH3**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**10.9.13**	**---**	**---**	**1** of **2**
	End: **10.9.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Grass over dark greenish brown clayey gravelly fine SAND. Gravel is angular to subrounded fine to coarse black flint and sandstone and occasional red brown siltstone.	(0.90)	
							0.90	
1.20-1.65	2	SPT	N=10			Loose to medium dense greenish brown clayey fine SAND.		
2.00-2.45	4	SPT	N=10			. . . recovered as moist locally fine to medium sand between 2.00m and 2.45m depth.	(2.10)	
							3.00	
3.00-3.45	6	SPT	N=20			Medium dense light greenish brown occasionally light orange brown slightly clayey fine SAND with occasional clayey horizons (less than 20mm thick).		
4.00-4.45	8	SPT	N=26				(2.75)	
5.00-5.45	10	SPT	N=29					
							5.75	
						Medium dense greenish brown very clayey fine SAND.	(0.75)	
							6.50	
6.50-6.95	13	SPT	N=16			Medium dense greenish brown clayey fine SAND.		
							(2.50)	
8.00-8.45	16	SPT	N=20					
							9.00	

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
10/09/13		4.00	4.00	150	Dry
10/09/13		11.00	6.00	150	Dry
10/09/13		15.00	6.00	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Hand dug inspection pit to 1.20m depth prior to drilling.
2. Borehole remained dry.
3. Borehole backfilled on completion.
4. SPT hammer EQU856-2013 E_r = 68.26%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	AD

AGS

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH3**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**10.9.13**	**---**	**---**	**2** of **2**
	End: **10.9.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.50-9.95	19	SPT	N=15			Medium dense greenish brown occasionally orange brown very clayey locally clayey fine SAND. . . . predominantly very clayey between 9.50m and 10.00m depth.	(2.50) 11.50	
11.00-11.45	22	SPT	N=15					
12.50-12.95	25	SPT	N=39			Dense greenish brown occasionally orange brown clayey slightly gravelly fine SAND with occasional pockets/horizonsof stiff up to firm to stiff grey brown slightly sandy clay (less than 50mm). Gravel is rare subrounded fine possible chalk/shell fragments.	(3.50)	
14.50-14.95	29	SPT	N=38			. . . occasional laminae of soft to firm grey brown mottled orange brown slightly sandy clay (less than 10mm thick) between 14.50m and 15.00m depth.	15.00	
						Borehole terminated at 15.00m depth.		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	

All dimensions in metres Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH4**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**11.09.13** End: **11.09.13**	---	---	**1** of **2**

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.10-0.30	1	B				Grass over firm dark brown sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse sandstone and black flint.	0.30	
0.50-1.00	2	B				Soft to firm dark brown sandy slightly gravelly CLAY locally dark brown very clayey fine sand. Gravel is angular to subrounded fine to coarse sandstone and black flint.	(1.00)	
1.20	3	U	20 blows				1.30	
1.65	4	D				Soft to firm brown slightly sandy locally sandy slightly gravelly silty CLAY. gravel is angular to subrounded fine to coarse flint, black flint and sandstone. Rare carbonaceous inclusions (less than 3mm diameter) possibly decomposed plant matter/charcoal.	(0.90)	
2.00-2.45	5	SPT	N=13				2.20	
2.00-2.45	6	B				Soft to firm brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse flint, black flint and sandstone.		
2.50-3.00	7	B					(1.60)	
3.00-3.45	8	SPT	N=13					
3.00-3.45	9	B					3.80	
3.80	10	D				Medium dense greenish brown occasionally orange brown very clayey fine SAND with occasional pockets/horizons of firm to stiff greenish grey subangular clay (less than 50mm diameter).		
4.00	11	U	45 blows					
4.45	12	D						
5.00-5.45	13	SPT	N=27			. . . occasional lenses of orange brown slightly gravelly silt between 5.00m and 8.45m depth. Gravel is subrounded fine iron rich siltstone.	(3.00)	
5.00-5.45	14	B						
6.00	15	D						
6.50	16	U	80 blows				6.80	
6.80	17	D				Band of very weak thinly laminated to thickly laminated greenish brown to light green grey fine grained SANDSTONE. Laminae typically 5mm to 15mm thick.	7.00	
7.50	18	D				Medium dense greenish brown clayey slightly gravelly fine SAND. Gravel is subangular fine sandstone.		
8.00-8.45	19	SPT	N=19				(2.50)	
8.00-8.45	20	B						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
11/09/13		1.20	1.20	150	Dry
11/09/13		10.00	1.20	150	Dry

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Hand dug inspection pit to 1.20m depth prior to drilling.
2. Borehole remained dry.
3. Borehole backfilled on completion.
4. SPT hammer EQU856-2013 (E_r = 68.26%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH4**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**11.09.13**	**---**	**---**	**2** of **2**
	End: **11.09.13**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00	21	D				Medium dense greenish brown clayey slightly gravelly fine SAND. Gravel is subangular fine sandstone. *(stratum copied from 7.00m from previous sheet)*	9.50	
9.50-9.95	22	SPT	N=35			. . . occasionally greenish grey and extremely weakly cemented horizons (less than 10mm thick) between 9.00m and 9.50m depth.	(0.50)	
9.50-10.00	23	B				Dense greenish brown very clayey slightly gravelly fine SAND locally firm to stiff greenish grey sandy CLAY. Gravel is subrounded fine to medium sandstone.	10.00	
						Borehole terminated at 10.00m depth.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH5**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**10.09.13** End: **10.09.13**	**---**	**---**	**1** of **2**

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.50-1.00	1	B				Grass over dark brown silty gravelly fine SAND with occasional pockets of firm to stiff grey brown sandy clay (less than 80mm diameter). Gravel is angular to subrounded fine to medium sandstone, flint and black flint	(1.00)	
							1.00	
1.20-1.65	2	SPT	N=9			Firm brown sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse sandstone and flint.	(0.80)	
1.20-1.65	3	B					1.80	
2.00-2.45	4	SPT	N=10			Medium dense greenish brown occasionally orange brown slightly gravelly clayey fine SAND. Gravel is occasionally subrounded fine to medium sandstone.		
2.00-2.45	5	B				. . . brown and very clayey between 1.80m and 2.00m depth.		
3.00-3.45	6	SPT	N=12					
3.00-3.45	7	B				. . . occasional extremely weakly compacted and light greenish grey between 3.00m and 4.00m depth.		
4.00-4.45	8	SPT	N=17				(4.70)	
4.00-4.45	9	B				. . . occasional laminae of soft to firm brown slightly sandy clay (less than 10mm thick) between 4.00m and 4.50m depth.		
5.00-5.45	10	SPT	N=23					
5.00-5.45	11	B						
6.00	12	D						
							6.50	
6.50-6.95	13	SPT	N=40			Dense greenish brown very clayey fine SAND with occasional horizons of dense greenish brown clayey fine SAND (less than 50mm thick).		
6.50-6.75	14	B					(1.50)	
7.50	15	D						
							8.00	
8.00-8.45	16	SPT	N=29	1		Medium dense greenish brown clayey fine SAND.		
8.00-8.45	17	B						
							(2.00)	

Boring Progress and Water Observations

Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth
10/09/13		2.00	1.20	150	Dry
10/09/13		9.00	2.00	150	9.00
10/09/13		9.00	2.00	150	8.30
10/09/13		10.50	2.00	150	8.00

Chiselling / Slow Progress

From	To	Duration (hh:mm)

General Remarks

1. Hand dug inspection pit to 1.20m depth prior to drilling.
2. Borehole remained dry.
3. 50mm diameter gas/groundwater standpipe installed to 10m depth on completion.
4. SPT hammer EQU856-2013 E_r = 68.26%) used.

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

STRUCTURAL SOILS

BOREHOLE LOG

Contract:	Client:	Borehole:
Dinah's Hollow, Melbury Abbas, Dorset	**Brody Forbes Limited**	**BH5**

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
728347	**10.09.13**	**---**	**---**	**2** of **2**
	End: **10.09.13**			

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00	18	D				Medium dense greenish brown clayey fine SAND. *(stratum copied from 8.00m from previous sheet)* . . . at 9.00m depth locally greenish grey and slightly clayey with occasional angular to subangular fine gravel of very weak light greenish grey fine grained sandstone (possible lithorelicts).	10.00	
10.00 10.00-10.11	19 20	D SPT	N=500*			Recovered as greenish brown clayey locally very clayey slightly gravelly fine SAND with pockets of soft to firm greenish brown clay (less than 50mm diameter). Gravel is subangular fine to coarse extremely weak to very weak fine grained sandstone and siltstone nodule fragments. Probably greenish brown clayey locally very clayey slightly gravelly fine SAND with horizons of soft to firm greenish brown clay (less than 50mm thick) and occasional laminae of extremely weak up to very weak greenish brown fine grained SANDSTONE (less than 40mm thick).	(0.50) 10.50	
						Borehole terminated at 10.50m depth.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: **1:50**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	**Dando 2000**	**PH**	**WAllwood**	

APPENDIX C

(i) Standard Penetration Test (SPT) Summary Sheet

(ii) SPT Hammer Calibration Records

(iii) SPT N value versus Depth Plot

(iv) SPT $N_{(60)}$ Value versus Depth Plot

STANDARD PENETRATION TEST SUMMARY TABLE

Exploratory Position ID	Depth (m)	Hole Dia (mm)	Casing Depth (m)	Water Depth (m)	Seating Drive		Test Drive			Hammer ID	Calibration Date	Energy Ratio (%)	N_{60}	Comments
					Blows	Pen (mm)	Blows	R (mm)	Result					
BH1	1.20	150	1.20	DRY	9,9	150	7,8,8,9		N=32	EQU856-2013	08/05/2013	68.26	36	
	2.20	150	2.00	DRY	14,8	150	16,27,10+	170	N=94*	EQU856-2013	08/05/2013	68.26	107	
	2.70	150	2.00	DRY	25	25	50+	70	N=214*	EQU856-2013	08/05/2013	68.26	243	
BH2	1.20	150	1.20	DRY	2,2	150	3,3,3,3		N=12	EQU856-2013	08/05/2013	68.26	14	
	3.50	150	1.20	DRY	2,2	150	3,2,1,1		N=7	EQU856-2013	08/05/2013	68.26	8	
	4.00	150	1.20	DRY	1,2	150	3,6,6,7		N=22	EQU856-2013	08/05/2013	68.26	25	
	5.00	150	1.20	DRY	3,5	150	4,4,4,5		N=17	EQU856-2013	08/05/2013	68.26	19	
	6.00	150	1.20	DRY	3,3	150	4,5,6,7		N=22	EQU856-2013	08/05/2013	68.26	25	
	7.50	150	7.50	DRY	4,6	150	8,9,10,11		N=38	EQU856-2013	08/05/2013	68.26	43	
	9.00	150	7.50	DRY	4,5	150	10,9,9,10		N=38	EQU856-2013	08/05/2013	68.26	43	
	9.50	150	7.50	DRY	3,4	150	5,5,6,6		N=22	EQU856-2013	08/05/2013	68.26	25	
BH3	1.20	150	1.20	DRY	2,2	150	2,2,2,4		N=10	EQU856-2013	08/05/2013	68.26	11	
	2.00	150	2.00	DRY	1,2	150	2,2,3,3		N=10	EQU856-2013	08/05/2013	68.26	11	
	3.00	150	2.00	DRY	2,3	150	3,5,5,7		N=20	EQU856-2013	08/05/2013	68.26	23	
	4.00	150	4.00	DRY	3,4	150	5,5,7,9		N=26	EQU856-2013	08/05/2013	68.26	30	
	5.00	150	5.00	DRY	3,4	150	6,7,7,9		N=29	EQU856-2013	08/05/2013	68.26	33	

Notes:
1. **Tests carried out in general accordance with BS EN ISO 22476-3:2005, including amendment A1 (2011).**
2. **Reported blows are for 75mm penetration unless indicated "+".**
3. **Where full test drive was not achieved, actual penetration (R) and extrapolated N value (N*) reported.**
4. **Tests carried out using a split spoon sampler unless noted as SPT(c) (denotes use of solid cone method) in the comments column.**
5. **Entries in the water depth column reflects the measured water depth at time of test.**

N_{60} = (Measured hammer energy ratio / 60) x N value

STRUCTURAL SOILS
The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By		Date	Contract Ref:
ADJC	**ADINGLE**	**4.11.13**	**728347**

