

Swan Vale Developments

Via email only: amacdonald@swanvaleddevelopments.com

Our Ref: 20188/FDLR

27th May 2022

Dear Andy,

Re: MIRA, Watling Street, Nuneaton, CV10 0TU

Following the completion of the site works, we write to update you on the findings to date, please find the attached the preliminary trial hole logs and data are given in the following appendices: Appendix A (WS Boreholes-Unlogged, DP and Trial Pits) and Appendix B (Infiltration Soakage).

Based on data to date and subject to the effect of desiccation (as roots were found to significant depths), the use of conventional foundations (strip or pads) is likely to be challenging.

Given the limited head loss with time, soakaways would not work to satisfactory standards on this site.

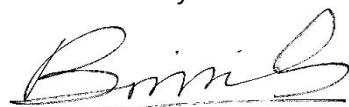
The samples are being logged and the laboratory analysis commencing. The laboratory results will be sent through when they become available.

The following figures and appendices complete this letter report.

*Figure 1. Site Location**Figure 2. Trial Hole Location Plan**Appendix A. Preliminary Trial Hole Logs (WS Boreholes-Unlogged, DP and Trial Pits)**Appendix B. Infiltration Soakage Data*

Should you have any questions please do not hesitate to contact the undersigned.

Yours sincerely

**Richard Biney** BSc (Hons) MSc CEng MICE CEnv CSci MEnvSc MCMI MIET FGS RoGEP

Associate Director

rb@soilslimited.co.uk**For and on behalf of Soils Limited**



Figure 1 – Site Location Map

Job Number
20188

Project
MIRA, Watling Street, Nuneaton, CV10 0TU

Client
Swan Vale Developments

Date
May 2022



Figure 2 – Trial Hole Location Plan

Job Number

20188

Project

MIRA, Watling Street, Nuneaton, CV10 0TU

Client

Swan Vale Developments

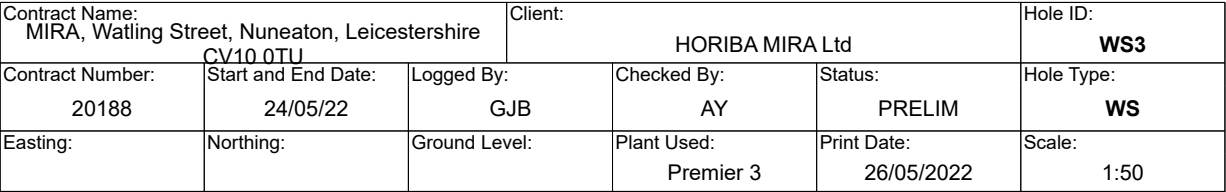
Date

May 2022

Appendix A. Preliminary Trial Hole Logs (WS Boreholes-Unlogged, DP and Trial Pits)

Observations		Borehole Diameter		Casing Diameter		Remarks:					
Sinking (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
						No groundwater encountered					
						Water Strikes					
Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
						Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					

				Contract Name: MIRA, Watling Street, Nuneaton, Leicestershire				Client: HORIBA MIRA Ltd				Hole ID: WS2			
				Contract Number: 20188		Start and End Date: 24/05/22		Logged By: GJB		Checked By: AY		Status: PRELIM		Hole Type: WS	
				Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 26/05/2022		Scale: 1:50	
Weather:				Termination: Sampler refusal						Sheet 1 of 1					
Samples & In Situ Testing				Strata Details										Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description							Water Strike	Backfill/ Installation	
				(1.00)		Over grown turf and nettles over soft dark reddish brown CLAY.									
				1.00		Firm to stiff dark reddish brown CLAY.							1		
				(2.50)									2		
													3		
				3.50		End of Borehole at 3.50m							4		
													5		
													6		
													7		
													8		
													9		
													10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	No groundwater encountered						
Chiselling					Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.															



Weather:	Termination: Sampler refusal	Sheet 1 of 1
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Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
						Over grown turf and nettles over soft dark reddish brown CLAY.			
				(2.00)			1		
				2.00		Firm to stiff dark reddish brown CLAY.	2		
				(1.00)					
				3.00		End of Borehole at 3.00m	3		
							4		
							5		
							6		
							7		
							8		
							9		
							10		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	No groundwater encountered					
Chiselling					Installation				Water Strikes					
									Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														



Contract Name: MIRA, Watling Street, Nuneaton, Leicestershire		Client: HORIBA MIRA Ltd			Hole ID: WS4	
Contract Number: 20188		Start and End Date: 24/05/22	Logged By: GJB	Checked By: AY	Status: PRELIM	Hole Type: WS
Easting:		Northing:	Ground Level:	Plant Used: Premier 3	Print Date: 26/05/2022	Scale: 1:50

Weather:		Termination: Sampler refusal			Sheet 1 of 1	
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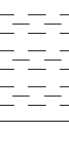
Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(1.00)		Over grown turf and nettles over soft dark reddish brown CLAY.		
				1.00		Firm to stiff dark reddish brown CLAY.	1	
				(1.90)			2	
				2.90		End of Borehole at 2.90m	3	
							4	
							5	
							6	
							7	
							8	
							9	
							10	

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: No groundwater encountered					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														



Contract Name: MIRA, Watling Street, Nuneaton, Leicestershire		Client: HORIBA MIRA Ltd			Hole ID: WS5	
Contract Number: 20188		Start and End Date: 24/05/22	Logged By: GJB	Checked By: AY	Status: PRELIM	Hole Type: WS
Easting:		Northing:	Ground Level:	Plant Used: Premier 3	Print Date: 26/05/2022	Scale: 1:50

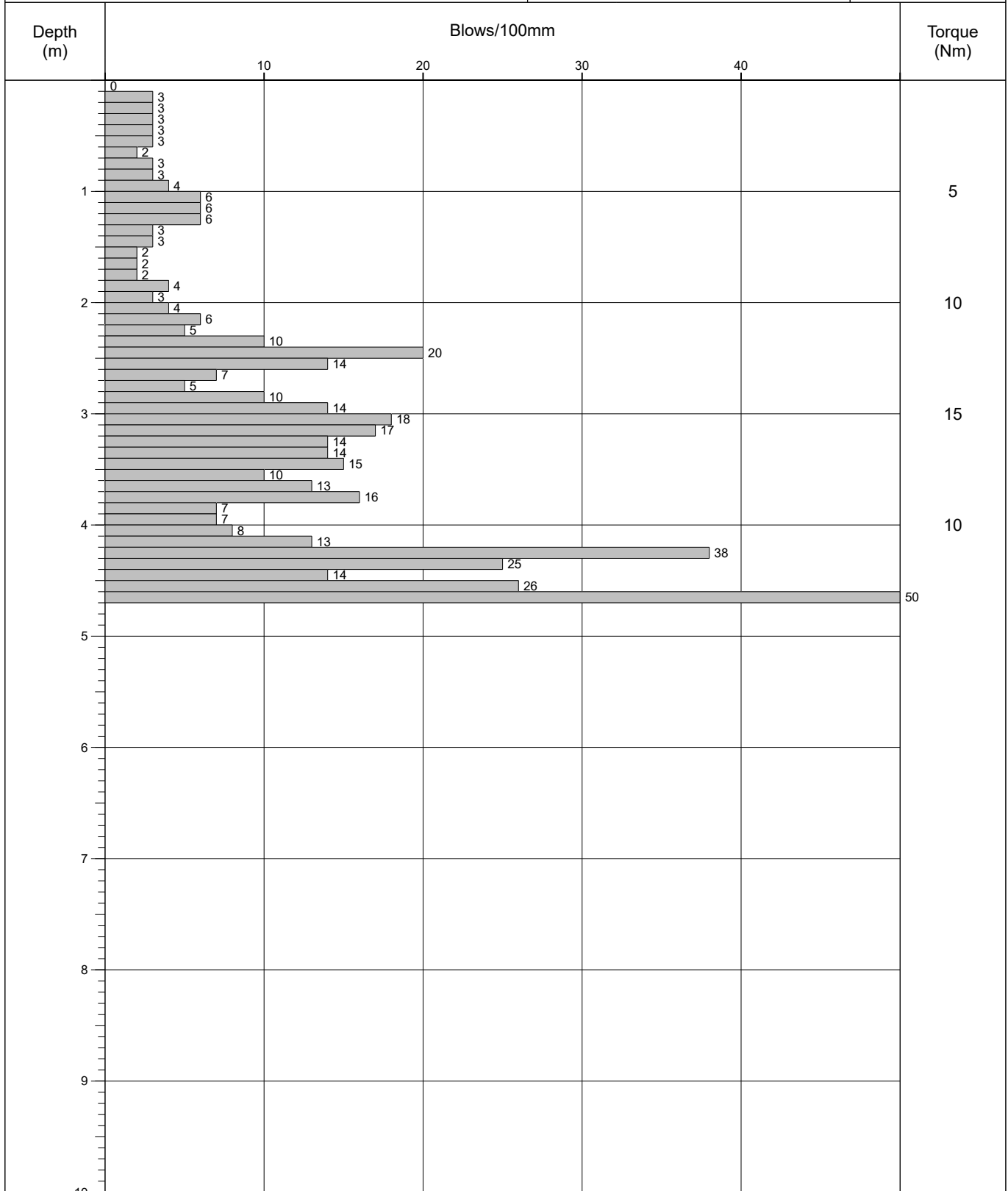
Weather:		Termination: Sampler refusal			Sheet 1 of 1	
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Samples & In Situ Testing			Strata Details					Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description			Water Strike	Backfill/ Installation
				(1.10)		Over grown turf and nettles over soft dark reddish brown CLAY.			1	
				1.10						
				(1.80)					2	
				2.90						
									4	
									6	
									8	
					10					

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: No groundwater encountered					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

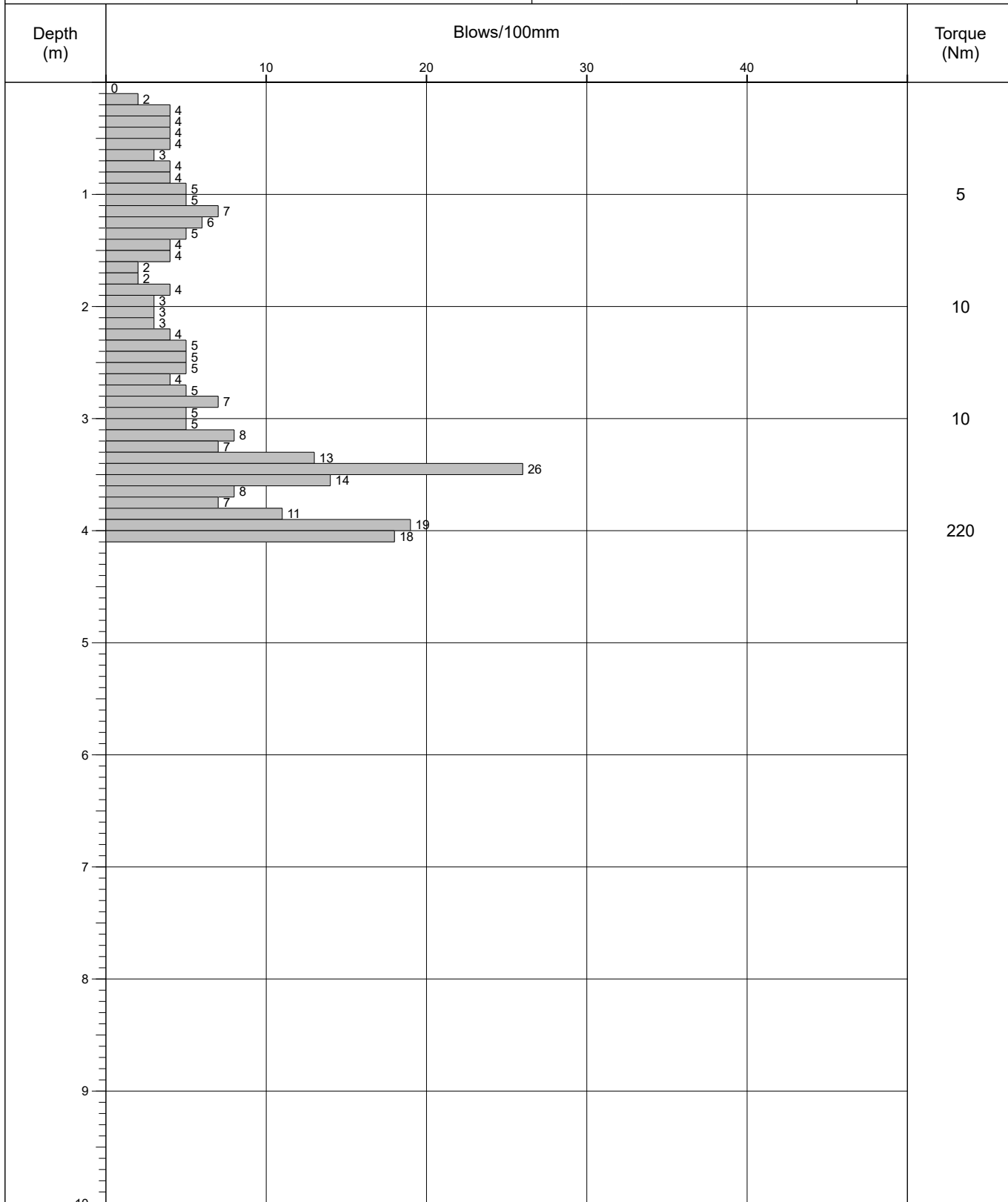
soils L I M I T E D				Contract Name: MIRA, Watling Street, Nuneaton, Leicestershire				Client: HORIBA MIRA Ltd				Hole ID: WS6				
				Contract Number: 20188		Start and End Date: 24/05/22		Logged By: GJB		Checked By: AY		Status: PRELIM		Hole Type: WS		
				Easting:		Northing:		Ground Level:		Plant Used: Premier 3		Print Date: 26/05/2022		Scale: 1:50		
Weather:				Termination: Sampler refusal						Sheet 1 of 1						
Samples & In Situ Testing					Strata Details										Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description							Water Strike	Backfill/ Installation		
				(1.10)		Over grown turf and nettles over soft dark reddish brown CLAY.										
				1.10		Firm to stiff dark reddish brown CLAY.										
				(2.90)												
				4.00		End of Borehole at 4.00m										
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:							
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)								
Chiselling					Installation				Water Strikes							
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks		
									3.20			20	3.20			
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.																

Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	25/05/2022			Logged By	GJB

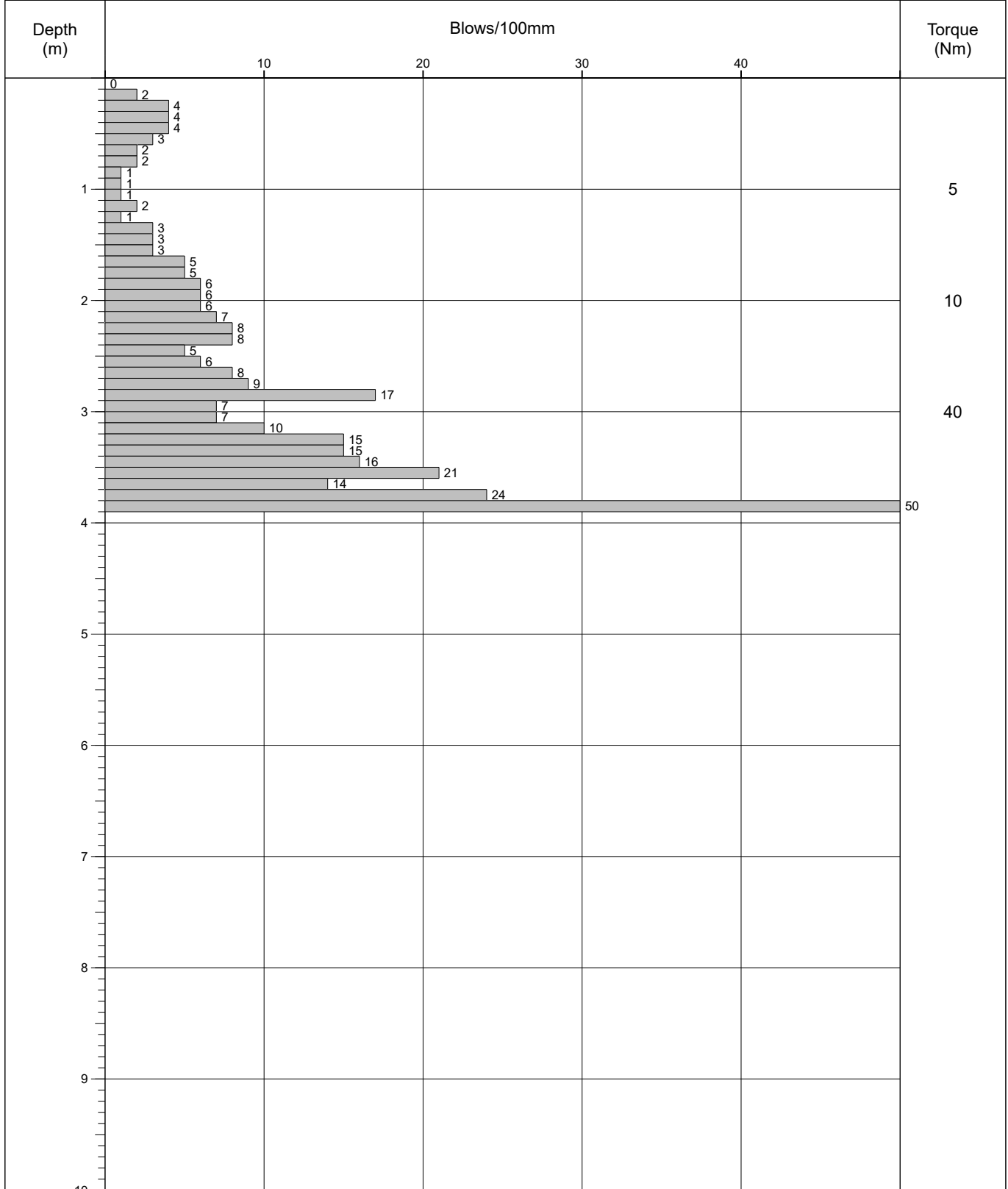


Remarks Refusal - 50 blows for 95mm	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	4.6m
	Probe Type	DPSH-B	Energy Ratio (Er)	90.53%

Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	24/05/2022			Logged By	GJB

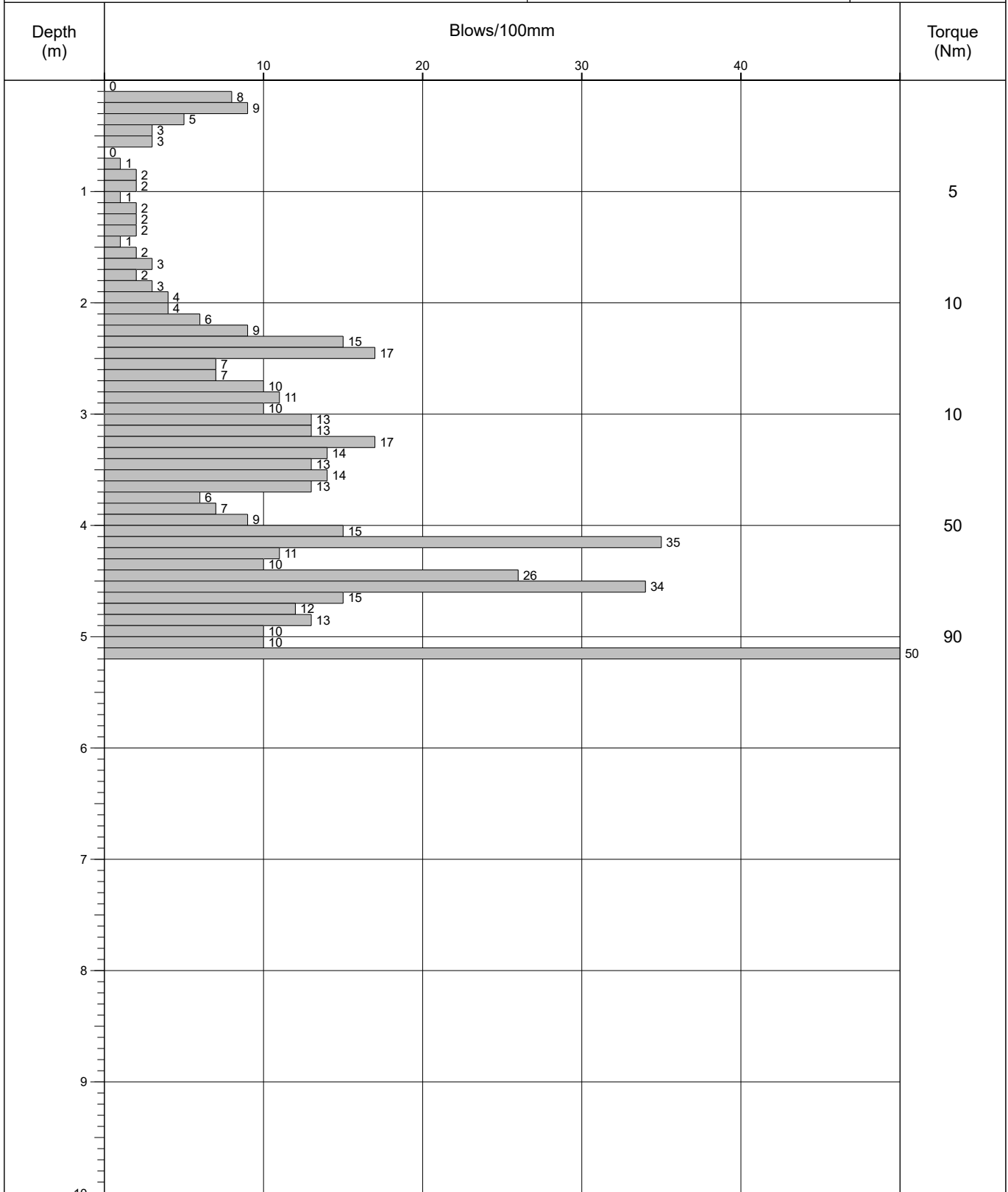


Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	24/05/2022			Logged By	GJB



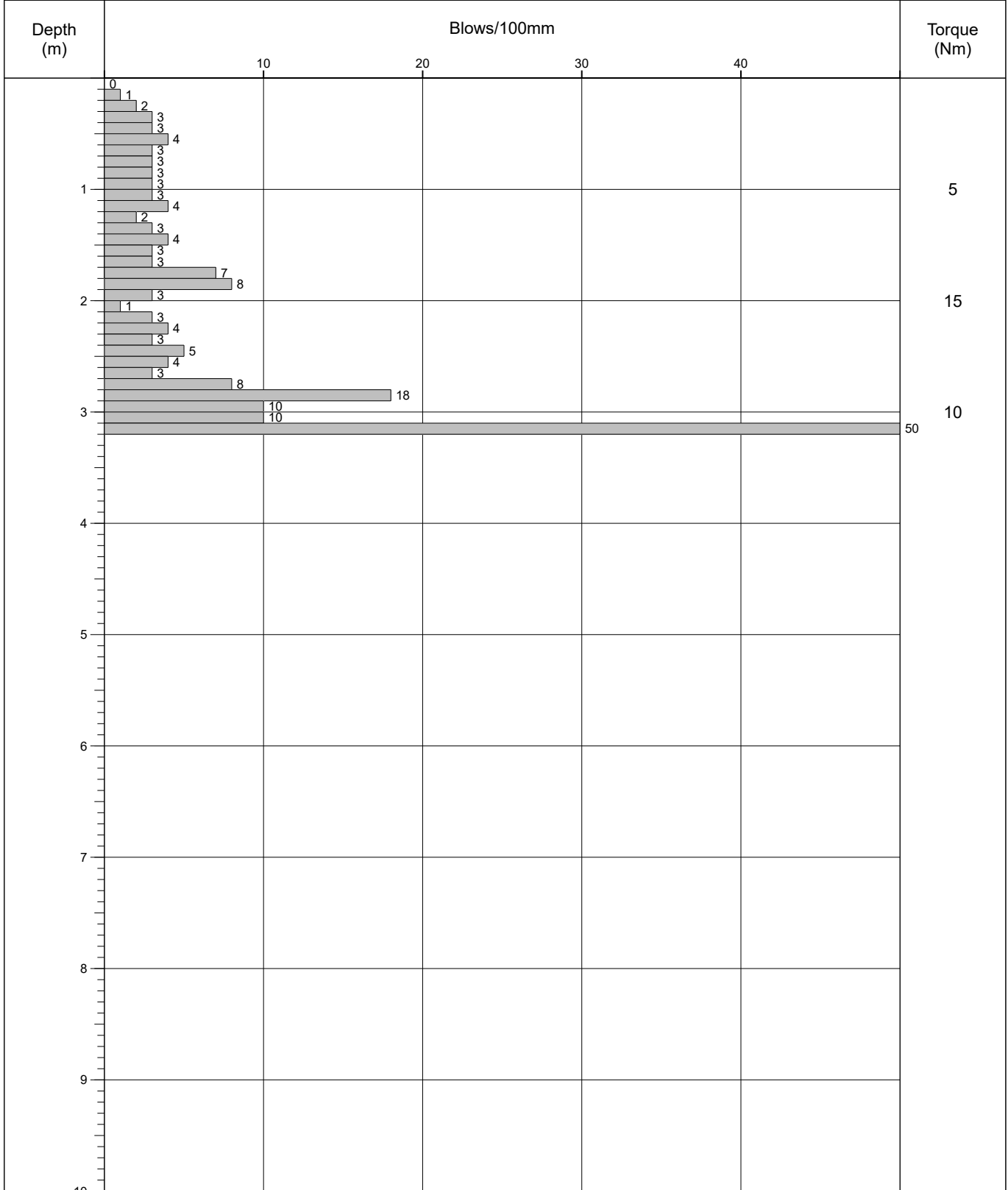
Remarks Refusal - 50 blows for 55mm	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	3.8m
	Probe Type	DPSH-B	Energy Ratio (Er)	90.53%

Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	24/05/2022			Logged By	GJB



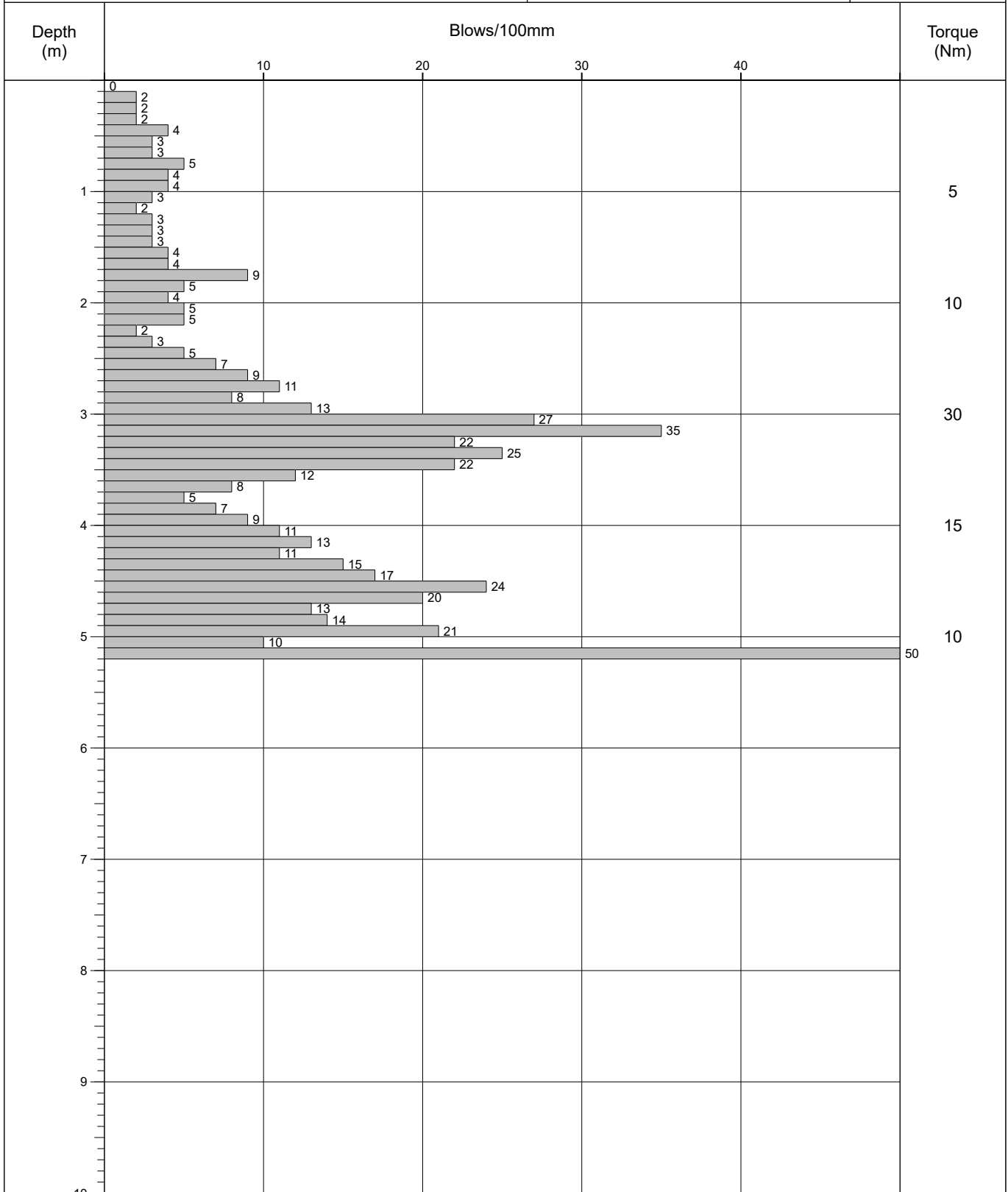
Remarks	Fall Height	760mm	Cone Base Diameter	52mm
Refusal - 50 blows for 65mm	Hammer Weight	63.5kg	Final Depth	5.1m
	Probe Type	DPSH-B	Energy Ratio (Er)	90.53%

Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	24/05/2022			Logged By	GJB



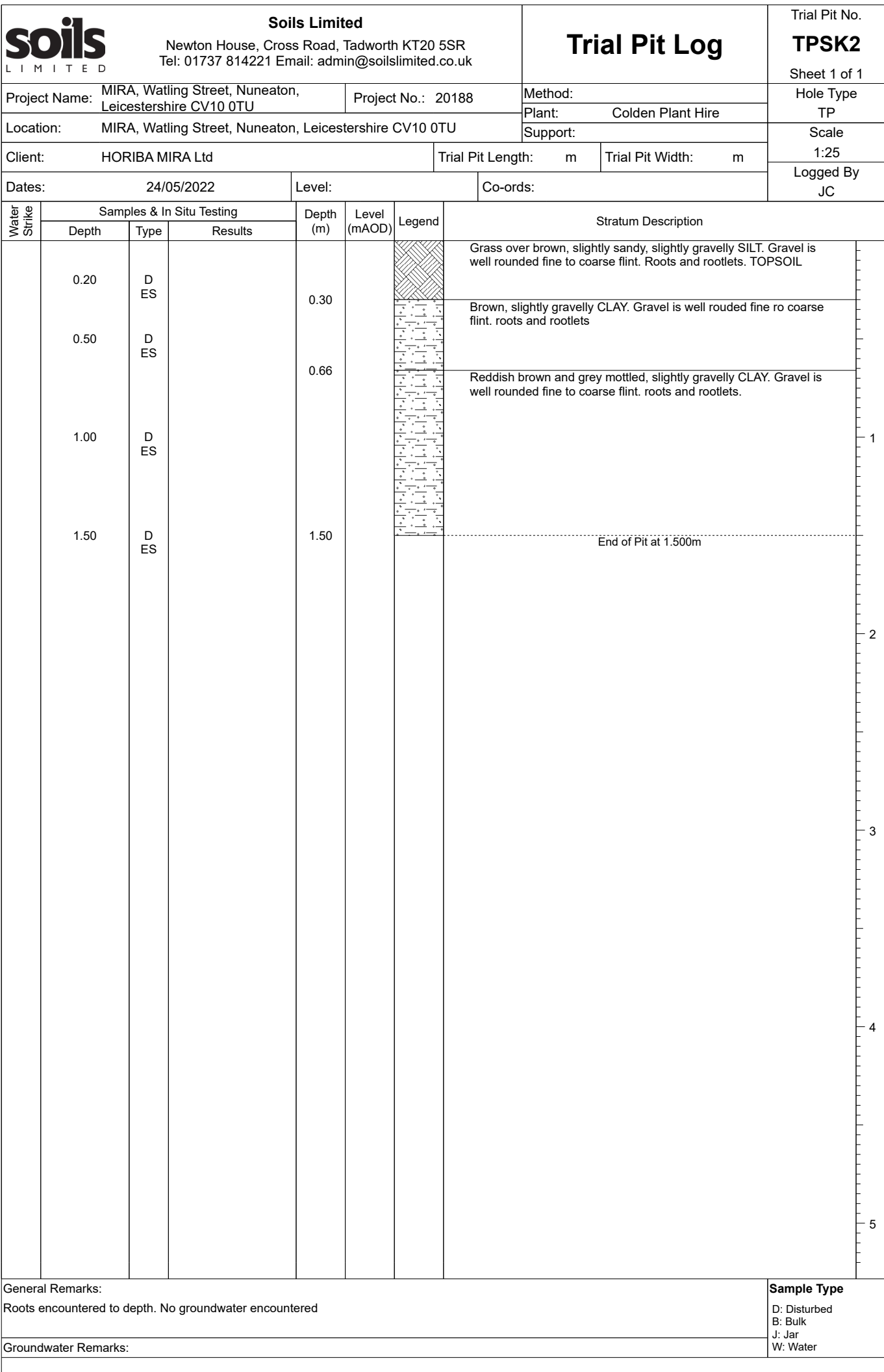
Remarks Refusal - 50 blows for 50mm	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	3.1m
	Probe Type	DPSH-B	Energy Ratio (Er)	90.53%

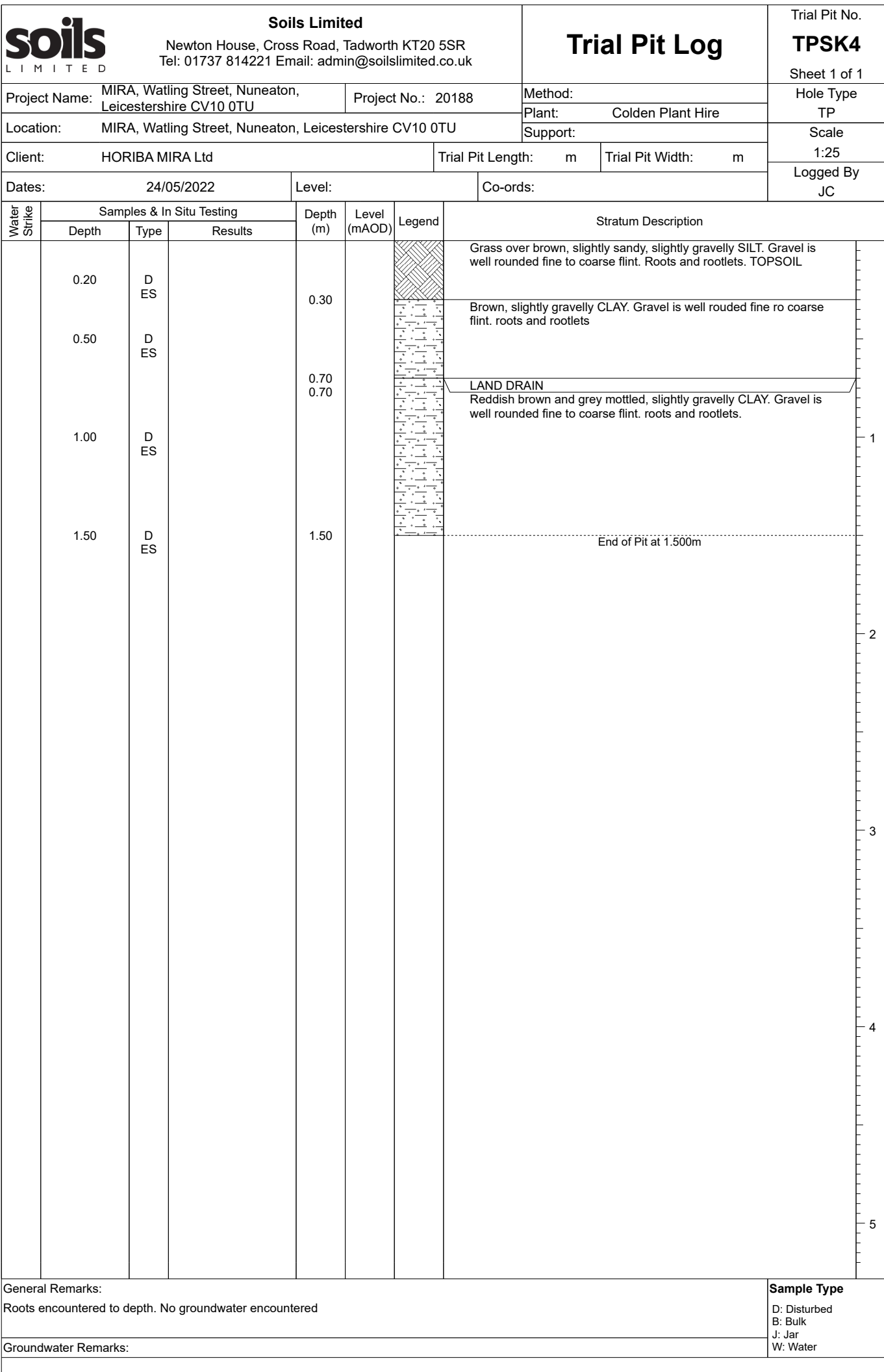
Project Name:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Project No.	20188	Co-ords:		Hole Type	DP
Location:	MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU	Level:	m AOD			Scale	1:50
Client:	HORIBA MIRA Ltd	Dates:	24/05/2022			Logged By	GJB



Remarks Refusal - 50 blows for 90mm	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	5.1m
	Probe Type	DPSH-B	Energy Ratio (Er)	90.53%

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk			Trial Pit Log		Trial Pit No. TPSK1 Sheet 1 of 1				
Project Name: MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU				Project No.: 20188		Method:		Hole Type TP			
Location: MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU				Support:		Scale 1:25		Logged By JC			
Client: HORIBA MIRA Ltd				Trial Pit Length: m		Trial Pit Width: m					
Dates: 24/05/2022			Level:		Co-ords:						
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description				
	Depth	Type	Results								
	0.20	D ES		0.30			Grass over brown, slightly sandy, slightly gravelly SILT. Gravel is well rounded fine to coarse flint. Roots and rootlets. TOPSOIL				
	0.50	D ES					0.70		Brown, slightly gravelly CLAY. Gravel is well rounded fine to coarse flint. roots and rootlets		
	1.00	D ES							Reddish brown and grey mottled, slightly gravelly CLAY. Gravel is well rounded fine to coarse flint. roots and rootlets.		
	1.50	D ES		1.50		End of Pit at 1.500m					
General Remarks: Roots encountered to depth. No groundwater encountered							Sample Type D: Disturbed B: Bulk J: Jar W: Water				
Groundwater Remarks:											





		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk			Trial Pit Log		Trial Pit No. TPSK6 Sheet 1 of 1		
Project Name: MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU				Project No.: 20188		Method:		Hole Type TP	
Location: MIRA, Watling Street, Nuneaton, Leicestershire CV10 0TU				Support:		Scale 1:25		Logged By JC	
Client: HORIBA MIRA Ltd				Trial Pit Length: m		Trial Pit Width: m			
Dates: 25/05/2022			Level:		Co-ords:				
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	D ES		0.35			Grass over brown, slightly sandy, slightly gravelly SILT. Gravel is well rounded fine to coarse flint. Roots and rootlets. TOPSOIL		
	0.50	D ES					Brown, slightly gravelly CLAY. Gravel is well rounded fine to coarse flint. roots and rootlets		
	1.00	D ES					Reddish brown and grey mottled, slightly gravelly CLAY. Gravel is well rounded fine to coarse flint. roots and rootlets.		
	1.50	D ES		1.50			End of Pit at 1.500m		
General Remarks: Roots encountered to depth. No groundwater encountered							Sample Type D: Disturbed B: Bulk J: Jar W: Water		
Groundwater Remarks:									

Appendix B. Infiltration Soakage Data

Soakaway Calculations

Soakaway Test No.	TPSK1
Site Name.	MIRA, Watling Street, Nuneaton
Job No.	20188

Field Test

Trial Pit Log (include details of groundwater):
See trial Pit

Depth of Pit	1.50 m bgl
Width of Pit	0.60 m
Length of Pit Top	2.40 m
Length of Pit Base	2.00 m
Depth of First Reading	0.31 m bgl

Calculations for Area of Trapezoid Side

Length at top of soak	2.3173
Length at 75% of soak	2.24
Length at 25% of soak	2.08

Area of middle 50% of one trapezoid side 1.2844

Calculations of length of one angled short side

Length of angled short side 1.2316

Depth of Pit Soaked	1.19 m
ap50	4.748 m2
Vp75-25	0.770644 m3
t75-25	0.0 min
Amount of water used total	1.5413 m3
Flow rate	#DIV/0! m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)
0.31	0	100
0.32	3.0	99
0.32	12.0	99
0.33	36.0	98
0.34	54.0	97
0.36	69.0	96
0.37	73.0	95
0.37	117.0	95
0.37	172.0	96
0.37	232.0	96
0.50	1266.0	85
0.51	1341.0	84

Total drain	0.20		
T75	0.000	0.6075	75% effective storage depth
T25	0.000	1.2025	25% effective storage depth
T75-25	0.000	Derived from Best Fit	

Comments

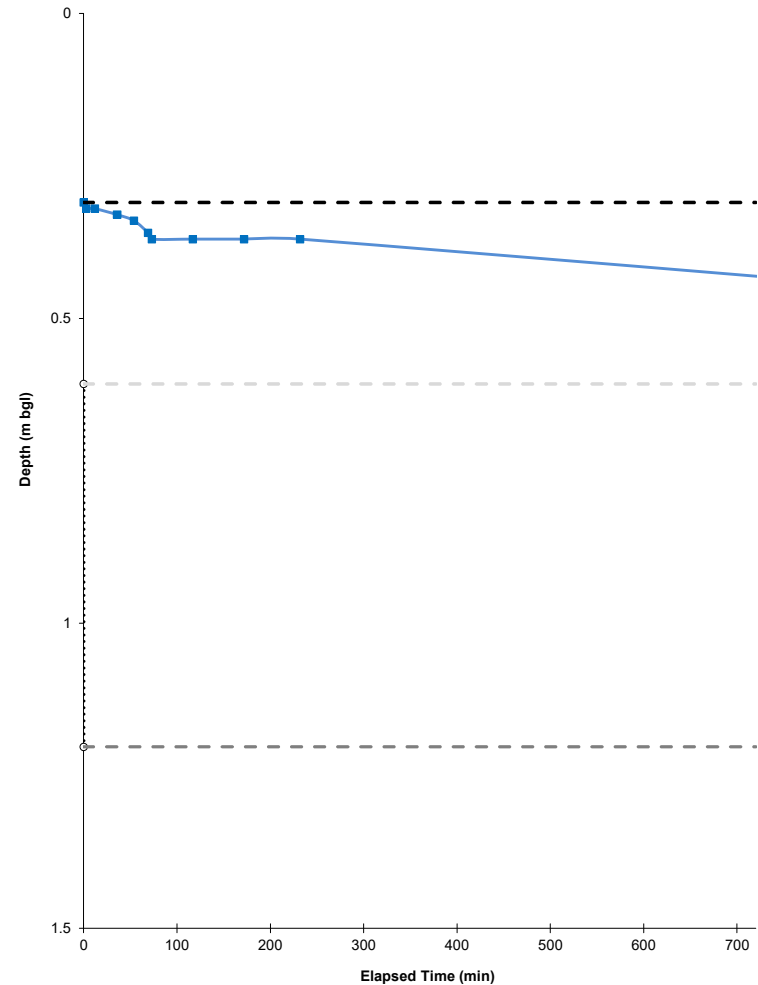
BRE Digest 365:2016

SOILS LIMITED

Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Telephone: 01737 814 221

Infiltration Rate Plot



Notes: The horizontal dashed black line represents the top of the water i.e. first reading

The light grey dashed represents 75% of the effective storage depth, The dark grey represents 25% of the effective storage depth.
The blue line is the depth to water with time. Where a red line is present it is extrapolated data.

Soakaway Calculations

Soakaway Test No.	TKSK2
Site Name.	MIRA, Watling Street, Nuneaton
Job No.	20188

Field Test

Trial Pit Log (include details of groundwater):
See trial Pit

Depth of Pit	1.50 m bgl
Width of Pit	0.60 m
Length of Pit Top	2.30 m
Length of Pit Base	1.80 m
Depth of First Reading	0.63 m bgl

Calculations for Area of Trapezoid Side

Length at top of soak	2.09
Length at 75% of soak	2.02
Length at 25% of soak	1.87

Area of middle 50% of one trapezoid side 0.8461

Calculations of length of one angled short side

Length of angled short side 0.9171

Depth of Pit Soaked	0.87 m
ap50	3.622 m2
Vp75-25	0.507645 m3
t75-25	0.0 min
Amount of water used total	1.0153 m3
Flow rate	#DIV/0! m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)
0.63	0	100
0.64	6.0	99
0.68	12.0	94
0.72	16.0	90
0.75	27.0	86
0.79	36.0	82
0.81	41.0	79
0.82	44.0	78
0.82	67.0	79
0.82	105.0	79
0.82	151.0	79
0.83	208.0	78
0.83	265.0	78
0.85	1301.0	76
0.85	1375.0	76
0.85	1510.0	76

Total drain	0.22	
T75	0.000	0.8475 75% effective storage depth
T25	0.000	1.2825 25% effective storage depth
T75-25	0.000	Derived from Best Fit

Comments

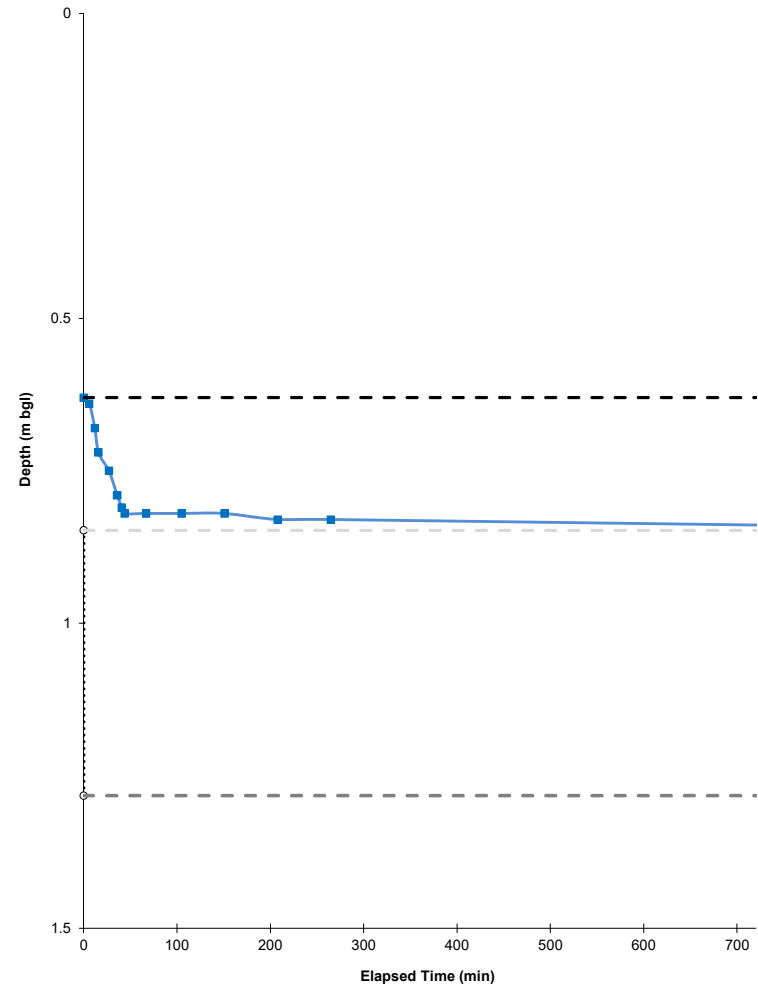
BRE Digest 365:2016

SOILS LIMITED

Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Telephone: 01737 814 221

Infiltration Rate Plot



Notes: The horizontal dashed black line represents the top of the water i.e. first reading

The light grey dashed represents 75% of the effective storage depth, The dark grey represents 25% of the effective storage depth. The blue line is the depth to water with time. Where a red line is present it is extrapolated data.

Soakaway Calculations

Soakaway Test No.	TPSK4
Site Name.	MIRA, Watling Street, Nuneaton
Job No.	20188

Field Test

Trial Pit Log (include details of groundwater):
See trial Pit

Depth of Pit	1.50 m bgl
Width of Pit	0.60 m
Length of Pit Top	2.00 m
Length of Pit Base	1.80 m
Depth of First Reading	0.63 m bgl

Calculations for Area of Trapezoid Side

Length at top of soak	1.916
Length at 75% of soak	1.89
Length at 25% of soak	1.83

Area of middle 50% of one trapezoid side 0.8082

Calculations of length of one angled short side

Length of angled short side 0.8777

Depth of Pit Soaked	0.87 m
ap50	3.343 m2
Vp75-25	0.484938 m3
t75-25	0.0 min
Amount of water used total	0.9699 m3
Flow rate	#DIV/0! m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)
0.87	0	100
0.88	1.0	98
0.88	4.0	98
0.88	9.0	98
0.88	46.0	98
0.88	90.0	98
0.88	109.0	98
0.88	147.0	98
0.88	196.0	100
0.88	246.0	100
0.88	307.0	100
0.91	1347.0	95
0.91	1422.0	95
0.91	1542.0	95

Total drain	0.04	
T75	0.000	0.8475 75% effective storage depth
T25	0.000	1.2825 25% effective storage depth
T75-25	0.000	Derived from Best Fit

Comments

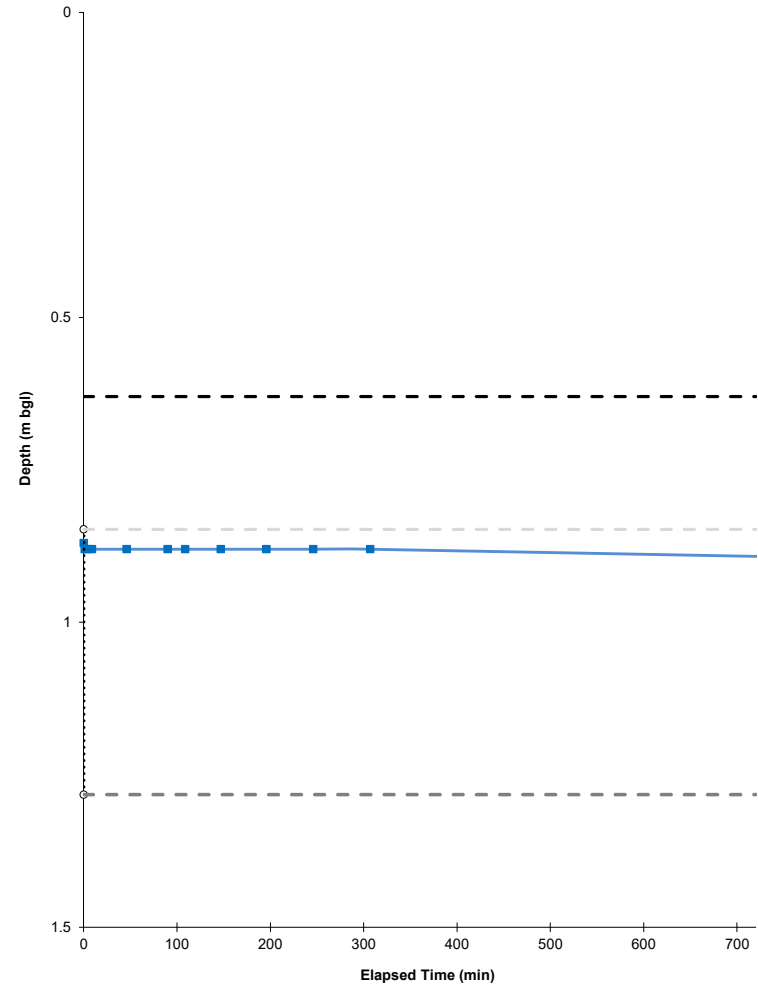
BRE Digest 365:2016

SOILS LIMITED

Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Telephone: 01737 814 221

Infiltration Rate Plot



Notes: The horizontal dashed black line represents the top of the water i.e. first reading

The light grey dashed represents 75% of the effective storage depth, The dark grey represents 25% of the effective storage depth. The blue line is the depth to water with time. Where a red line is present it is extrapolated data.