Contract: **Dinah's Hollow, Melbury Abbas, Dorset**

AGS

STANDARD PENETRATION TEST SUMMARY TABLE

Exploratory Position ID	Depth (m)	Hole Dia (mm)	Casing Depth (m)	Water Depth (m)	Seating Drive		Test Drive			Hammer ID	Calibration Date	Energy Ratio (%)	N_{60}	Comments
					Blows	Pen (mm)	Blows	R (mm)	Result					
BH3	6.50	150	6.00	DRY	2,2	150	4,3,4,5		N=16	EQU856-2013	08/05/2013	68.26	18	
	8.00	150	6.00	DRY	3,4	150	4,5,5,6		N=20	EQU856-2013	08/05/2013	68.26	23	
	9.50	150	6.00	DRY	2,3	150	3,4,4,4		N=15	EQU856-2013	08/05/2013	68.26	17	
	11.00	150	6.00	DRY	2,3	150	3,3,4,5		N=15	EQU856-2013	08/05/2013	68.26	17	
	12.50	150	6.00	DRY	5,7	150	9,9,10,11		N=39	EQU856-2013	08/05/2013	68.26	44	
	14.50	150	6.00	DRY	4,5	150	7,9,10,12		N=38	EQU856-2013	08/05/2013	68.26	43	
BH4	2.00	150	1.20	DRY	1,1	150	1,3,5,4		N=13	EQU856-2013	08/05/2013	68.26	15	
	3.00	150	1.20	DRY	1,2	150	3,5,2,3		N=13	EQU856-2013	08/05/2013	68.26	15	
	5.00	150	1.20	DRY	2,4	150	6,6,7,8		N=27	EQU856-2013	08/05/2013	68.26	31	
	8.00	150	1.20	DRY	2,3	150	4,4,5,6		N=19	EQU856-2013	08/05/2013	68.26	22	
	9.50	150	1.20	DRY	4,5	150	7,8,9,11		N=35	EQU856-2013	08/05/2013	68.26	40	
BH5	1.20	150	1.20		1,2	150	2,2,2,3		N=9	EQU856-2013	08/05/2013	68.26	10	
	2.00	150	2.00		1,2	150	3,2,2,3		N=10	EQU856-2013	08/05/2013	68.26	11	
	3.00	150	2.00		2,2	150	2,3,3,4		N=12	EQU856-2013	08/05/2013	68.26	14	
	4.00	150	2.00		2,5	150	4,4,5,4		N=17	EQU856-2013	08/05/2013	68.26	19	
	5.00	150	2.00		2,3	150	4,5,5,9		N=23	EQU856-2013	08/05/2013	68.26	26	

Notes:
1. **Tests carried out in general accordance with BS EN ISO 22476-3:2005, including amendment A1 (2011).**
2. **Reported blows are for 75mm penetration unless indicated "+".**
3. **Where full test drive was not achieved, actual penetration (R) and extrapolated N value (N*) reported.**
4. **Tests carried out using a split spoon sampler unless noted as SPT(c) (denotes use of solid cone method) in the comments column.**
5. **Entries in the water depth column reflects the measured water depth at time of test.**

N_{60} = (Measured hammer energy ratio / 60) x N value

STRUCTURAL SOILS
The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By		Date	Contract Ref:
ADJC	**ADINGLE**	**4.11.13**	**728347**
Contract: **Dinah's Hollow, Melbury Abbas, Dorset**			Page **2** of **3**

STANDARD PENETRATION TEST SUMMARY TABLE

Exploratory Position ID	Depth (m)	Hole Dia (mm)	Casing Depth (m)	Water Depth (m)	Seating Drive		Test Drive			Hammer ID	Calibration Date	Energy Ratio (%)	N_{60}	Comments
					Blows	Pen (mm)	Blows	R (mm)	Result					
BH5	6.50	150	2.00		3,4	150	7,8,11,14		N=40	EQU856-2013	08/05/2013	68.26	46	
	8.00	150	2.00		3,4	150	7,8,7,7		N=29	EQU856-2013	08/05/2013	68.26	33	
	10.00	150	2.00		25	75	50+	30	N=500*	EQU856-2013	08/05/2013	68.26	569	

Notes:
1. **Tests carried out in general accordance with BS EN ISO 22476-3:2005, including amendment A1 (2011).**
2. **Reported blows are for 75mm penetration unless indicated "+".**
3. **Where full test drive was not achieved, actual penetration (R) and extrapolated N value (N*) reported.**
4. **Tests carried out using a split spoon sampler unless noted as SPT(c) (denotes use of solid cone method) in the comments column.**
5. **Entries in the water depth column reflects the measured water depth at time of test.**

N_{60} = (Measured hammer energy ratio / 60) x N value

STRUCTURAL SOILS
The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By		Date	Contract Ref:
ADJC	**ADINGLE**	**4.11.13**	**728347**

Contract: **Dinah's Hollow, Melbury Abbas, Dorset**

AGS

SPT Calibration Report

www.equipegroup.com

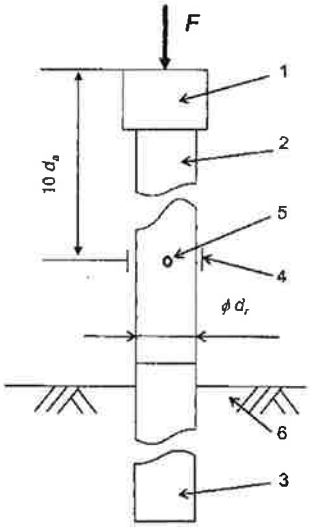
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	WEST WIGHT DRILLING
Test No	EQU856
Test Depth (m)	6.75
Date of Test	08 May 2013
Valid until	08 May 2014
Hammer ID	EQU856

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

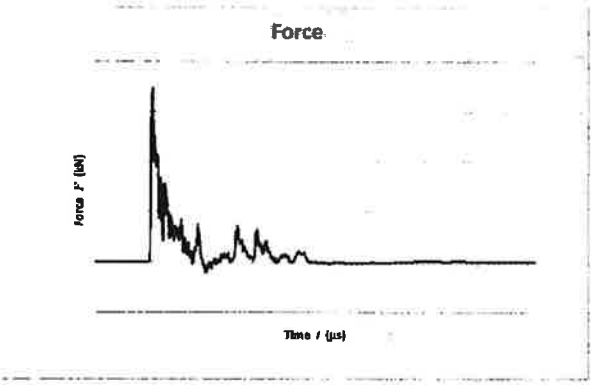


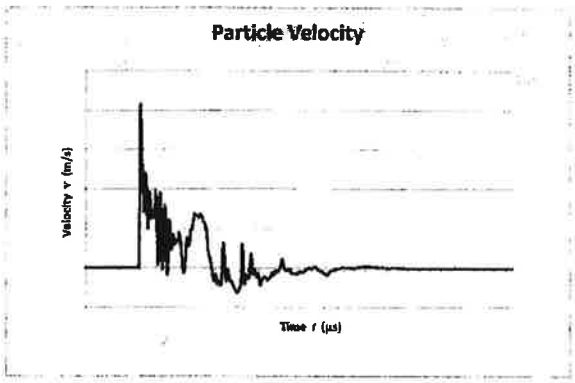
Key

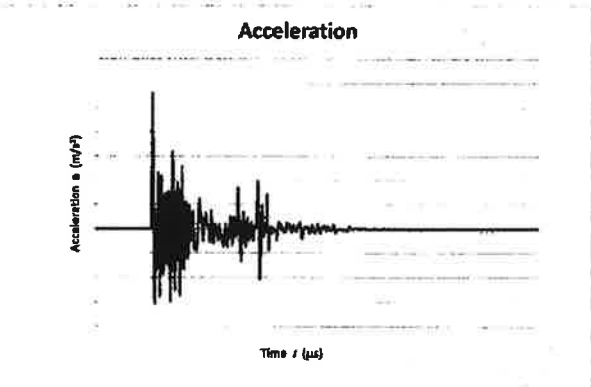
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

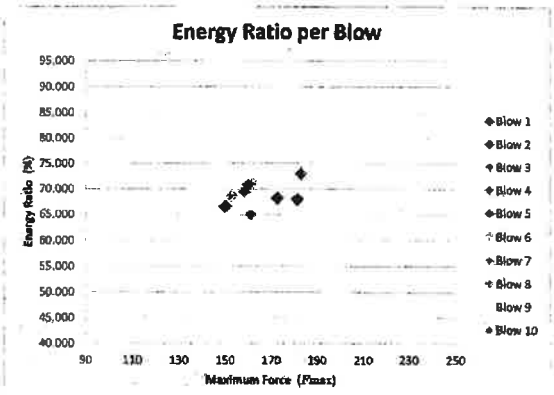
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:

E_{meas} = **0.323** kN-m

E_{theor} = **0.473** kN-m

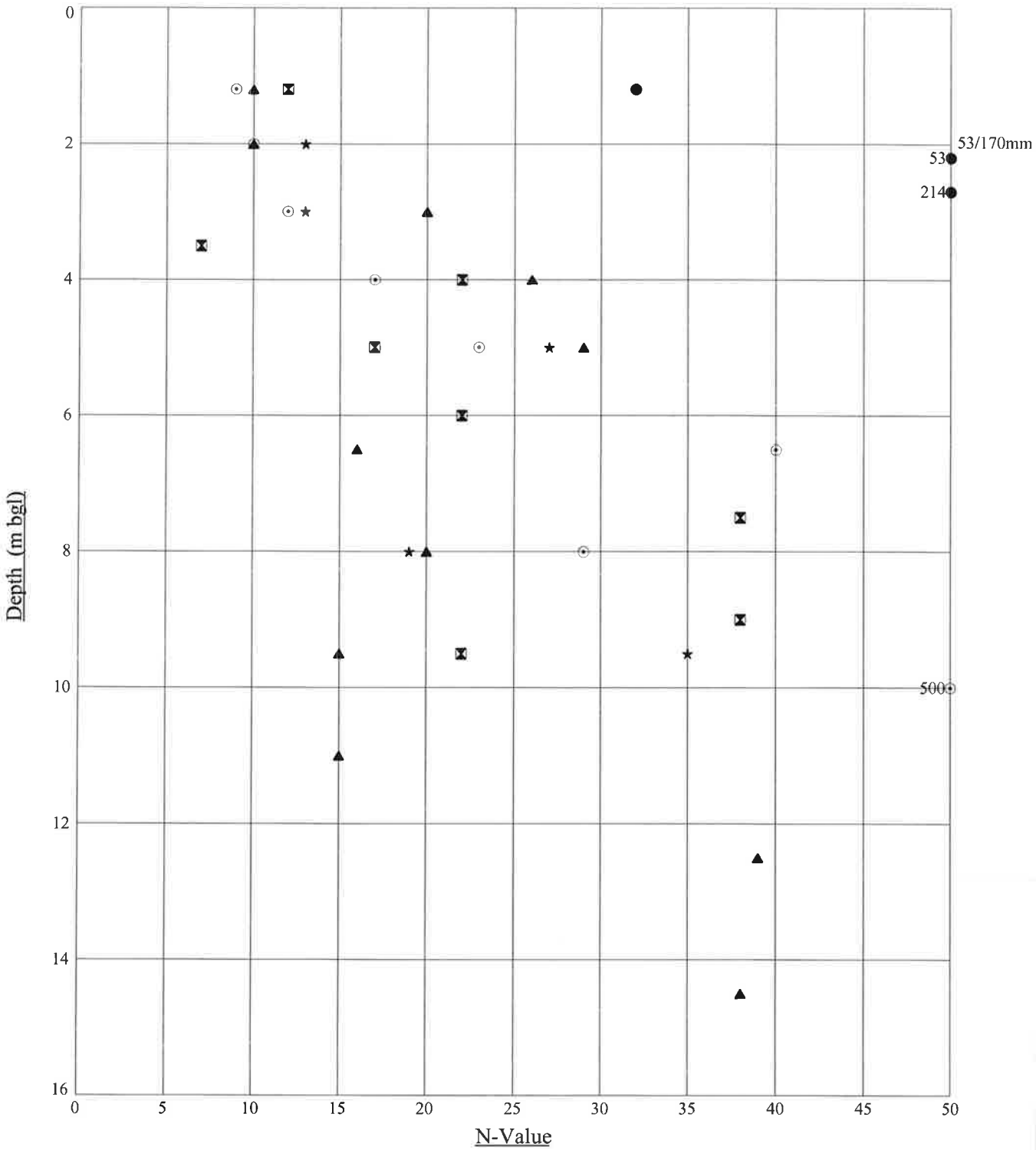
Energy Ratio = $\frac{E_{meas}}{E_{theor}}$ = (E_r) **68.26%**