Soakaway Calculations

Soakaway Test No.	TPSK6
Site Name.	MIRA, Watling Street, Nuneaton
Job No.	20188

Field Test

Trial Pit Log (include details of groundwater):
See trial Pit

Depth of Pit	1.50 m bgl
Width of Pit	0.60 m
Length of Pit Top	2.60 m
Length of Pit Base	1.80 m
Depth of First Reading	0.63 m bgl

Calculations for Area of Trapezoid Side

Length at top of soak	2.264
Length at 75% of soak	2.15
Length at 25% of soak	1.92

Area of middle 50% of one trapezoid side 0.8839

Calculations of length of one angled short side

Length of angled short side	0.986
-----------------------------	-------

Depth of Pit Soaked	0.87 m
ap50	3.919 m2
Vp75-25	0.530352 m3
t75-25	0.0 min
Amount of water used total	1.0607 m3
Flow rate	#DIV/0! m/sec.

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)
0.63	0	100
0.63	14.0	100
0.63	29.0	100
0.63	60.0	100
0.64	102.0	99
0.64	130.0	99
0.64	163.0	99
0.64	221.0	99
0.64	461.0	99

Total drain	0.01	
T75	0.000	0.8475 75% effective storage depth
T25	0.000	1.2825 25% effective storage depth
T75-25	0.000	Derived from Best Fit

Comments

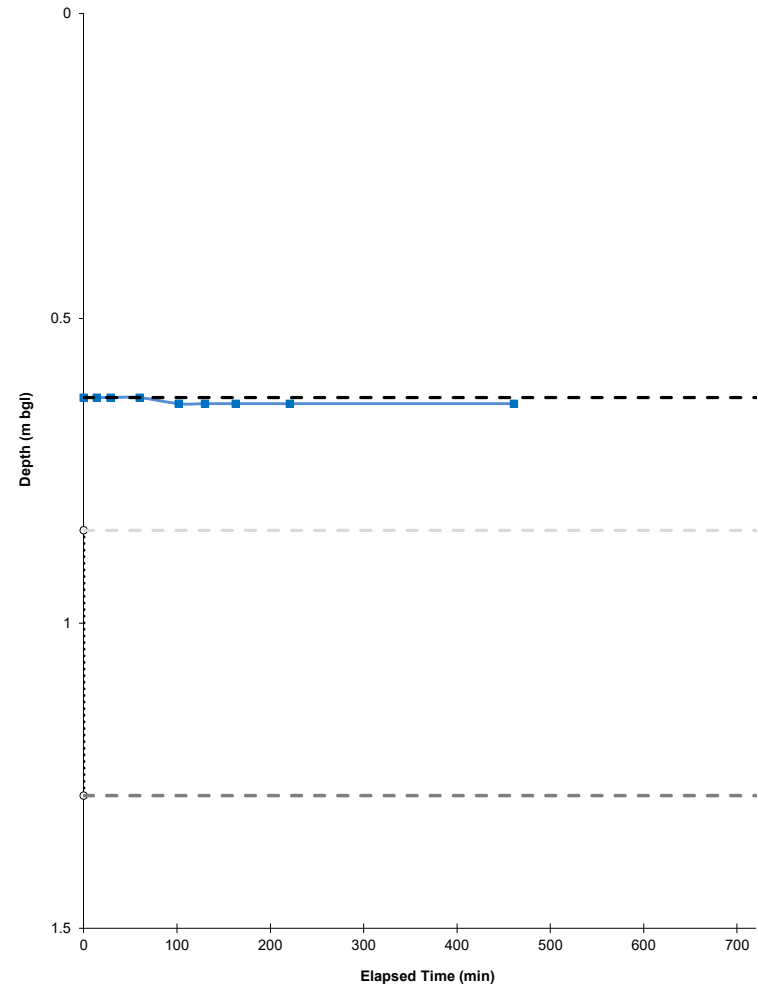
BRE Digest 365:2016

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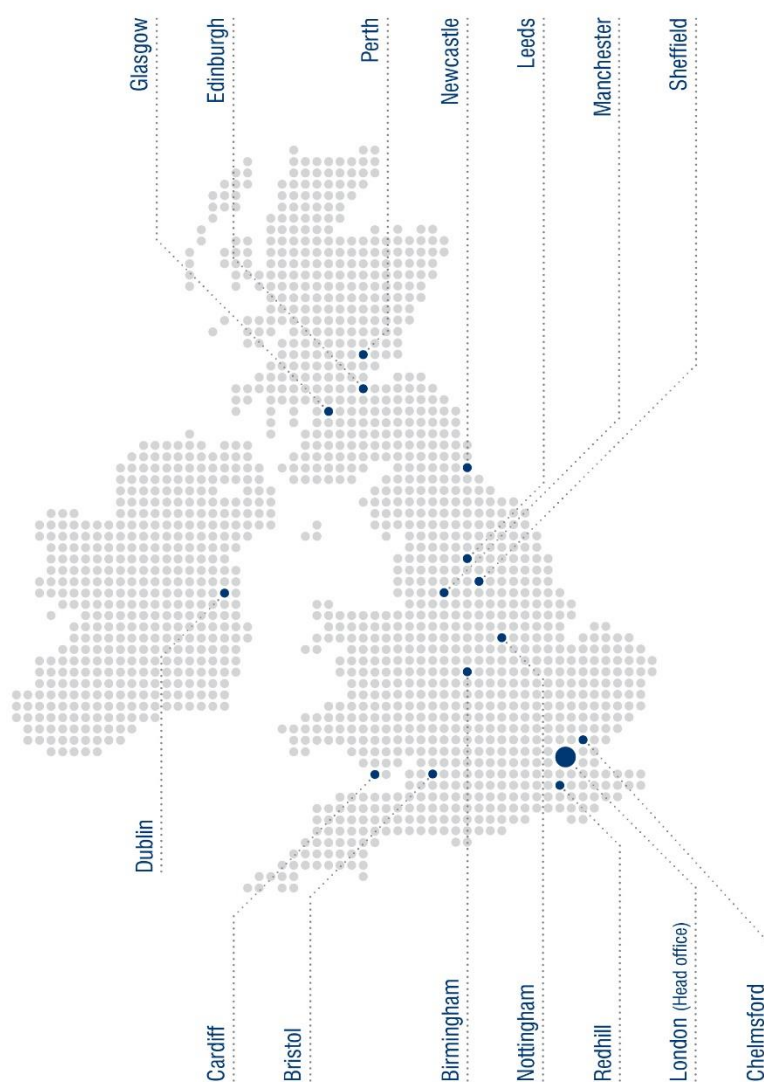
Infiltration Rate Plot



Notes: The horizontal dashed black line represents the top of the water i.e. first reading

The light grey dashed represents 75% of the effective storage depth, The dark grey represents 25% of the effective storage depth.
The blue line is the depth to water with time. Where a red line is present it is extrapolated data.

UK and Ireland Office Locations



Planning Tracker

MIRA NORTH SITE - CONDITIONS TRACKER – 01/01/23

Pre-commencement Condition requiring action

Pre-commencement Condition awaiting approval

Compliance Condition

Prior to Occupancy Condition requiring action

Discharged Condition – No Action Needed

Technology Park Permission (14/00661/CONDIT)

	MIRA TECHNOLOGY PARK PERMISSION 14/00661/CONDIT	Notes	GMI Obligations
1	Applications for the approval of all the reserved matters for the first phase of the development referred to herein shall be made within a period of 3 years from the date of permission 11/00360/OUT. Applications for the approval of all remaining reserved matters shall be made within a period of 10 years from the date of this permission. i) 3 years from the date of this permission: or ii) 2 years from the final approval of the said reserved matters, or, in the case of approval on different dates, the final approval of the last such matter to be approved.	Deadline for all RMs is 1 December 2024	N/A
2	In respect of each part of the development to be the subject of a separate reserved matters approval, that phase or part of the development as hereby permitted shall not be commenced until approval of the following details (hereinafter called "reserved matters") has been obtained from the Local Planning Authority in writing:		N/A

	i) Layout ii) Scale iii) Appearance iv) Landscaping The development shall be implemented in accordance with the approved details. There shall be no amendments or variations to the approved details unless otherwise agreed in writing by the Local Planning Authority.		
3	The development hereby permitted shall not be carried out otherwise than in complete accordance with the submitted application details, as follows: Site Location Plan 1:10,000 received 11 May 2011 Planning Parameters Report (including Parameter Plans PP2-PP5) Revision 2 June 2011 as amended by Plans PP2 and PP3 received 4 October 2011 ATC-10_014-A_2A-R2 ATC-10_014-A_2B-R1 ATC-10_014-A_2C-R2 ATC-10_014-A_2D-R1		N/A these relate to the parameters for the outline application – GMI obligations to carry out development as per reserved matters consent and subsequent NMAs
4	Notwithstanding provision of the Town and Country Planning (Use Classes Order 1987) as amended, the development hereby permitted shall not be used for any other purposes other than: a) Any use falling within Class B1b of the Town and Country Planning (Use Classes Order 1987) or; b) Any use falling within Class B1a or B1c which:		N/A

	(i) Is directly or functionally related to MIRA, transport or automotive research and development sector or other research facilities on the Site; or (ii) Has a special need to be located close to MIRA or other research facilities on the Site that is agreed with the Local Planning Authority.		
5	With the exception of the A5 highways improvements and the internal road infrastructure no development shall commence until a scheme for targeting local people for construction and post construction employment shall be submitted to and approved in writing by the local planning authority. The scheme shall be implemented in accordance with the approved details.	Local Employment Strategy produced. Forms part of Part 2 DOC Application submitted 2 March 2023. Approved 25 May 2023	Employment Strategy requires early co-operation to scope out building construction and labour force requirements and explore opportunities to procure materials, plant and products and services locally where possible.
6	Notwithstanding the details submitted, with the exception of the A5 highways and the internal road infrastructure improvements, no development shall commence until such time as a Green Travel Plan to promote sustainable transport modes of travel to the site from the surrounding area, including Hinckley & Bosworth, North Warwickshire and Nuneaton and Bedworth has been submitted to and approved in writing by the Local Planning Authority. Before the first use of each phase of the development, the Plan shall be implemented in accordance with the relevant approved details.	Submitted as Part 1 DOC Application – Approved 18 April 2023	N/A Green travel plan already in operation.
7	With the exception of the A5 highways improvements no development shall commence on the construction of any building within each phase until such time as a BREEAM Design Stage Assessment, carried out by a qualified assessor, demonstrating that the development within that	Design Stage Assessment approved 18/4/23	BREEAM certificate min VERY GOOD to be submitted before operation.

	phase can be constructed to a minimum of a BREEAM 'Very Good' Standard has been submitted to and approved in writing by the Local Planning Authority. In addition, prior to the first use of that phase of the development, a final certificate demonstrating that the development has been constructed to BREEAM 'Very Good' Standard shall be provided to the Local Planning Authority.		
8	With the exception of the A5 highways improvements and the internal road infrastructure no development shall commence within each phase until such time as a scheme for protecting residential dwellings from noise from the completed development of that phase has been submitted to and agreed in writing by the Local Planning Authority. The scheme shall be fully implemented as approved for each applicable phase of development hereby approved and maintained as approved thereafter.	Report received from RSK and submitted as part of Part 2 DOC Application on 2 March 2023. Partially discharged on 25 May 2023. Once Plant details for buildings are known, a further noise report is required.	No action required from GMI other than implementing in accordance with approved development.
9	With the exception of the A5 highways improvements no development shall commence within each phase until such time as a scheme for the external lighting of that phase including details of permanent external lighting including layout plan, lighting types, luminaire type, intensity, mounting height, aiming angles and luminaire profiles, has been submitted to and agreed in writing by the Local Planning Authority. The scheme shall be fully implemented as approved for each applicable phase of the development hereby approved and be maintained as approved thereafter.	Prepared by Hoare Lea. Submitted as part of Part 2 DOC Application on 2 March 2023. Approved 25 May 2023	No action required from GMI other than implementing in accordance with approved development.
10	With the exception of the A5 highways improvements, no development shall commence until such time as a scheme for the external lighting of each phase of the site during the preparation and construction phase,	Confirmation provided that no external lighting will be required for the construction phases. This information has been provided as	No action required from GMI other than implementing in accordance with approved development. I.e. without

	has been submitted to and agreed in writing by the Local Planning Authority. The scheme shall be fully implemented as approved for each applicable phase of the development hereby approved and be maintained as approved thereafter.	part of Part 2 DOC Application submitted 2 March 2023. Approved 25 May 2023	external lighting during construction.
11	With the exception of the A5 highways improvements no development shall commence until such time as a Risk Based Land Contamination Assessment (including landfill gas) relating to that phase of development has been submitted to and agreed in writing by the Local Planning Authority. The assessment shall be fully implemented as approved for each applicable phase of the development hereby approved.	This has been partially discharged on 18/4/23 based on information available to allow development to commence. Results of further intrusive assessments are now available and can be used to fully discharge the condition for this phase.	Approved by the LPA. Compliance required with Waterman Remediation and Discovery Strategy (Sept 2022)
12	Should any unacceptable risks be identified in the Risk Based Land Contamination Assessment, a Remedial Scheme and Verification Plan shall be prepared and submitted to and agreed in writing by the Local Planning Authority. The assessment shall be fully implemented as approved for each applicable phase of the development hereby approved.	Required if contamination found	GMI to prepare and submit if required
13	If during the course of development, previously unidentified contamination is discovered, development shall cease immediately on the affected part of the site and it must be reported in writing to the Local Planning Authority within 10 working days of its discovery. Prior to the recommencement of development on the affected part of the site, a Risk Based Land Contamination Assessment for the discovered contamination (to include any required amendments to the Remedial Scheme and Verification Plan) must be submitted to and approved in writing by the Local Planning Authority.	During development	GMI to carry out in the event of unidentified contamination found

14	Should any imported fill or cover system be required as part of the Remedial Scheme or site preparation works, prior to installation of the imported fill or cover system, an independent validation of the materials origin and characteristic shall be submitted to and approved in writing by the Local Planning Authority. Only the approved material shall be used on the development site.	During development	To be prepared and submitted by GMI if required.
15	With the exception of the A5 highways improvements no development approved by this permission shall commence until a scheme for the management of land contamination during the site preparation and construction works on the site relating to that phase of development has been submitted to and agreed in writing by the Local Planning Authority. The approved scheme shall be implemented in accordance with the agreed details.	Watermans report provided. Details submitted as part of Part 2 DOC Application on 2 March 2023. Approved 25 May 2023	No action required from GMI other than implementing in accordance with approved scheme. Compliance required with Waterman Remediation and Discovery Strategy (Sept 2022)
16	Notwithstanding the detail submitted, with the exception of the A5 highways improvements, no development shall commence until a Construction Environmental Management Plan has been submitted to and agreed in writing by the local Planning Authority. The plan shall detail how, during the site preparation and construction phase of the development, the impact on local residents and the environment shall be prevented or mitigated from dust, odour, noise, smoke, light and land contamination. The plan shall detail how such controls will be monitored and provide a procedure for the investigation of complaints. The plan shall be implemented throughout the duration of the construction works.	CS2 prepared high level statement submitted as part of Part 2 DOC Application. Approved 25 May 2023	No action required from GMI other than implementing in accordance with approved scheme. Compliance required with CS2 Construction Method Statement (Nov 2022)

17	With the exception of the A5 highways improvements no development shall commence on the construction of any building until such time as a waste management plan has been submitted to and agreed in writing by the local planning authority. The plan shall then be implemented as approved through each phase of the development and be maintained as approved thereafter in the completed development.	Included as part of Part 2 DOC Application. Approved 25 May 2023	No action required from GMI other than implementing in accordance with approved scheme.
18	The development hereby permitted shall comprise no more than the following uses and areas: Use Class B1(b) Research & Development - 118,413m2 Use Class B1(a) Offices - 14,303m2 Use Class C3 Hotel - 4,500m2 (100 beds) Use Class A1 Local Retail Facilities - 500m2 Use Class A3 Restaurants - 1,000m2 Use Class D2 Leisure - 1,000m2	Parameters	N/A
19	No more than 35,524m2 B1b, 4,290m2 B1a and 2,100m2 hotel / service uses shall be occupied on the application site until the Access Junction Improvements shown in ATC drawings ATC-10_014-A_2E (or as amended by Road Safety Audit or Detailed Design) are complete and open to traffic.	Complete	N/A
20	No more than 35,524m2 B1b, 4,290m2 B1a and 2,100m2 hotel / service uses shall be occupied on the application site until the Wood Lane Junction Improvements shown in ATC drawings ATCMIRA_A5_JCT-WDLN-R2 (or as amended by Road Safety Audit or Detailed Design) are complete and open to traffic.	Complete	N/A
21	No more than 35,524m2 B1b, 4,290m2 B1a and 2,100m2 hotel / service uses shall be occupied on the application site until the A5 Redgate Improvement Scheme shown in ATC drawing ATCMIRA_A5_JCT-	Complete	N/A

	RDGT-R3 (or as amended by Road Safety Audit or Detailed Design) is complete and open to traffic.		
22	No more than 71,048m2 B1b, 8,580m2 B1a and 4,200m2 hotel / services shall be occupied on the application site until the Access Strategy shown in ATC drawings ATC-10_014-A_2A-R2, ATC-10_014-A_2B-R1, ATC-10_014-A_2C-R2, ATC-10_014-A_2D-R1 (or as amended by Road Safety Audit or Detailed Design) are complete and open to traffic.	Complete	N/A
23	No more than 71,048m2 B1b, 8,580m2 B1a and 4,200m2 hotel / services shall be occupied on the application site until the Higham Roundabout Improvement Scheme shown in ATC drawing MIRA/A5/JCT-HGHRDBT-R2 (or as amended by Road Safety Audit or Detailed Design) is complete and open to traffic.	Complete	N/A
24	No more than 71,048m2 B1b, 8,580m2 B1a and 4,200m2 hotel / services shall be occupied on the application site until the Longshoot Roundabout Improvement Scheme shown in ATC drawing MIRA_A5_JCT-LNGSH-R3 (or as amended by Road Safety Audit or Detailed Design) is complete and open to traffic.	Complete	N/A
25	No more than 71,048m2 B1b, 8,580m2 B1a and 4,200m2 hotel / services shall be occupied on the application site until the Dodwells Roundabout Improvement Scheme shown in ATC drawing MIRA_A5_JCT-DWLRDBT-R2 (or as amended by Road Safety Audit or Detailed Design) is complete and open to traffic.	Complete	N/A
26	In accordance with the requirements of the submitted Environmental Assessment, no development shall commence, with the exception of the A5 highways	Badger Survey completed and approved	Approved and mitigation complete....Check?

	improvements until such time as a further survey for badgers within the application site relevant to the phase of development and a scheme of any necessary arising mitigation and or compensation has been submitted to an agreed in writing by the Local Planning Authority. The approved details and any mitigation shall be fully implemented before the commencement of any relevant development phase.		Compliance required with CS2 Construction Method Statement (Nov 2022)
27	In accordance with the requirements of the submitted Environmental Assessment, with the exception of the A5 highways improvements, no development shall commence until such time as method statement detailing measures to prevent harm to Great Crested Newts, provision of new habitat and reinstatement of previous habitat relating to that phase of development has been submitted to an agreed in writing by the Local Planning Authority. The method statement and any mitigation shall be fully implemented before the commencement of any relevant development phase.	Approved 18 April 2023	Check in relation to monitoring and /or maintenance of newt fencing during construction outwith plots. Compliance required with CS2 Construction Method Statement (Nov 2022) and GCN Licence.
28	With the exception of the A5 highways improvements no development shall commence until such time as a master surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydrogeological context of the development, has been submitted to and approved in writing by the local planning authority (in consultation with the Environment Agency). The scheme shall subsequently be implemented in accordance with the approved details before the development is completed.	Submitted as Part 1 DOC – Approved 18 April 2023	No action required from GMI other than implementing in accordance with approved scheme.
29	With the exception of the A5 highways improvements no development shall commence within each phase until such time as drainage plans for the disposal of surface water and foul sewage in accordance with the	Approved 18 April 2023	GMI to implement in accordance with approved scheme.

	agreed drainage strategy have been submitted to and approved in writing by the local planning authority. The scheme shall be fully implemented in accordance with the approved details before the development is first brought into use.		Compliance required with GMI Construction Environment Management Plan Rev A.
30	With the exception of the A5 highways improvements no development shall commence until a soil handling and reuse strategy has been submitted to and agreed in writing by the local planning authority. All existing site soils should then be managed and reused in accordance with this strategy at all times thereafter.	Approved 18 April 2023	GMI to implement in accordance with approved scheme.
31	With the exception of the A5 highways improvements no development shall commence until such time as a scheme detailing the improvements as generally described in Section 10.13 - 10.18 and Figure 10.1 - off-sites cycle infrastructure improvements within the Supplementary Transport Assessment Report, August 2011, including a proposed programme of implementation, has been submitted to and approved in writing by the Local Planning Authority in consultation with the Highway Authority. No more than 35,524m² B1b, 4,290m² B1a and 2,100m² hotel/service uses shall be occupied until the approved A5 corridor cycle works have been implemented in accordance with the approved implementation programme between Redgate junction and Wood Lane. No more than 71,048m² B1b, 8,580 m² B1a and 4,200 hotel/service uses shall be occupied until the approved A5 corridor cycle works have been implemented in accordance with the approved implementation programme between Wood Lane and the Higham Roundabout.	Complete	N/A

32	With the exception of the A5 highways improvements, no demolition/development shall take place/commence until a programme of archaeological work including a Written Scheme(s) of Investigation relating to that phase of development has been submitted to and approved in writing by the local planning authority. The scheme(s) shall include an assessment of significance and research questions; and: The programme and methodology of site investigation and recording The programme for post investigation assessment Provision to be made for analysis of the site investigation and recording Provision to be made for publication and dissemination of the analysis and records of the site investigation Provision to be made for archive deposition of the analysis and records of the site investigation Nomination of a competent person or persons/organisation to undertake the works set out within the Written Scheme of Investigation. No demolition/development shall take place other than in accordance with the approved Written Scheme(s) of Investigation.	Approved 18 April 2023	Archaeology complete. GMI to comply with any mitigation during construction.
33	The development in each phase shall not be occupied until the site investigation and post investigation assessment for each phase has been completed in	Compliance prior to occupation	GMI to implement in accordance with approved scheme.

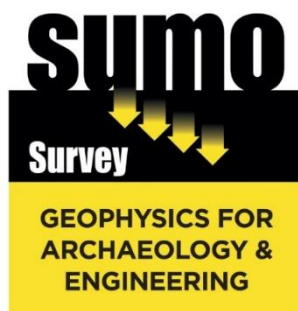
	accordance with the programme set out in the Written Scheme(s) of Investigation approved under condition 32 and the provision made for analysis, publication and dissemination of results and archive deposition has been secured.		
34	In accordance with the requirements of the submitted Environmental Assessment, with the exception of the A5 highways improvements, no development that affects Lindley Grange shall commence until such time as a further survey for bats within the outbuildings to Lindley Grange and a scheme of any necessary arising mitigation and or compensation has been submitted to an agreed in writing by the Local Planning Authority. The approved details and any mitigation shall be fully implemented before the commencement of any relevant development phase	Completed	N/A

Infrastructure Application

	MIRA LIF2 INFRASTRUCTURE PERMISSION 22/00412/FUL	Actions
1	Development to commence prior to 7 October 2025	
2	Development approved in accordance with specific plans	
3	Hard and soft landscaping to be carried out in accordance with approved plans and maintained for 5 years	
4	Development in accordance with tree protection plan	
5	Land Contamination Investigation Strategy	Strategy approved by 22/01188/DISCON but condition only partly discharged until implementation and results are known.

6	If contamination found, development must stop until addendum to scheme of investigation is submitted and approved.	Only required if contamination is found.
7	Construction Travel Plan	Approved by 22/01188/DISCON
8	Archaeological WSI	Partly discharged by 22/01188/DISCON and new application submitted to allow full discharge now archaeological work has been completed.
9	Archaeology results to be submitted	Detail provided and application 23/00144/DISCON approved 31/3/23
10	Surface Water management during construction	Details provided within CMP approved through 22/01188/DISCON
11	Long term surface water infrastructure management	Drainage Maintenance plan approved.
12	Infiltration Testing	Approved through 22/01188/DISCON
13	Ecological Mitigation to be undertaken in accordance with submitted strategy	Compliance
14	New bat survey required if work not commenced prior to April 2023	Compliance

Geophysical Survey Report



GEOPHYSICAL SURVEY REPORT

MIRA, Watling Street, Leicestershire

Client

ULAS

For

Horiba MIRA

Survey Report

07582

OASIS Ref. No.

sumogeop1-507208

Date

07 June 2022



Survey Report 07582: MIRA, Watling Street, Leicestershire

Survey dates 16-17 May 2022

Field co-ordinator Jay Griffiths BA

Field Team Simon Lobel BSc

Report Date 07 June 2022

CAD Illustrations Thomas Cockcroft MSc
Liam Brice-Bateman BA

Report Author Thomas Cockcroft MSc

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Report approved Dr John Gater BSc DSc(Hon) MCIfA FSA

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1 LIST OF FIGURES

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Figure 02	1:1500	Magnetometer Survey - Greyscale Plots
Figure 03	1:1500	Magnetometer Survey - Colour Plots
Figure 04	1:1000	Magnetometer Survey - Interpretation
Figure 05	NTS	Greyscale Plots / Interpretation / c. 1945 - 65 Ordnance Survey Map / 2018 Aerial Image
Figure 06	1:1500	Minimally Processed Data - Greyscale Plots
Figure 07	1:1500	XY Trace Plots (clipped at +/-15nT)

2 LIST OF APPENDICES

Appendix A	Technical Information: Magnetometer Survey Methods, Processing and Presentation
Appendix B	Technical Information: Magnetic Theory
Appendix C	OASIS Data Collection Sheet

3 SURVEY TECHNIQUE

- 3.1 Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site. All survey techniques will follow the guidance set out by CIFA (2014, updated 2020), Historic England (2008), and the European Archaeology Council (EAC) (2016).

Bartington Cart System Traverse Interval 1.0m Sample Interval 0.125m

The only processes performed on data are the following unless specifically stated otherwise:

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes instrument striping effects and edge discontinuities over the whole of the data set.
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4 SUMMARY OF RESULTS

- 4.1 A magnetometer survey of 7.8 hectares of land at MIRA, Watling Street has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. A number of uncertain responses are likely to be due to agricultural or other modern processes. A former field boundary is visible in the magnetic data along with several land drains. The routes of service pipes have also been marked.

5 INTRODUCTION

- 5.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **ULAS** on behalf of **Horiba MIRA**.