Equipe SPT Analyzer Operators: CS

Prepared by: **Checked by:** **Date** 15/05/2013

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

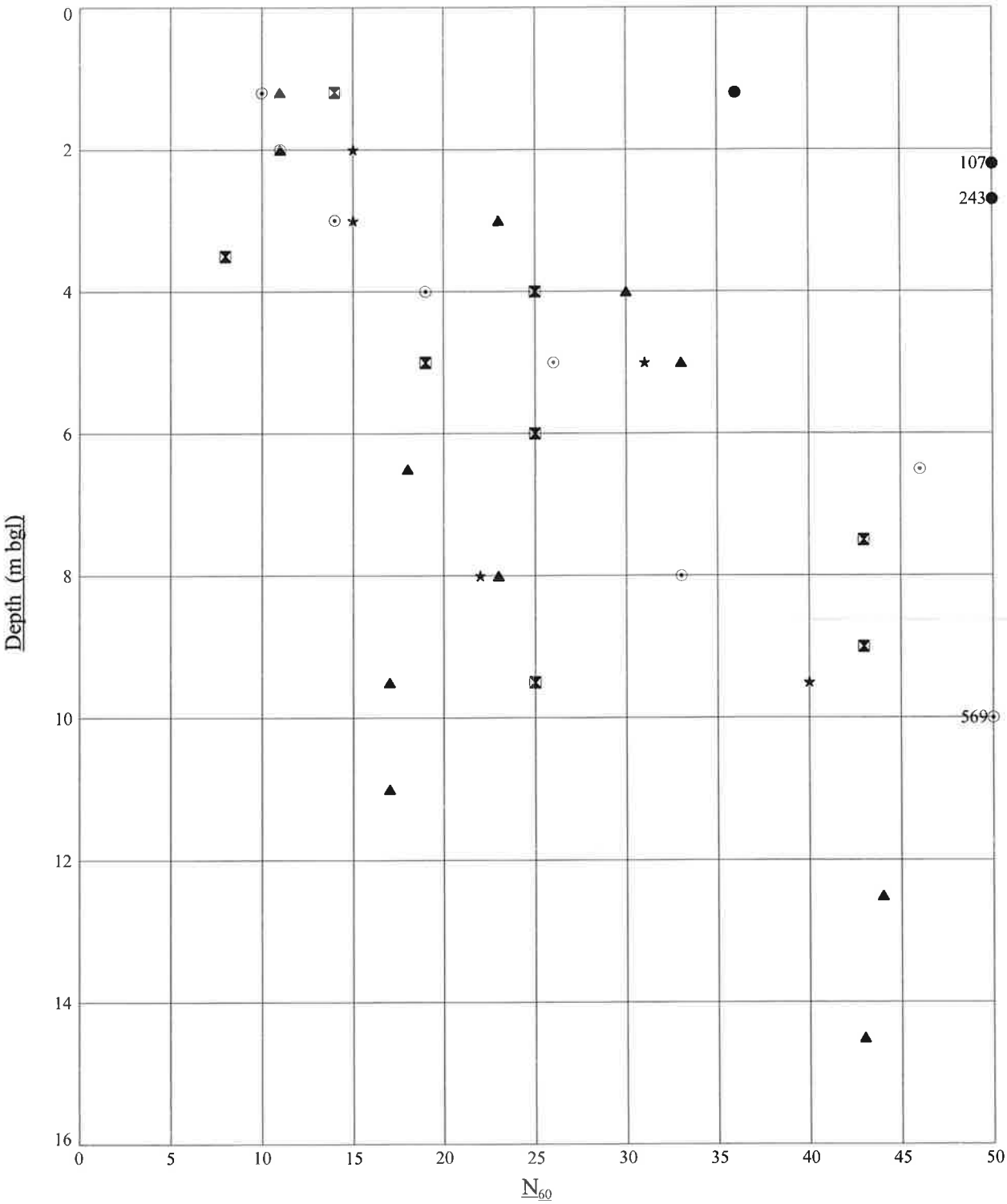
STANDARD PENETRATION TEST (SPT N-Value)
vs
DEPTH



Key: ● = BH1, ⊠ = BH2, ▲ = BH3, ★ = BH4, ⊙ = BH5

STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Contract **Dinah's Hollow, Melbury Abbas, Dorset**	Date **4.11.13**	Compiled By AD
	Client **Brody Forbes Limited**	Contract Ref: **728347**	AGS

STANDARD PENETRATION TEST (SPT N_{60}) VS DEPTH



Key: ● = BH1, ⊠ = BH2, ▲ = BH3, ★ = BH4, ⊙ = BH5

STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Contract **Dinah's Hollow, Melbury Abbas, Dorset**	Date **4.11.13**	Compiled By AD
	Client **Brody Forbes Limited**	Contract Ref: **728347**	AGS

APPENDIX D

(i) Geotechnical Laboratory Test Verification Sheet

(ii) Geotechnical Laboratory Test Results

TESTING VERIFICATION CERTIFICATE

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with Structural Soils Ltd Laboratory Quality Assurance Manual, Issue 6, January 2010 all results sheets and summaries of results issued by the laboratory are checked by an approved signatory. This check will also involve checking of at least 10% of calculations for each test type to ensure that data has been correctly entered into the computer and calculated. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Assurance Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **06/11/2013 15:45:21**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Justin Barrett (Laboratory Manager)

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Contract:
Dinah's Hollow, Melbury Abbas, Dorset

Job No:
728347

AGS

QUICK DRAINED SHEAR BOX TEST

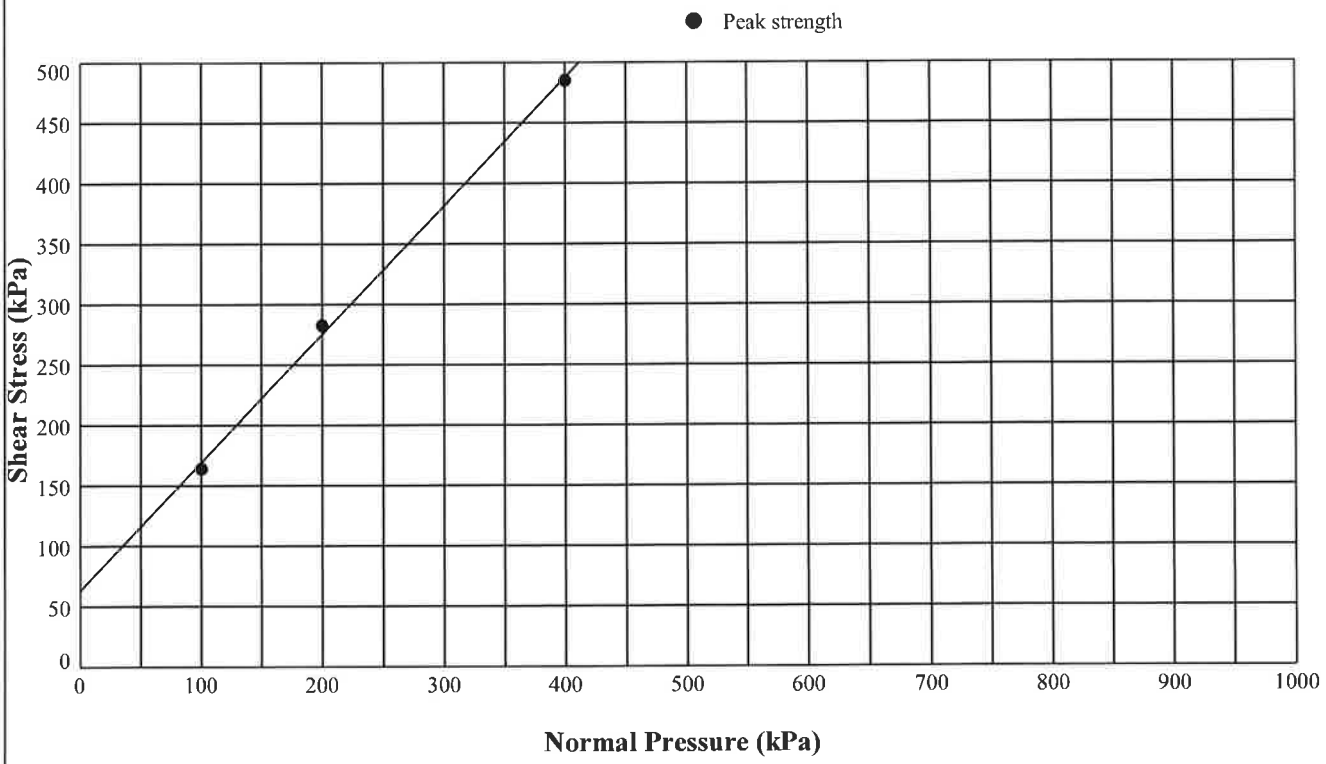
In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH2** Sample Ref: **17** Sample Type: **D** Depth (m): **8.50**

Width x Length (mm) : **60 x 60** Sample Height (mm) : **20.0** Particle Density (Assumed) : **2.65**

Description : **Greenish brown clayey SAND** Sample Condition : **Recompacted**

	SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Moisture Content	(%)	16	16	16
	Initial Bulk Density	(Mg/m^3)	2.08	2.06	2.08
	Initial Dry Density	(Mg/m^3)	1.79	1.78	1.80
	Initial Voids Ratio		0.4785	0.4909	0.4755
CONSOLIDATION	Normal Pressure	(kPa)	100	200	400
	Initial Height	(mm)	18.712	19.104	18.726
SHEAR	Rate of Horizontal Displacement	(mm/min)	0.600	0.600	0.600
	Horizontal Displacement at Peak Shear Stress	(mm)	4.5	4.8	6.3
	Peak Shear Stress	(kPa)	164	283	485
PEAK STRENGTH	Effective Cohesion (C') 63	(kPa)	Effective Angle of Friction (ϕ') 46.5		(deg)



Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
A.D.Frost	ALAN FROST	04/11/13

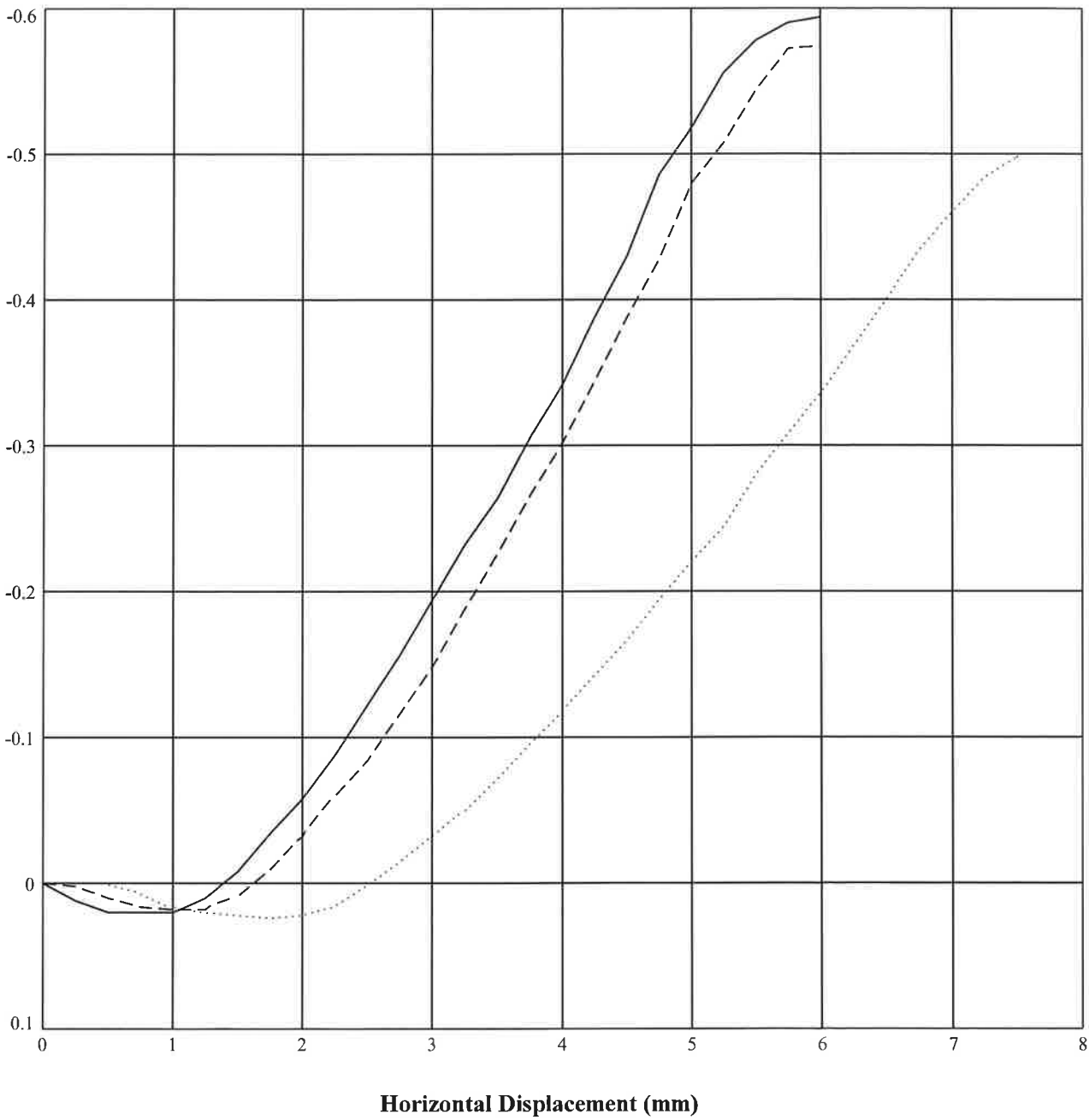
Contract	Contract Ref:
Dinah's Hollow, Melbury Abbas, Dorset	**728347**

AGS

QUICK DRAINED SHEAR BOX
HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH2** Sample Ref: **17** Sample Type: **D** Depth (m): **8.50**



KEY :

Solid Line = Specimen 1 (**100** kPa), *Dashed Line* = Specimen 2 (**200** kPa), *Dotted Line* = Specimen 3 (**400** kPa).

Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
A.D.Frost	ALAN FROST	04/11/13

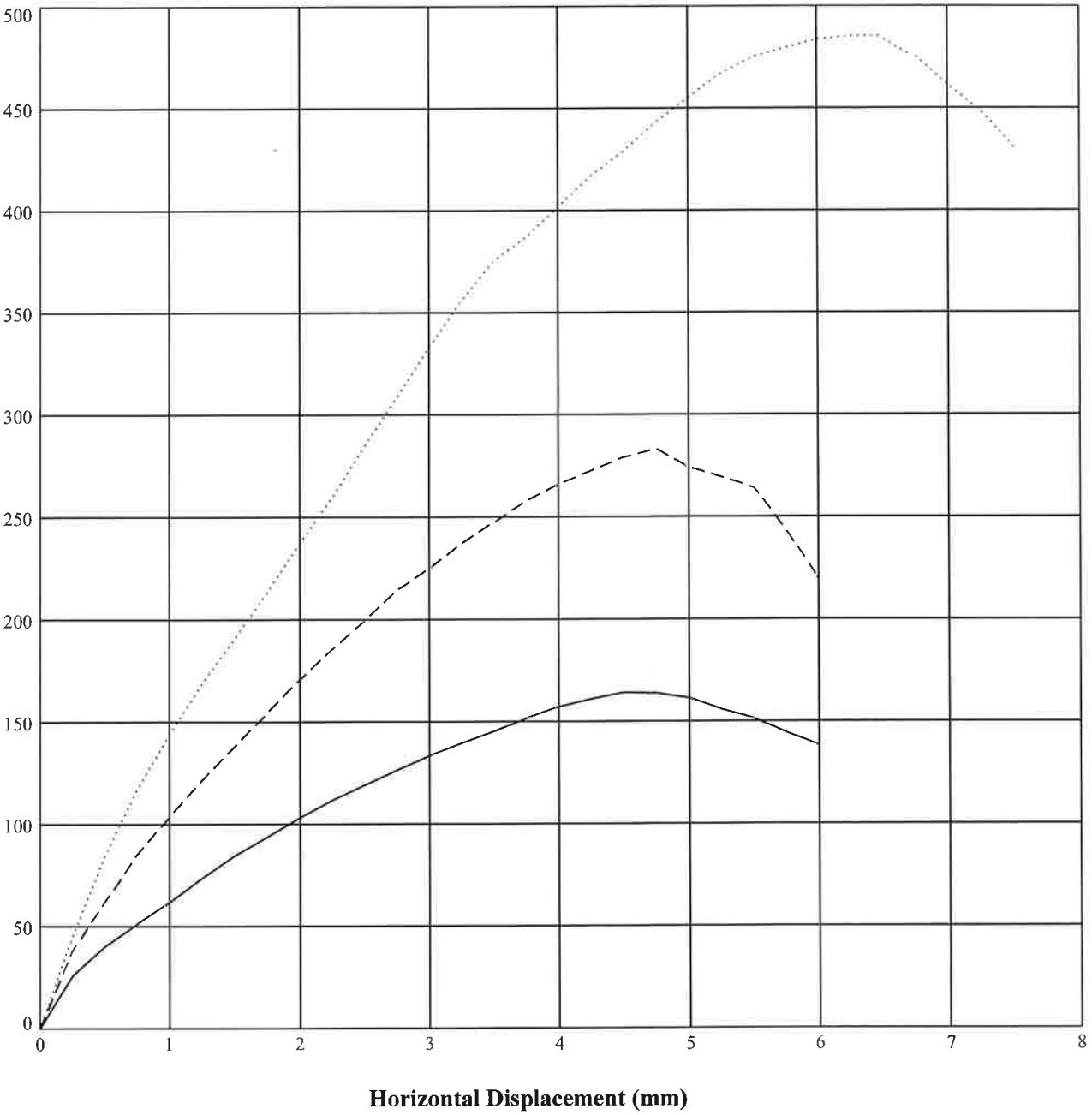
Contract	Contract Ref:
Dinah's Hollow, Melbury Abbas, Dorset	**728347**

AGS

QUICK DRAINED SHEAR BOX
SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH2** Sample Ref: **17** Sample Type: **D** Depth (m): **8.50**



KEY :

Solid Line = Specimen 1 (**100** kPa), *Dashed Line* = Specimen 2 (**200** kPa), *Dotted Line* = Specimen 3 (**400** kPa).

Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
A.D.Frost	ALAN FROST	04/11/13

Contract	Contract Ref:
Dinah's Hollow, Melbury Abbas, Dorset	**728347**

AGS

CONSOLIDATED DRAINED SHEAR BOX TEST

In accordance with clause 4.5 of BS1377:Part 7:1990

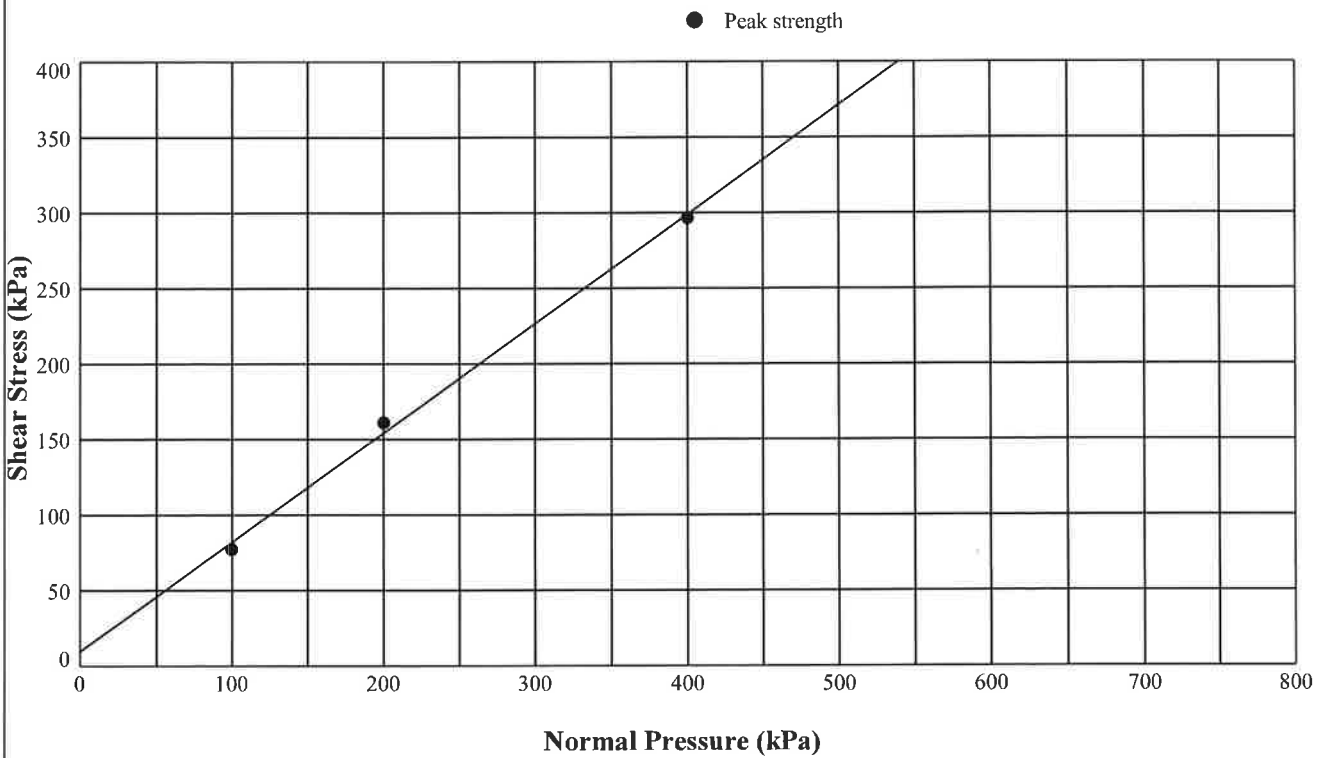
Borehole : **BH3** Sample Ref: **27** Sample Type: **D** Depth (m): **13.50**

Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**

Description: **Greenish brown very clayey SAND** Sample Condition: **Recompacted**

Remarks : **Material added from BH3/26 at 12.50m to obtain sufficient material for test**

	SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Moisture Content	(%)	21	21	21
	Initial Bulk Density	(Mg/m^3)	1.98	1.98	1.99
	Initial Dry Density	(Mg/m^3)	1.63	1.63	1.64
	Initial Voids Ratio		0.6276	0.6271	0.6155
CONSOLIDATION	Normal Pressure	(kPa)	100	200	400
	Initial Height	(mm)	20.090	19.918	19.888
	Consolidated Height	(mm)	18.666	18.201	18.095
SHEAR	Rate of Horizontal Displacement	(mm/min)	0.0031	0.0040	0.0070
	Horizontal Displacement at Peak Shear Stress	(mm)	3.9	4.6	4.2
	Peak Shear Stress	(kPa)	77	161	297
PEAK STRENGTH	Effective Cohesion (C') 10	(kPa)	Effective Angle of Friction (ϕ') 36		(deg)



Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
A.D.Frost	ALAN FROST	04/11/13

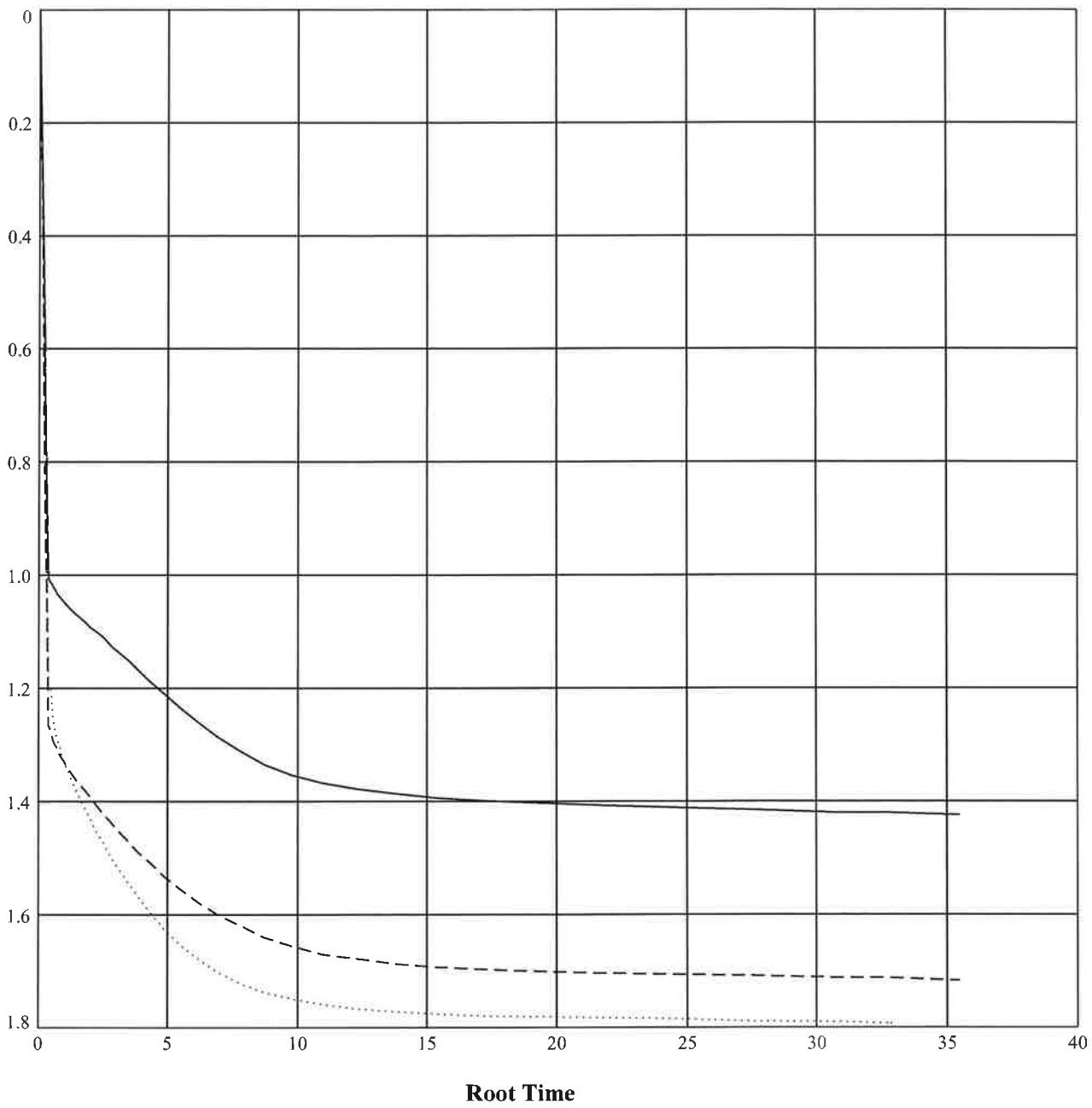
Contract	Contract Ref:
Dinah's Hollow, Melbury Abbas, Dorset	**728347**

AGS

CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH3** Sample Ref: **27** Sample Type: **D** Depth (m): **13.50**



KEY :

Solid Line = Specimen 1 (**100** kPa), *Dashed Line* = Specimen 2 (**200** kPa), *Dotted Line* = Specimen 3 (**400** kPa).

Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
A.D.Frost	**ALAN FROST**	**04/11/13**

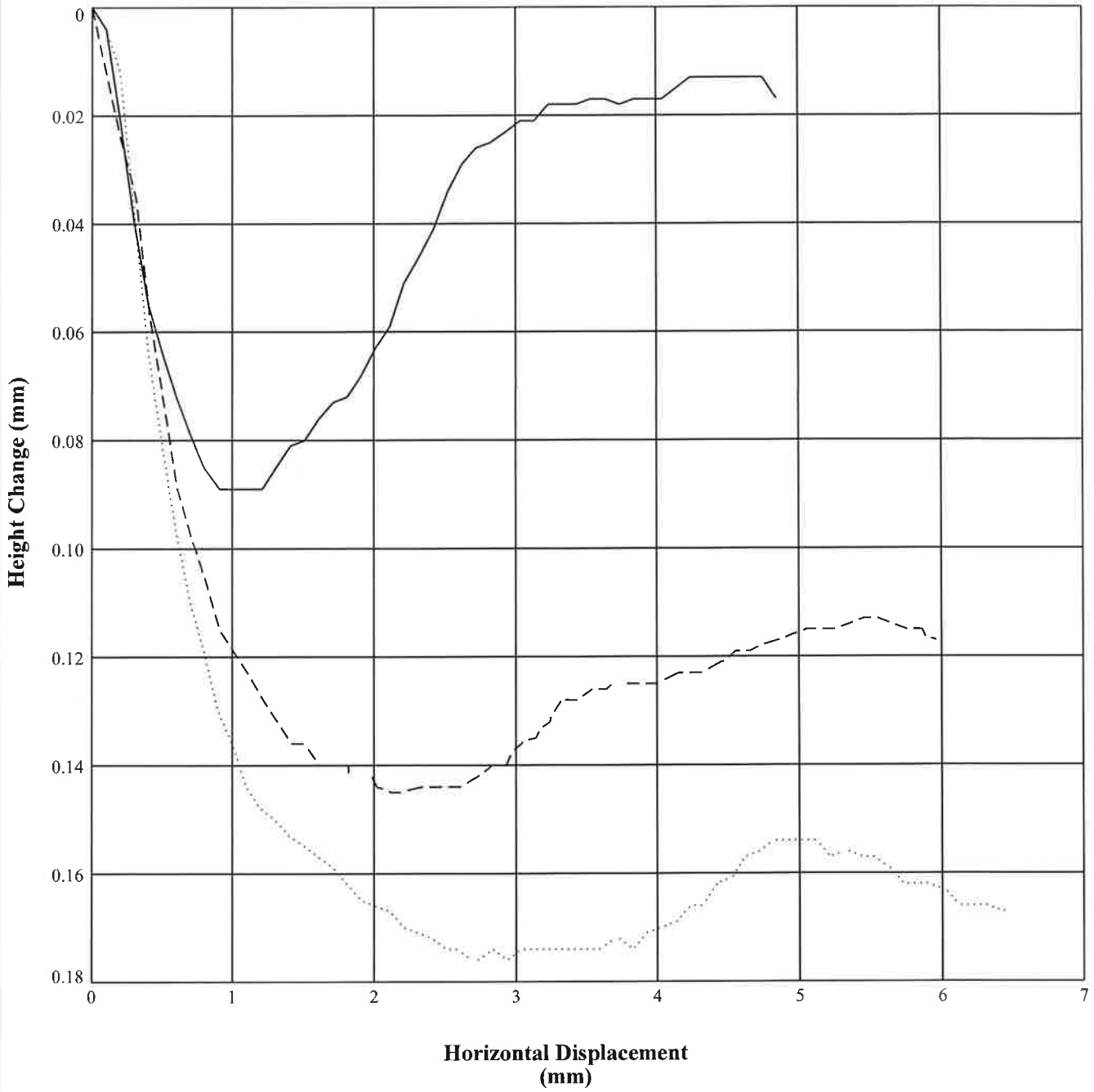
Contract	Contract Ref:
Dinah's Hollow, Melbury Abbas, Dorset	**728347**

AGS

CONSOLIDATED DRAINED SHEAR BOX
HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH3** Sample Ref: **27** Sample Type: **D** Depth (m): **13.50**



KEY :

Solid Line = Specimen 1 (**100** kPa), *Dashed Line* = Specimen 2 (**200** kPa), *Dotted Line* = Specimen 3 (**400** kPa).

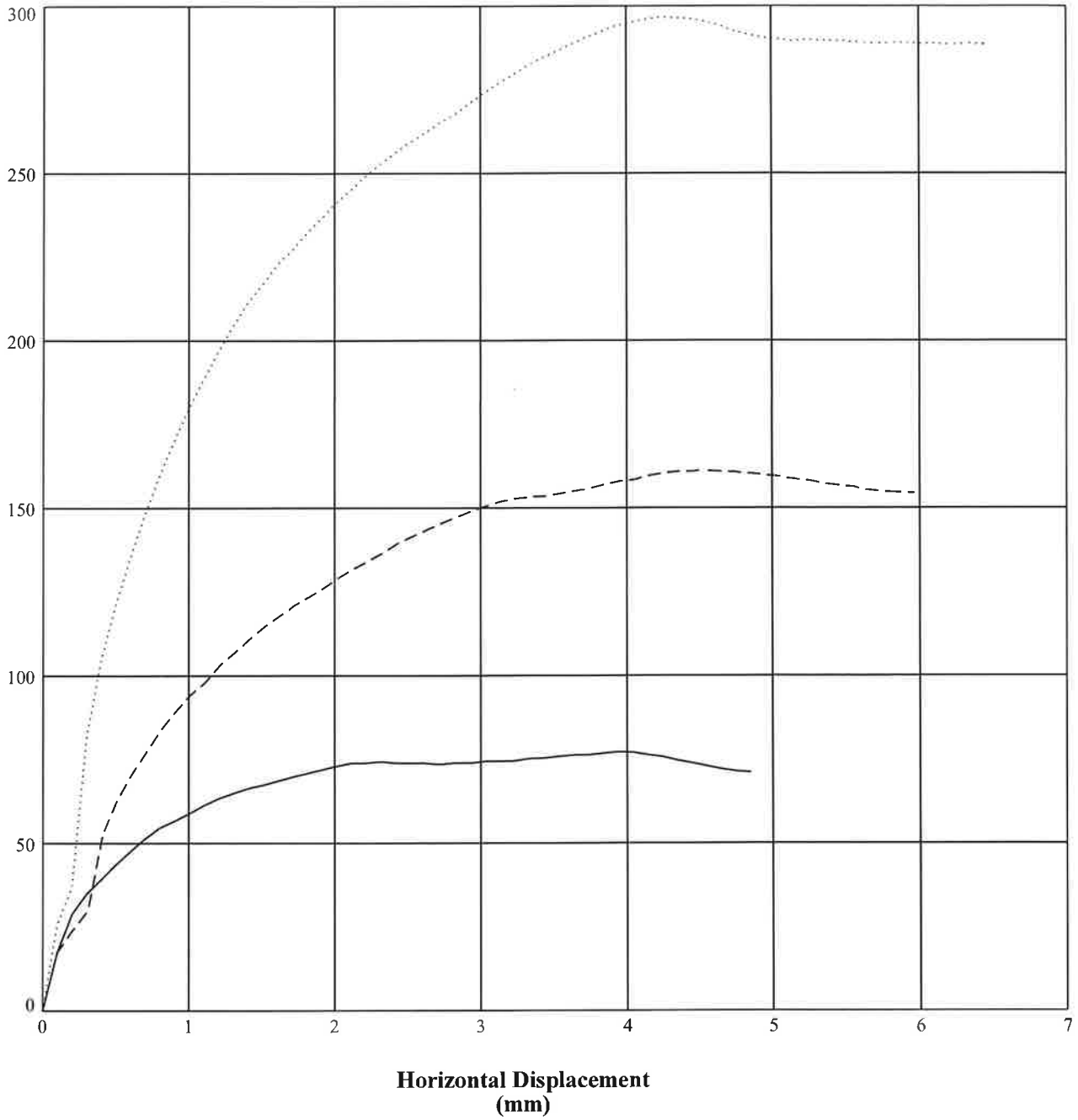
Approved Signatories: J.BARRETT A.FROST M.STOKES S.HANDCOCK

STRUCTURAL SOILS 1a Princess Street Bedminster Bristol BS3 4AG	Compiled By: A.D. Frost — **ALAN FROST**	Date: **04/11/13**
	Contract: **Dinah's Hollow, Melbury Abbas, Dorset**	Contract Ref: **728347**

CONSOLIDATED DRAINED SHEAR BOX
SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH3** Sample Ref: **27** Sample Type: **D** Depth (m): **13.50**



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CONSOLIDATED DRAINED SHEAR BOX TEST

In accordance with clause 4.5 of BS1377:Part 7:1990

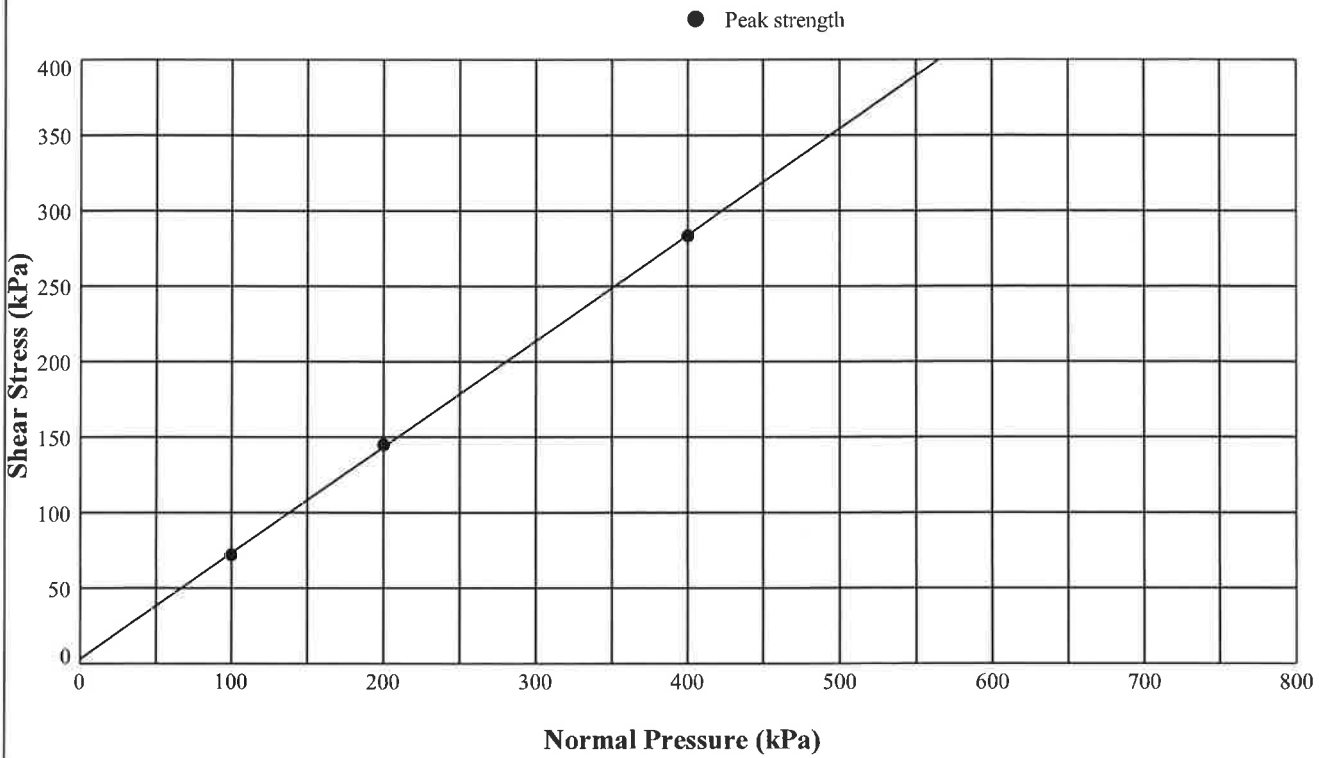
Borehole : **BH4** Sample Ref: **21** Sample Type: **D** Depth (m): **9.00**

Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**

Description: **Greenish brown very clayey SAND** Sample Condition: **Recompacted**

Remarks : **Material added from BH4/20 at 8.00m to obtain sufficient material for test**

	SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Moisture Content	(%)	28	28	28
	Initial Bulk Density	(Mg/m^3)	1.91	1.91	1.92
	Initial Dry Density	(Mg/m^3)	1.50	1.50	1.50
	Initial Voids Ratio		0.7704	0.7703	0.7661
CONSOLIDATION	Normal Pressure	(kPa)	100	200	400
	Initial Height	(mm)	19.178	19.276	19.126
	Consolidated Height	(mm)	17.576	16.717	16.509
SHEAR	Rate of Horizontal Displacement	(mm/min)	0.0069	0.0070	0.0149
	Horizontal Displacement at Peak Shear Stress	(mm)	4.1	5.3	7.0
	Peak Shear Stress	(kPa)	72	145	284
PEAK STRENGTH	Effective Cohesion (C') 3	(kPa)	Effective Angle of Friction (ϕ') 35		(deg)