5.2 Site Details

NGR / Postcode	SP 36470 95582 / CV10 0TT	
Location	The site is located 3.5 km north of Nuneaton and 5.5km west of Hinckley. The survey area is bounded to the south by ICS UK - MIRA Technology Park Technology Centre buildings off the A5 and to the east by Lindley Grange.	
HER	Leicestershire HER	
OASIS Ref. No.	sumogeop1-507208	
District	Hinckley and Bosworth District (B)	
Parish	Higham on the Hill Civil Parish	
Topography	Generally flat	
Land Use	Arable agriculture	
Geology (BGS 2022)	Bedrock:	Mercia Mudstone Group - Mudstone Gunthorpe Member - Siltstone, Dolomitic
	Superficial:	Anker Sand and Gravel - Sand and Gravel
Soils (CU 2022)	Soilscape 8: Slightly acid loamy and clayey soils with impeded drainage	
Survey Methods	Magnetometer survey (fluxgate gradiometer)	
Study Area	7.8 ha	

5.3 *Archaeological Background*

- 5.3.1 A desk-based assessment has been carried by ULAS (2021) on land due south-west of the survey area.
- 5.3.2 The assessment area lies adjacent to the line of Watling Street, a Roman road. Roman remains have been revealed along the line of the road within the main MIRA site. There are also several findspots for prehistoric flint tools in the vicinity and a findspot for a medieval artefact within the boundary of the site itself, although the land lies outside the medieval core of Caldecote village. There is moderate to high potential for archaeological remains, particularly from the prehistoric and Roman periods, and low to moderate potential for medieval and post-medieval remains.
- 5.3.3 A magnetometer survey was carried out due south-west of the site by Sumo Geophysics (SGL 2022) which recorded two circular anomalies which were tentatively interpreted as being ring-ditches; however, they could also be due to agricultural practices. Land drains, ridge and furrow ploughing, former field boundaries and a former track are all visible in the survey.

5.4 ***Aims and Objectives***

- 5.4.1 To locate and characterise any anomalies of possible archaeological interest within the study area.

6 **RESULTS**

6.1 ***Probable / Possible Archaeology***

- 6.1.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest.

6.2 ***Uncertain***

- 6.2.1 A number of linear trends have been detected in the magnetic data and have been assigned to the category of *Uncertain*. They generally lack the defined morphology of anomalies that would usually be interpreted as being of archaeological interest. They are likely to be due to agricultural or other modern processes.

6.3 ***Former Field Boundary – Corroborated***

- 6.3.1 A linear anomaly has been recorded in the data which corresponds to the route of a recorded field boundary which is visible in historic mapping (see Figure 05).

6.4 ***Agricultural –Land Drains***

- 6.4.1 Linear chains of relatively weak dipolar ferrous anomalies are due to land drains.

6.5 ***Service***

- 6.5.1 Strong dipolar linear ferrous responses have been detected in the magnetic data and mark the locations of service pipes.

6.6 ***Ferrous / Magnetic Disturbance***

- 6.6.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

7 **DATA APPRAISAL & CONFIDENCE ASSESSMENT**

- 7.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of a former field boundary and linear trends; as a consequence, there is no *a priori* reason why archaeological features would not have been detected, if present.

8 **CONCLUSION**

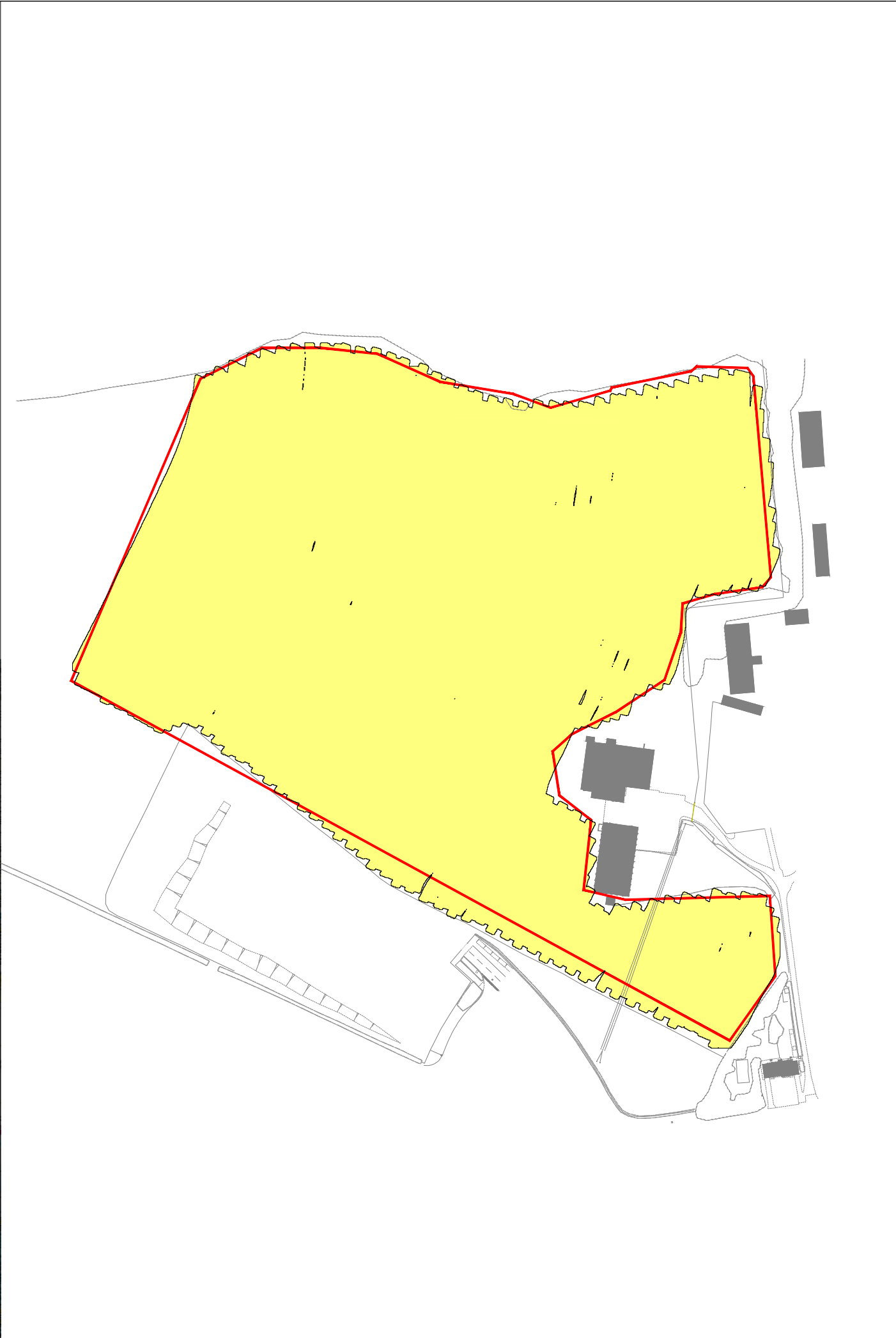
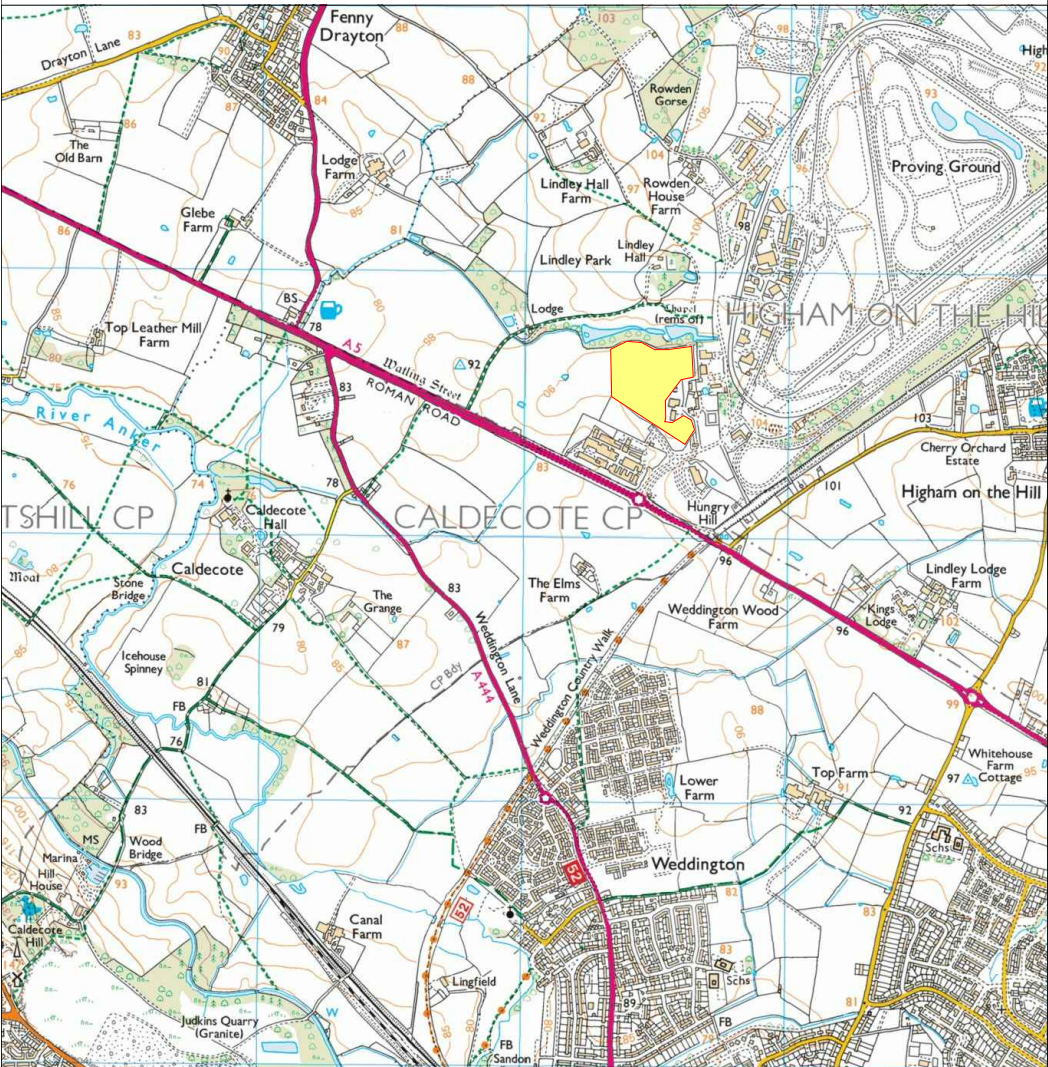
- 8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. A couple of linear trends have been assigned to the category of uncertain; they are likely to be due to modern agricultural processes. A former field boundary is visible in the magnetic data long with a number of land drains. The routes of service pipes have also been marked.

9 REFERENCES

- BGS 2022 British Geological Survey, Geology of Britain viewer [accessed 07/07/2022] *website:* (<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
- ClfA 2014 *Standard and Guidance for Archaeological Geophysical Survey*. Amended 2020.
Amended ClfA Guidance note. Chartered Institute for Archaeologists, Reading
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- CU 2022 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 07/06/2022] *website:* <http://mapapps2.bgs.ac.uk/ukso/home.html>
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- EH 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage, Swindon (now withdrawn, but used for evaluating suitability of soil types)
- SGL 2022 *MIRA South, Weddington Lane, Caldecote, Warwickshire Geophysical Survey Report (05341)*. SUMO Geophysics Ltd, Upton-upon-Severn
- ULAS 2021 *An archaeological desk-based assessment for MIRA South, Weddington Lane, Caldecote, Warwickshire (SP 35846 95142)*. ULAS, Leicester

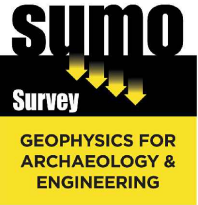
10 ARCHIVE

- 10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO Geophysics Ltd.'s** digital archive, on an internal RAID configured NAS drive in the Midlands Office. These data are also backed up to the Cloud for off-site storage.
- 10.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months.