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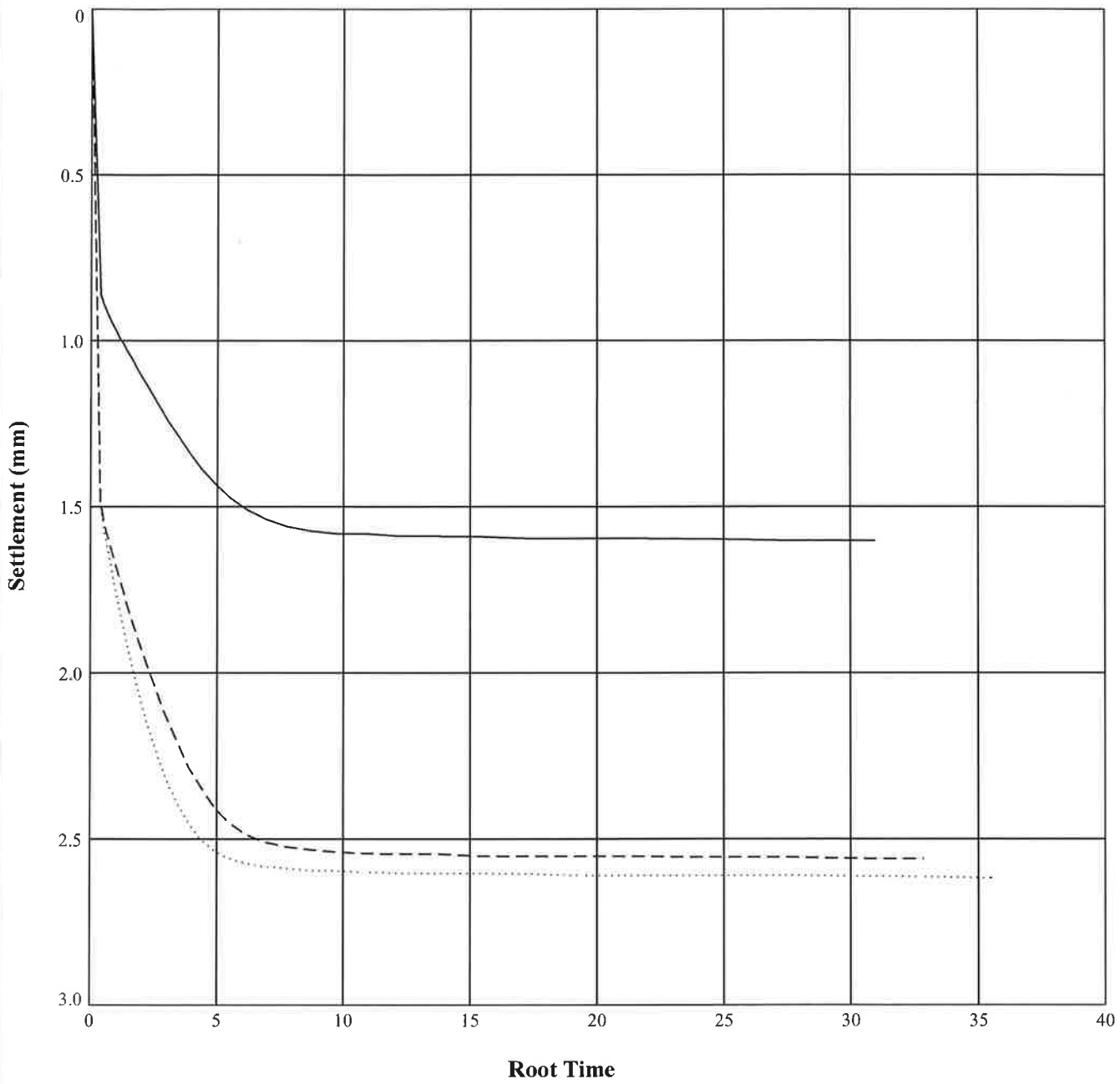
CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH4** Sample Ref: **21** Sample Type: **D** Depth (m): **9.00**



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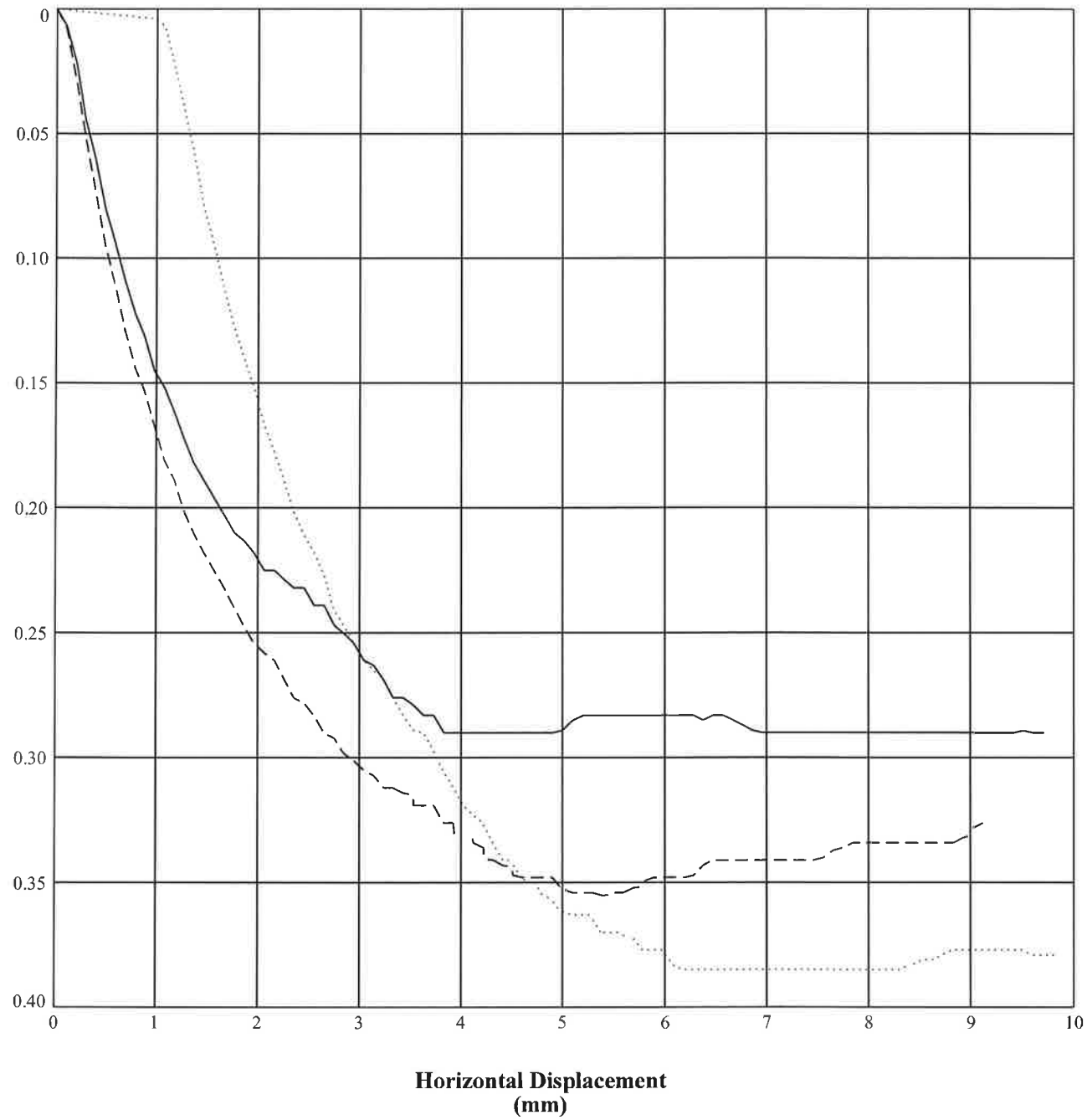
CONSOLIDATED DRAINED SHEAR BOX
HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH4** Sample Ref: **21** Sample Type: **D** Depth (m): **9.00**



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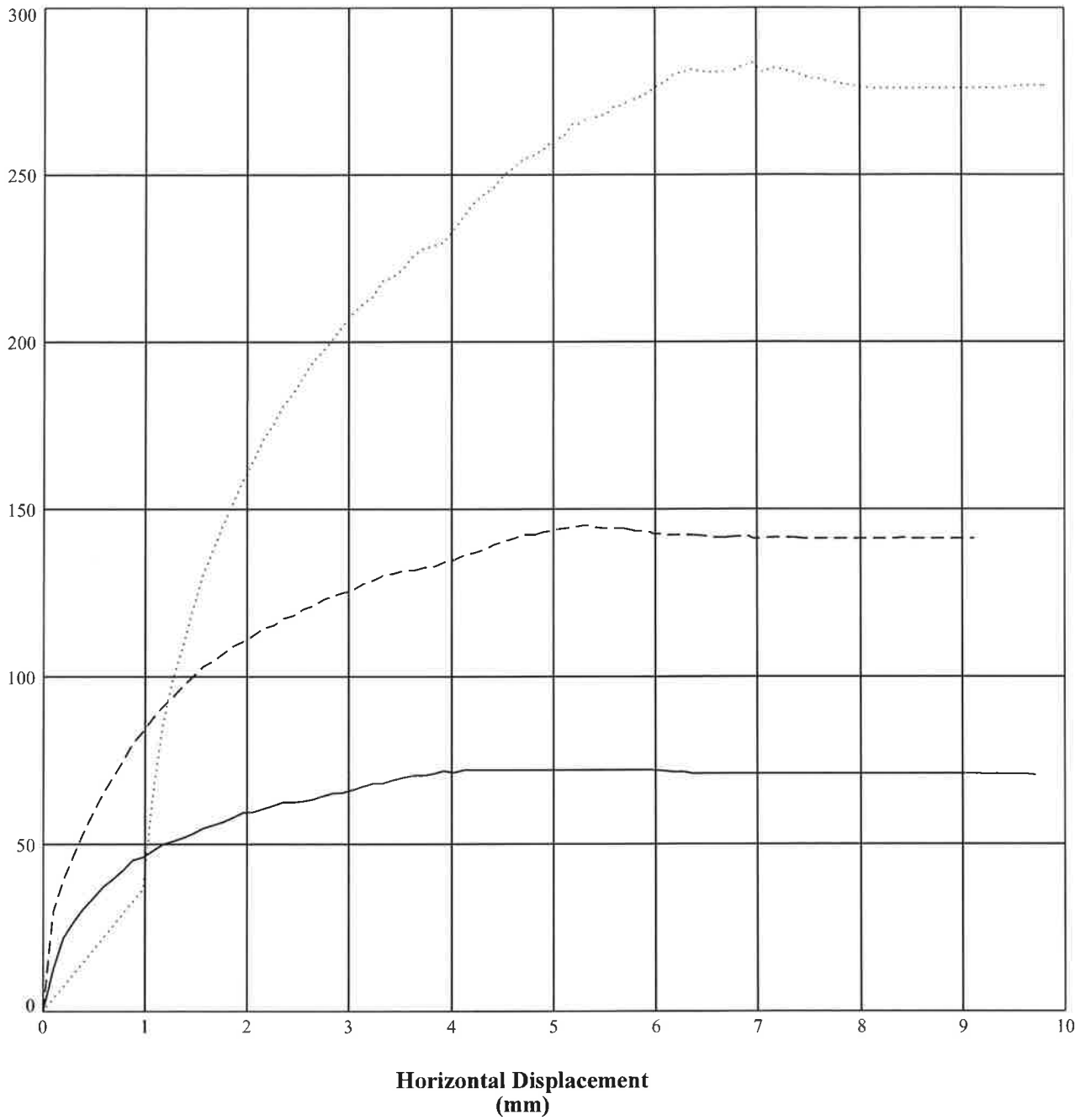
CONSOLIDATED DRAINED SHEAR BOX
SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH4** Sample Ref: **21** Sample Type: **D** Depth (m): **9.00**



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CONSOLIDATED DRAINED SHEAR BOX TEST

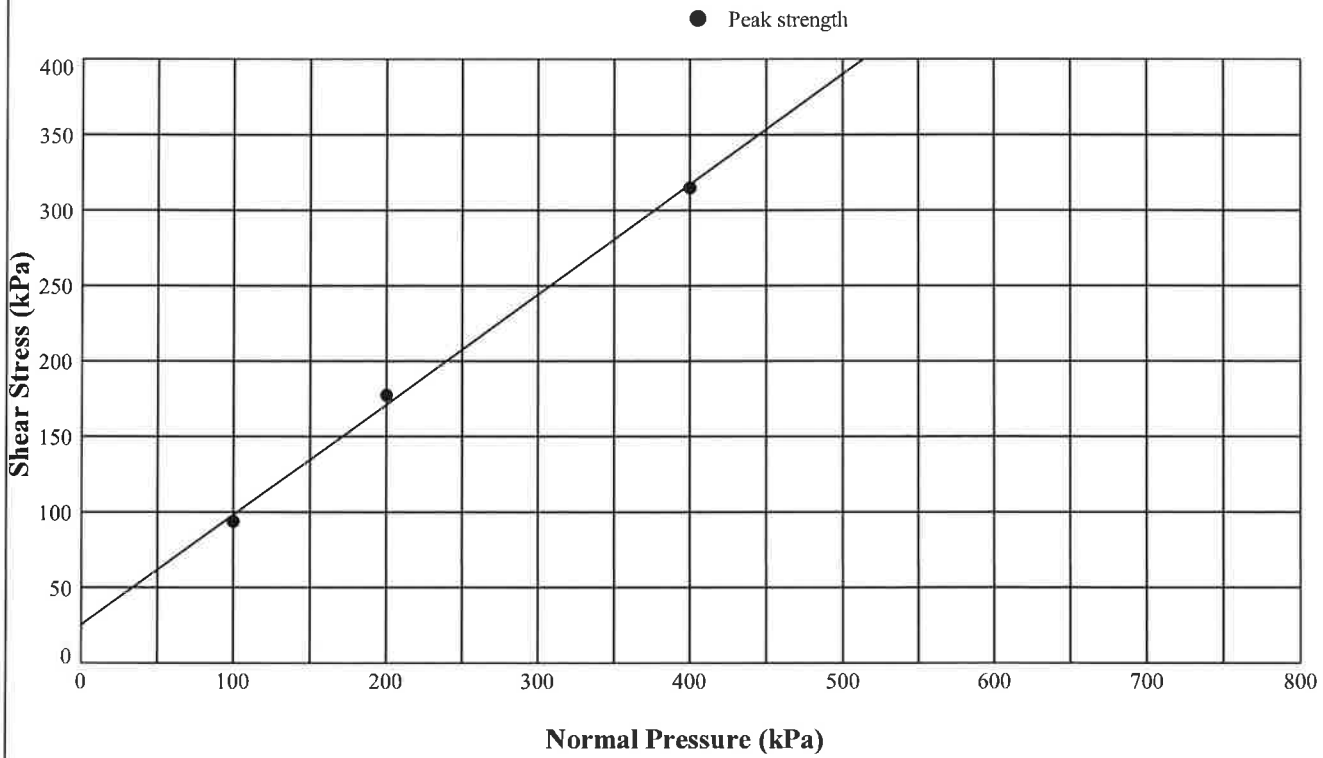
In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH5** Sample Ref: **18** Sample Type: **D** Depth (m): **9.00**

Width x Length (mm): **60 x 60** Sample Height (mm): **20.0** Particle Density (Assumed): **2.65**

Description: **Greenish grey very clayey SAND** Sample Condition: **Recompacted**

	SPECIMEN NUMBER		1	2	3
PROPERTIES	Initial Moisture Content	(%)	25	25	25
	Initial Bulk Density	(Mg/m^3)	1.91	1.91	1.90
	Initial Dry Density	(Mg/m^3)	1.52	1.53	1.52
	Initial Voids Ratio		0.7387	0.7342	0.7435
CONSOLIDATION	Normal Pressure	(kPa)	100	200	400
	Initial Height	(mm)	18.500	18.592	18.882
	Consolidated Height	(mm)	17.077	16.606	16.849
SHEAR	Rate of Horizontal Displacement	(mm/min)	0.0243	0.0289	0.0076
	Horizontal Displacement at Peak Shear Stress	(mm)	4.4	6.6	5.3
	Peak Shear Stress	(kPa)	94	178	315
PEAK STRENGTH	Effective Cohesion (C') **25**	(kPa)	Effective Angle of Friction (ϕ') **36**		(deg)



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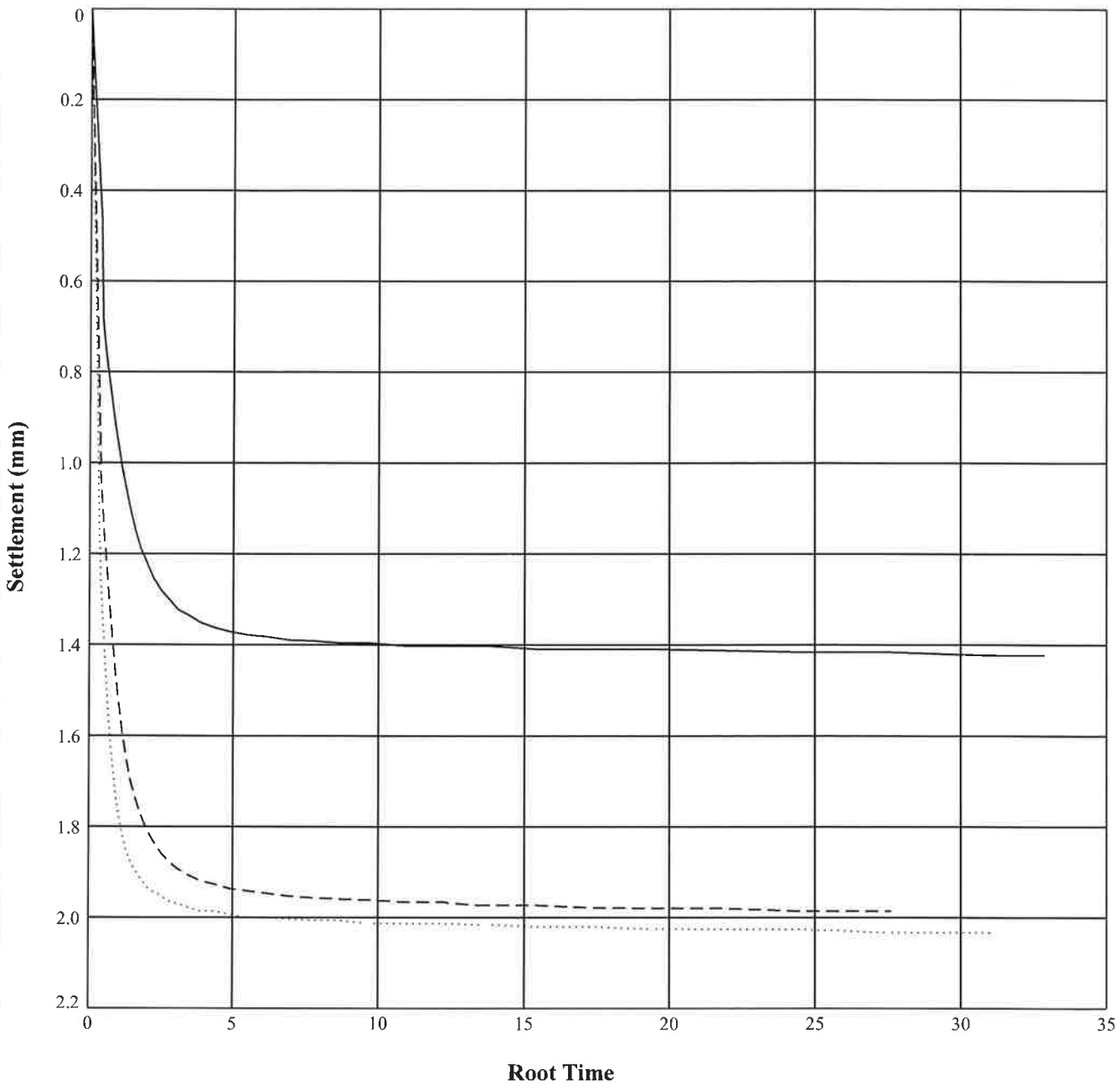
CONSOLIDATED DRAINED SHEAR BOX - CONSOLIDATION GRAPH

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH5** Sample Ref: **18** Sample Type: **D** Depth (m): **9.00**



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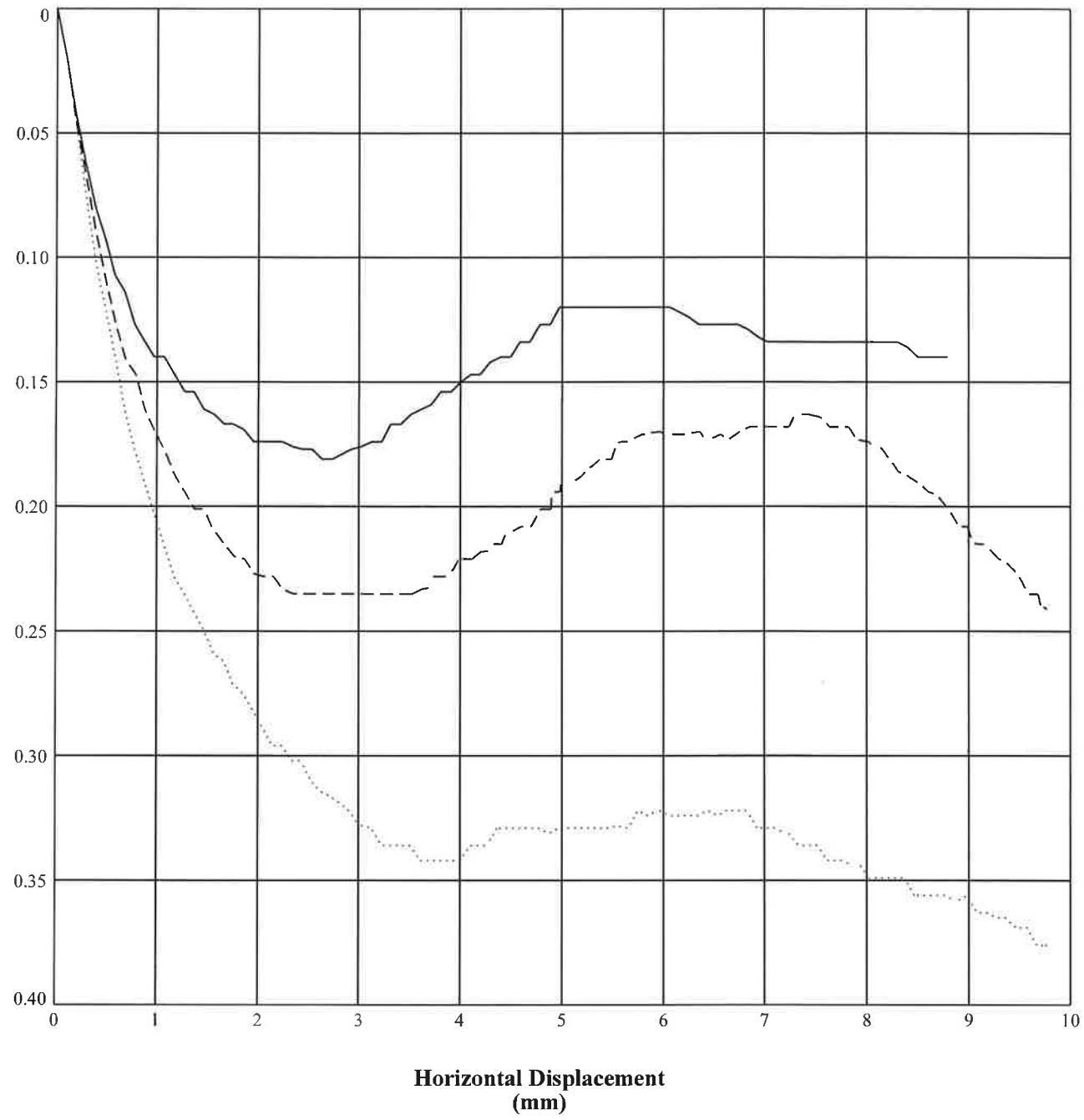
CONSOLIDATED DRAINED SHEAR BOX
HEIGHT CHANGE vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH5** Sample Ref: **18** Sample Type: **D** Depth (m): **9.00**



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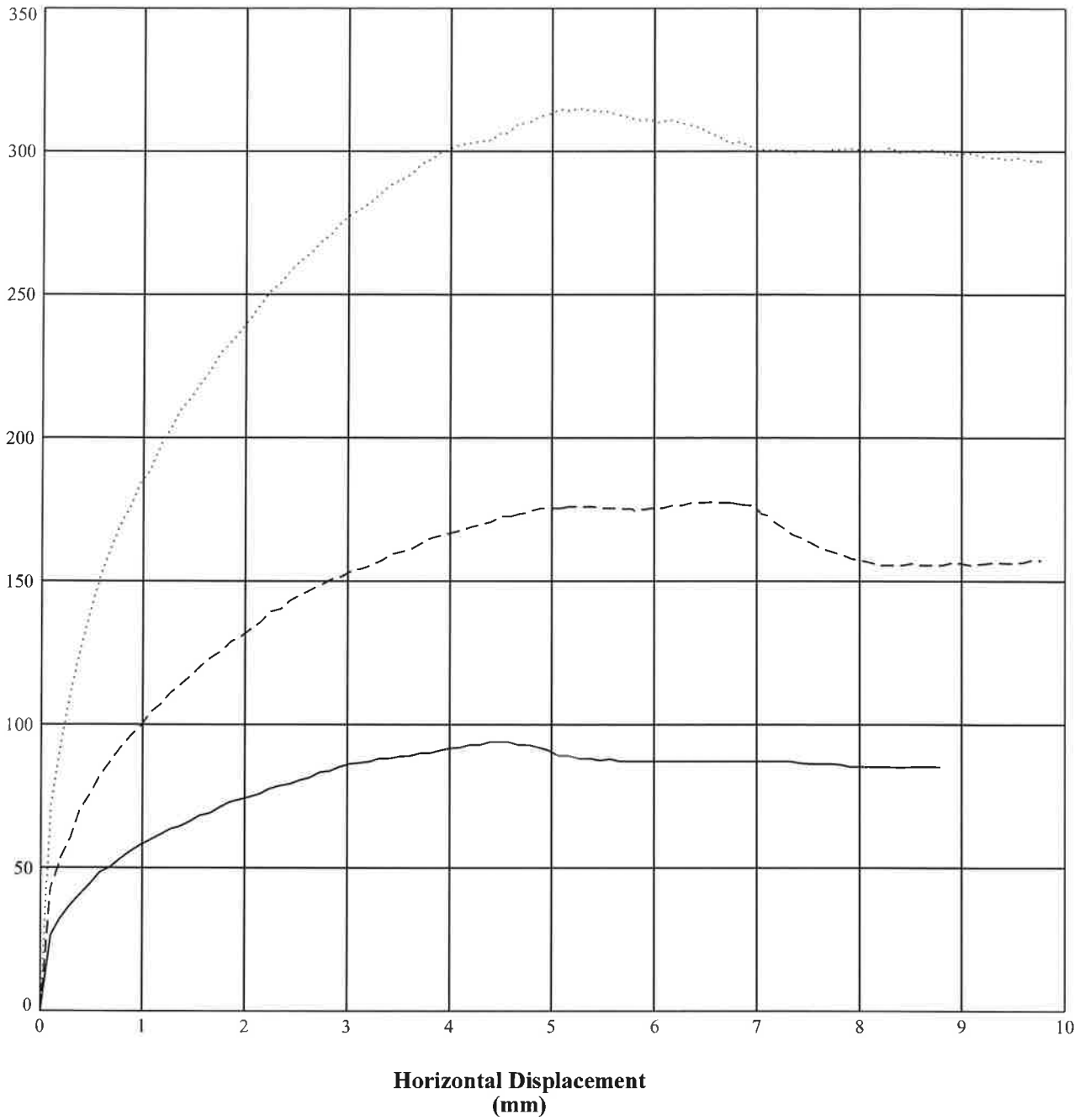
CONSOLIDATED DRAINED SHEAR BOX
SHEAR STRESS vs HORIZONTAL DISPLACEMENT

In accordance with clause 4.5 of BS1377:Part 7:1990

Borehole : **BH5** Sample Ref: **18** Sample Type: **D** Depth (m): **9.00**



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MEASUREMENT OF RESISTIVITY: DISC ELECTRODE METHOD

In accordance with BS1377:Part 3:1990, clause 10.2

Borehole No.: **BH2** Sample No.: **16** Depth (m): **7.50**

Description: **Light greenish brown clayey SAND**

Preparation: **Remoulded at as received moisture content using 2.5kg rammer (4 layers)**

Electrodes: **2 x stainless steel electrodes 98mm in diameter located at each end of the sample**

Remarks:

Length of test specimen (mm):	**167.0**
Diameter of test specimen (mm):	**103.0**
Moisture Content (%):	**25**
Bulk Density (Mg/m^3):	**1.94**
Dry Density ($M/g/m^3$):	**1.55**
Temperature at time of test (^{o}C):	**18.6**
Electrical Resistivity at $20^{o}C$ (ohm.m):	**30**

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON M. STOKES

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MEASUREMENT OF RESISTIVITY: DISC ELECTRODE METHOD

In accordance with BS1377:Part 3:1990, clause 10.2

Borehole No.:	**BH3**	Sample No.:	**26**	Depth (m):	**12.50**

Description: **Greenish brown clayey SAND**

Preparation: **Remoulded at as received moisture content using 2.5kg rammer (4 layers)**

Electrodes: **2 x stainless steel electrodes 98mm in diameter located at each end of the sample**

Remarks:

Length of test specimen (mm):	**172.0**
Diameter of test specimen (mm):	**103.0**
Moisture Content (%):	**23**
Bulk Density (Mg/m^3):	**1.97**
Dry Density ($M/g/m^3$):	**1.60**
Temperature at time of test (^{o}C):	**18.6**
Electrical Resistivity at $20^{o}C$ (ohm.m):	**20**

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MEASUREMENT OF RESISTIVITY: DISC ELECTRODE METHOD

In accordance with BS1377:Part 3:1990, clause 10.2

Borehole No.:	**BH4**	Sample No.:	**20**	Depth (m):	**8.00**

Description: **Greenish brown very clayey SAND**

Preparation: **Remoulded at as received moisture content using 2.5kg rammer (4 layers)**

Electrodes: **2 x stainless steel electrodes 98mm in diameter located at each end of the sample**

Remarks:

Length of test specimen (mm):	**169.0**
Diameter of test specimen (mm):	**103.0**
Moisture Content (%):	**28**
Bulk Density (Mg/m^3):	**1.92**
Dry Density ($M/g/m^3$):	**1.50**
Temperature at time of test (^oC):	**18.7**
Electrical Resistivity at 20^oC (ohm.m):	**21**

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MEASUREMENT OF RESISTIVITY: DISC ELECTRODE METHOD

In accordance with BS1377:Part 3:1990, clause 10.2

Borehole No.: **BH5** Sample No.: **17** Depth (m): **8.00**

Description: **Greenish brown clayey SAND**

Preparation: **Remoulded at as received moisture content using 2.5kg rammer (4 layers)**

Electrodes: **2 x stainless steel electrodes 98mm in diameter located at each end of the sample**

Remarks:

Length of test specimen (mm):	**171.0**
Diameter of test specimen (mm):	**103.0**
Moisture Content (%):	**24**
Bulk Density (Mg/m^3):	**1.98**
Dry Density ($M/g/m^3$):	**1.59**
Temperature at time of test (^{o}C):	**18.7**
Electrical Resistivity at $20^{o}C$ (ohm.m):	**22**

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SUMMARY OF CHEMICAL ANALYSES

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Acid Soluble Sulphate (% SO_4)	Aqueous Extract Sulphate (mg/l SO_4)	Chloride: Aqueous Extract (mg/l)	pH	Total Sulphur (%)	Description
BH2	16	B	7.50	<0.02	33	12	8.69	<0.01	Light greenish brown clayey SAND
BH3	26	B	12.50	<0.02	<10	<7	8.22	<0.01	Greenish brown clayey SAND
BH4	20	B	8.00	<0.02	<10	<7	7.36	<0.01	Greenish brown very clayey SAND
BH5	17	B	8.00	<0.02	<10	<7	7.45	<0.01	Greenish brown clayey SAND

NOTES:- All chemical tests were undertaken by Envirolab.

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Brody Forbes
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APPENDIX 05

SOIL NAIL PANEL SYSTEM LITERATURE

Phi Group
Retaining Structures

Retaining Walls
Soil Nailing
Reinforced Soil

www.phigroup.co.uk



Welcome to Retaining Walls, Soil Nailing and Reinforced Soil specialist Phi Group.

Phi Group is the largest retaining solution specialist in the UK, designing supplying and building retaining structures including timber crib and concrete crib retaining walls, soil nailing, soil panels, modular block reinforced soil systems, concrete panel faced reinforced soil and planted/grassed reinforced soil slopes.

A complete service is offered including design, supply and construction undertaken by the company's in house chartered engineers and backed up by full indemnity insurance.

Based in Cheltenham with regional offices in Wetherby and Dunfermline the company is at the forefront of retaining structure technology balancing engineering demands with environmental consideration.

Phi Group's own directly employed experienced construction teams, operate nationwide completing the total design, supply and build package, thus affording, optimum peace of mind and minimum risk, to client and contractor alike.

For an audience of 10 or more people the company offers a complimentary lunchtime CPD presentation at your offices. The seminar identifies the primary reasons for using retaining structures and how cost and programme savings can be made by utilising the latest retaining wall and soil stabilisation techniques.

Phi Group's procedures follow an Integrated Management System which has resulted in ISO 9001, ISO 14001 and ISO 18001 accreditation.
Full Link Up accreditation enables Phi Group to provide engineering solutions to the railway sector and many products have BBA technical approval.

If you have a project requiring a retaining structure, Phi Group will be happy to supply you with a free quotation, please send us your existing and proposed levels survey together with any available site investigation information.

Index

Phi Group
Retaining Structures

Gravity Retaining Walls

Gravity walls use their self weight to counteract the earth pressures and surcharge loadings and can be constructed from various systems

Permacrib
Andacrib
Gabions
Lockstone

Soil Nailing and Facings

Soil Nailing is a method to stabilise existing embankments using grouted steel bars. A facing can then be applied to create the required aesthetics, be it grass, flexible, or hard facings.

Soil Panel (Stone Filled)
Soil Panel (Grass face)

Reinforced Soil Solutions

The use of reinforced soils is mainly used in areas of fill to support elevated levels. These walls can be vertical with the block wall systems, or have a stone/soil finished batter between 50 and 70 degrees.

Textomur
Titan
Geolock
Concrete Panel System

Mitigation of Greenhouse Effects
Trees are the lungs of the earth - absorbing CO2 and converting it to oxygen. Mature trees absorb less C02 therefore by harvesting and re-planting with young specimens a constant cycle of C02 absorption is ensured. Manufacture and construction are very simple and requires low levels of energy.

Sustainability
Timber for the Permacrib system meets the requirements of the "UK Government Procurement Policy" as being from both a legal and sustainable source.

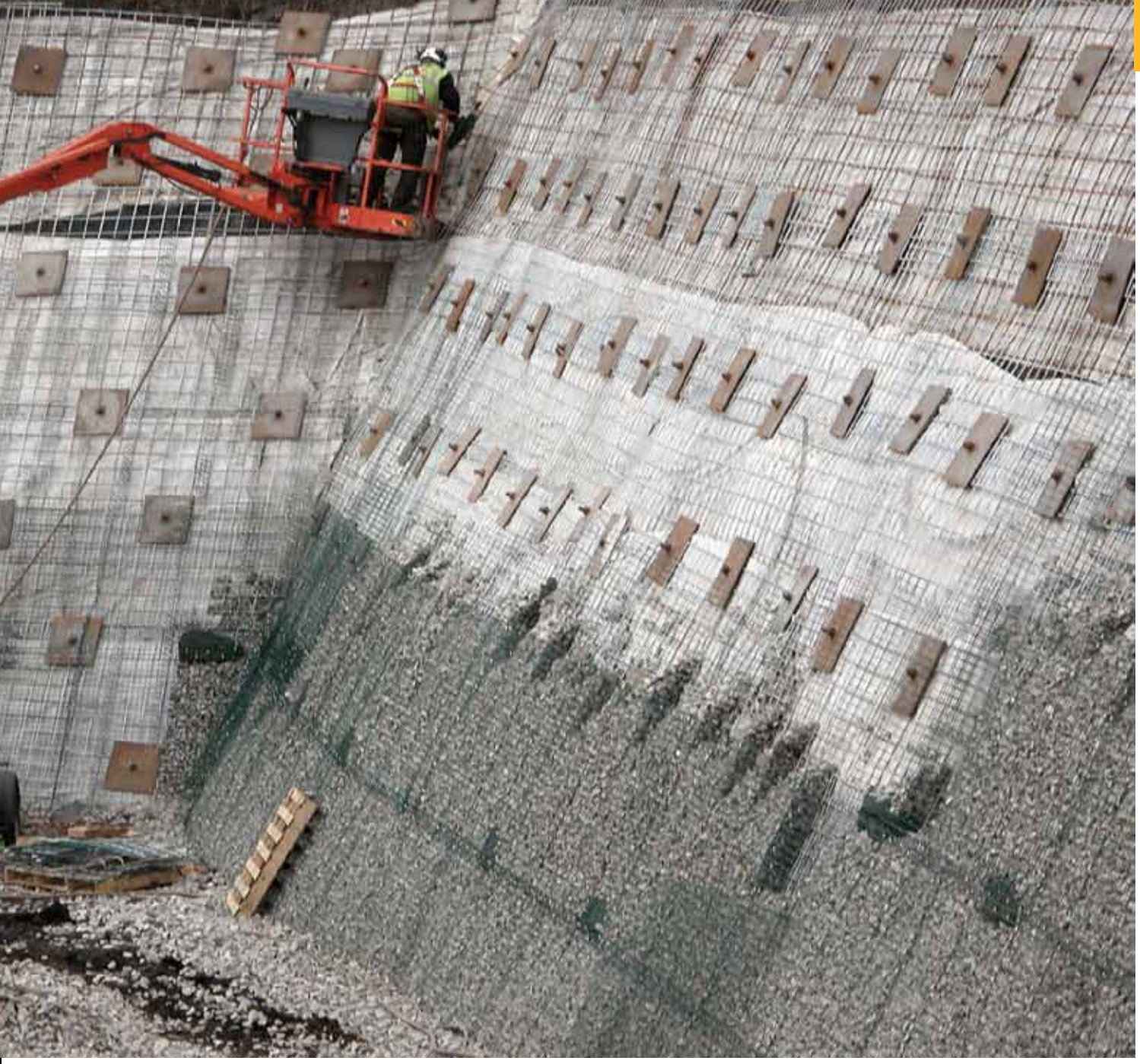
Landscaping
Permacrib can be fully landscaped with a variety of plants in order to enhance its natural appearance.

Phi Group offer a complete design, supply and installation service using drilling and grouting techniques to stabilise embankments.
A large range of plant is maintained to ensure that production rates are optimised in challenging soil types and restricted access situations.

Soil Nailing

With available development land becoming ever more costly, gaining usable space on steeply sloping sites is paramount, Soil Nailing can offer the following benefits:

- Soil Nailing techniques are often an ideal solution, combined with Phi Group's range of facing products, yielding maximum space gains whilst working safely with significant height temporary earthworks profiles.
- Using top down construction methods, with each subsequent row of nails providing both temporary and long term support, the need for costly temporary works is avoided.
- Elimination of the need for expensive stone backfill imported to site.
- Existing structures and embankments can be stabilised without rebuilding, saving costs and maintaining serviceability, for example, existing railway embankments.
- Trees, vegetation or architectural features can often remain unaffected by soil nails, as the nails can be sited to pass around or between obstacles.



Typical applications for Soil Nailing:

- Stabilising steep cuttings to maximise development space.
- The stabilising of existing over-steep embankments.
- Soil Nailing through existing concrete or masonry structures such as failing retaining walls and bridge abutments to provide long term stability without demolition and rebuild costs.
- Temporary support can be provided to excavations without the need for bulky and intrusive scaffold type temporary works solutions.

Soil Panel

Soil Panel was designed and patented by Phi Group to be used specifically in conjunction with Soil Nails where the creation of extra space requires existing embankments to be cut back forming steep sloping faces. Whilst soil nailing provides the principle structural support to the cutting, Soil Panel steel cages provide a flexible facing which can provide structural support as well as facilitating an excellent finish

The internal face of the panel forms part of the structural support to the embankment face and the outer, geotextile lined face allows filling with growing medium for vegetation establishment, or for containment of stone where required. Growing medium is then placed into the panel and is either pre-seeded or planted during the growing season.
An alternative is to fill Soil Panel with stone and this is often chosen due to restricted light locations or where a zero maintenance requirement is preferred.
Additionally Soil Panel provides excellent protection to structural elements from accidental impact or fire damage, thus enhancing durability.
The technique of using Soil Panel to provide a vegetated face is protected by UK Patent.

Benefits

- Highways Agency approved system.
- Choice of face finishes.
- Unique, innovative system supported by full design and build service.
- Protection of structural elements in the event of collision or fire damage.
- No foundations required.
- Minimises muck away, saves on Landfill Tax.
- A system, successfully used in a wide variety of applications.