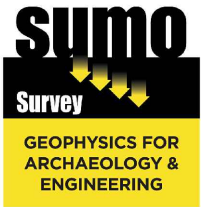
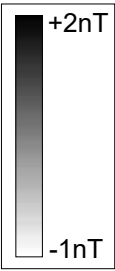
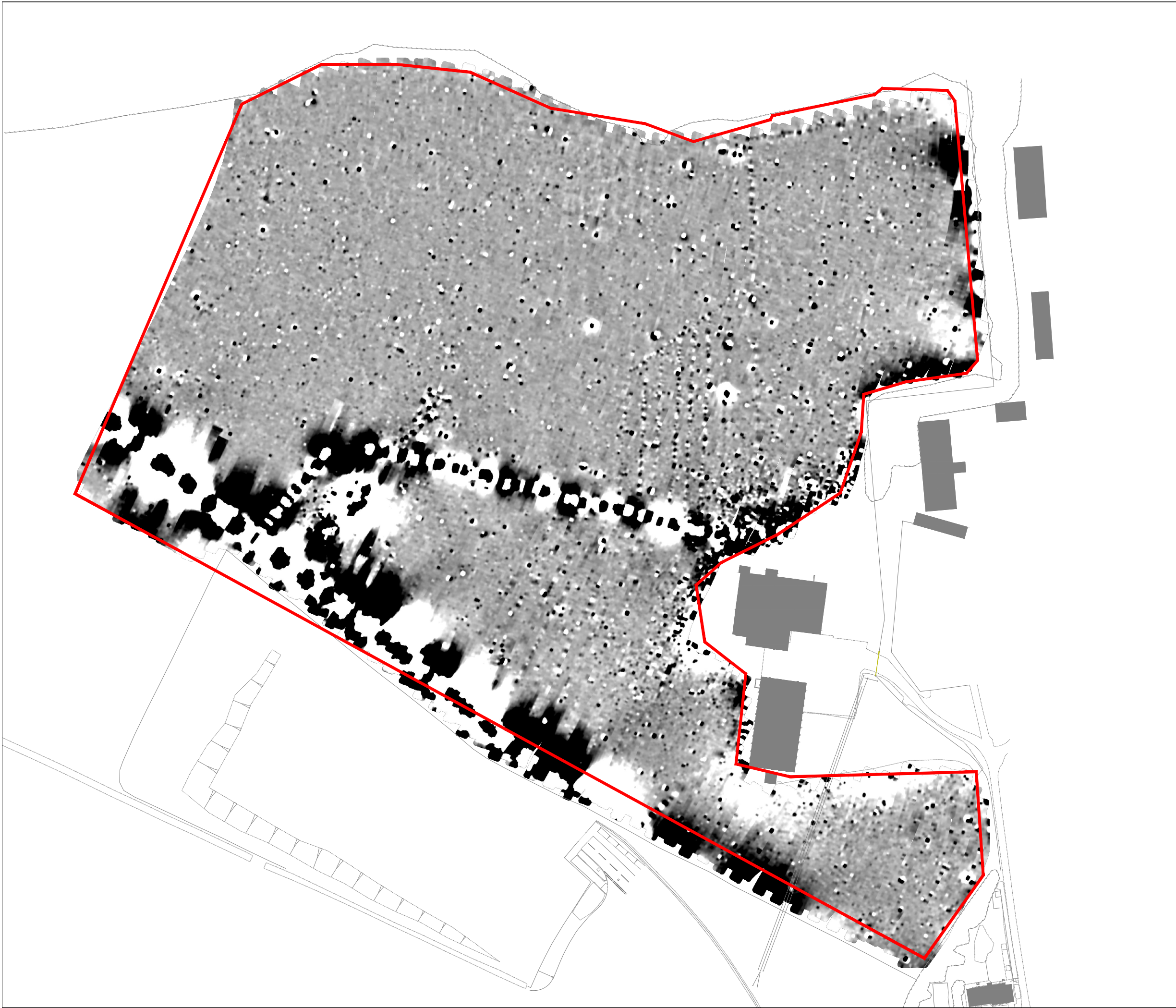


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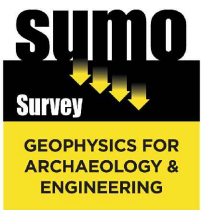
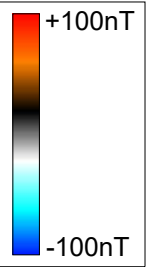
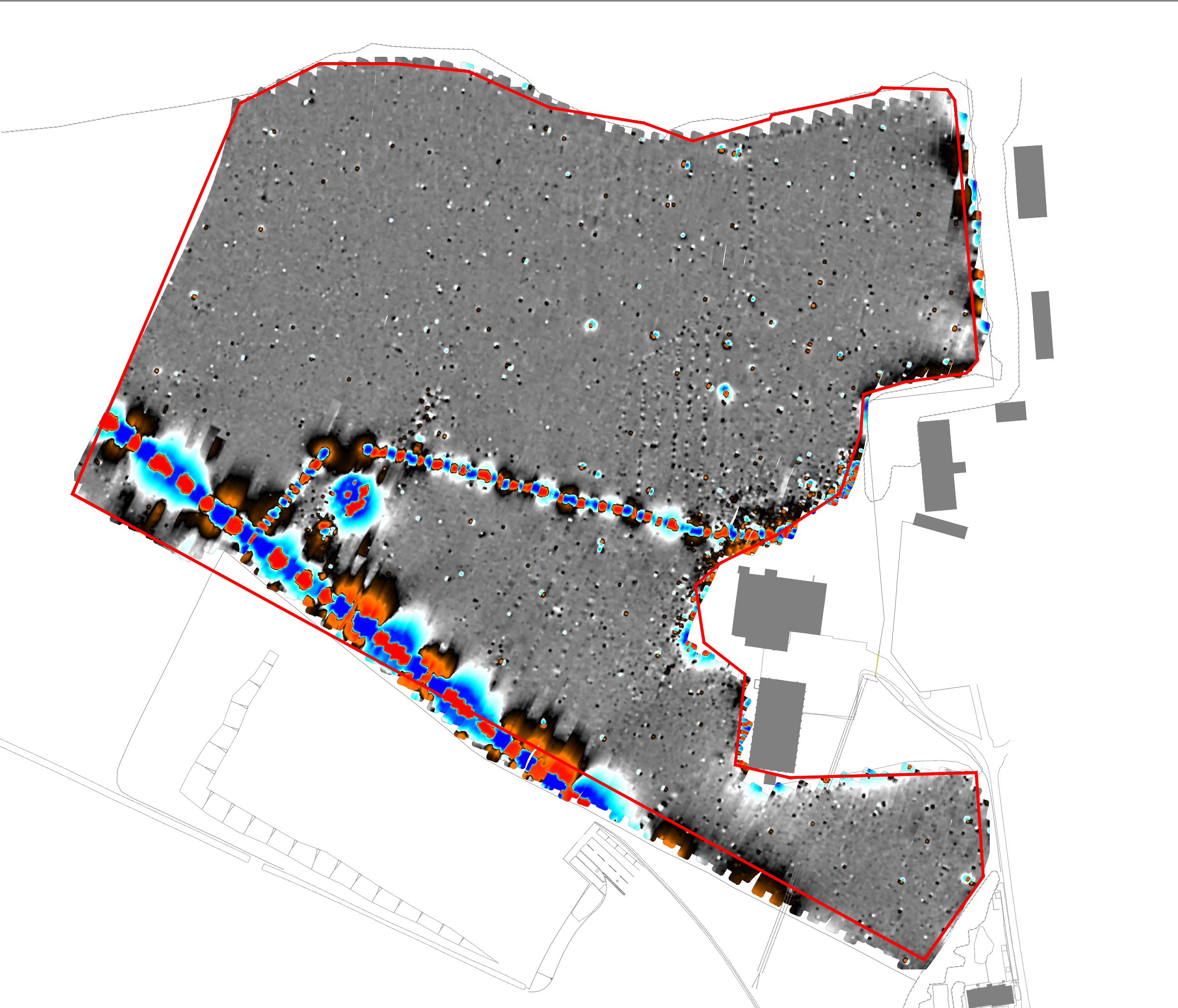
	Survey Areas	
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Title: Site Location	
Client: ULAS	
Project: 07582 - MIRA, Watling Street, Leicestershire	
Scale: NOT TO SCALE	Fig No: 01



Title: Magnetometer Survey - Greyscale Plots	
Client: ULAS	
Project: 07582 - MIRA, Watling Street, Leicestershire	
Scale: 0 metres 75 1:1500 @ A3	Fig No: 02

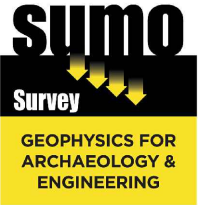


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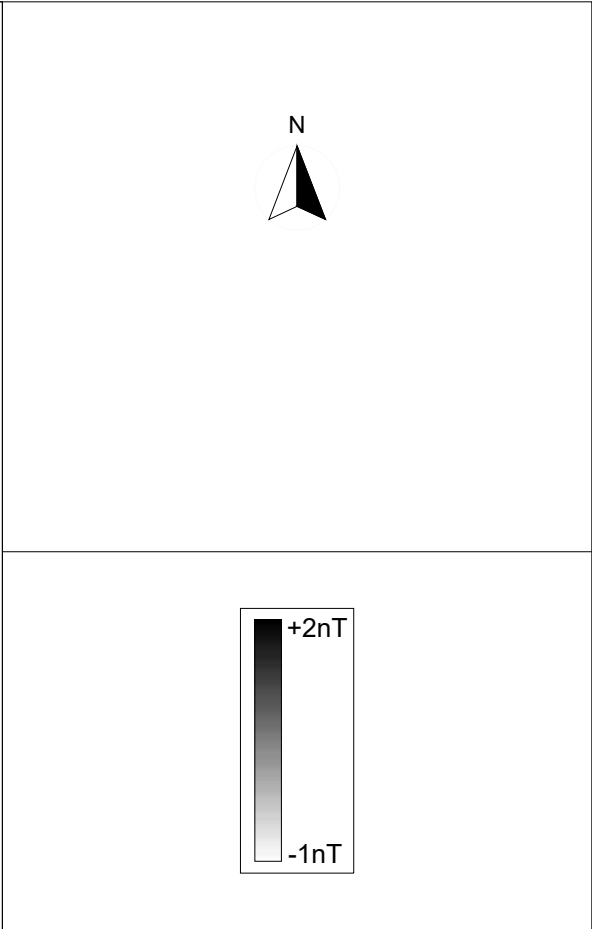


KEY

	Uncertain Origin (discrete anomaly / trend)
	Land drain
	Former field boundary (corroborated)
	Service
	Ferrous

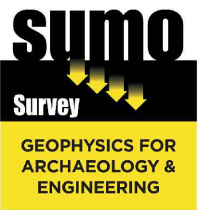


Title: Magnetometer Survey - Interpretation	
Client: ULAS	
Project: 07582 - MIRA, Watling Street, Leicestershire	
Scale: 0 75 metres 1:1500 @ A3	Fig No: 04



KEY

	Uncertain Origin (discrete anomaly / trend)
	Land drain
	Former field boundary (corroborated)
	Service
	Ferrous

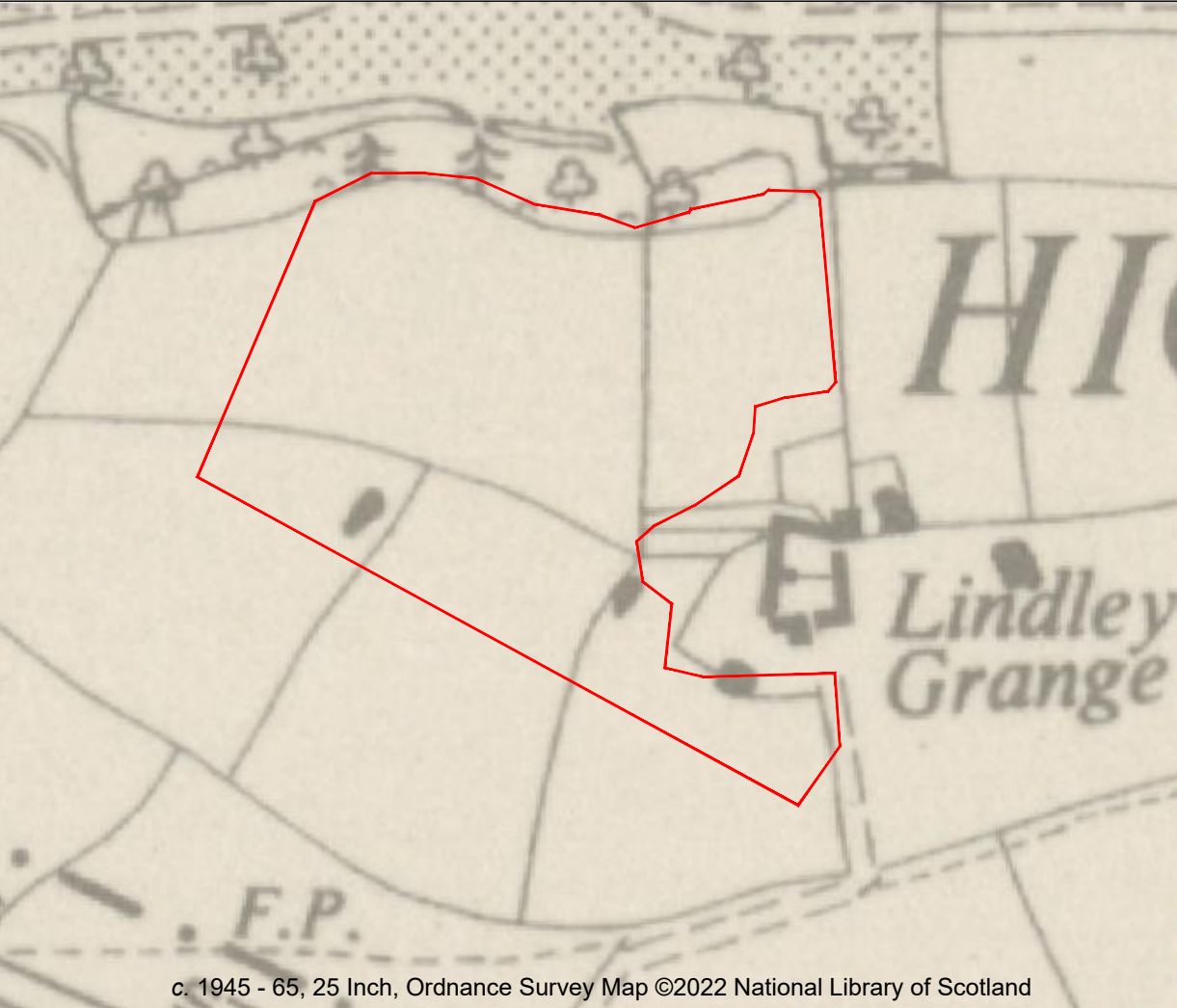


Title:
Greyscale Plots / Interpretation / c. 1945 - 65
Ordnance Survey Map / 2018 Aerial Image

Client:
ULAS

Project:
07582 - MIRA, Watling Street, Leicestershire

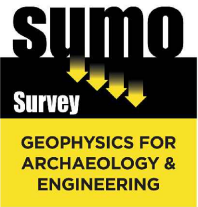
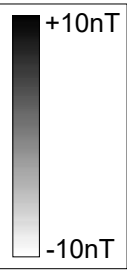
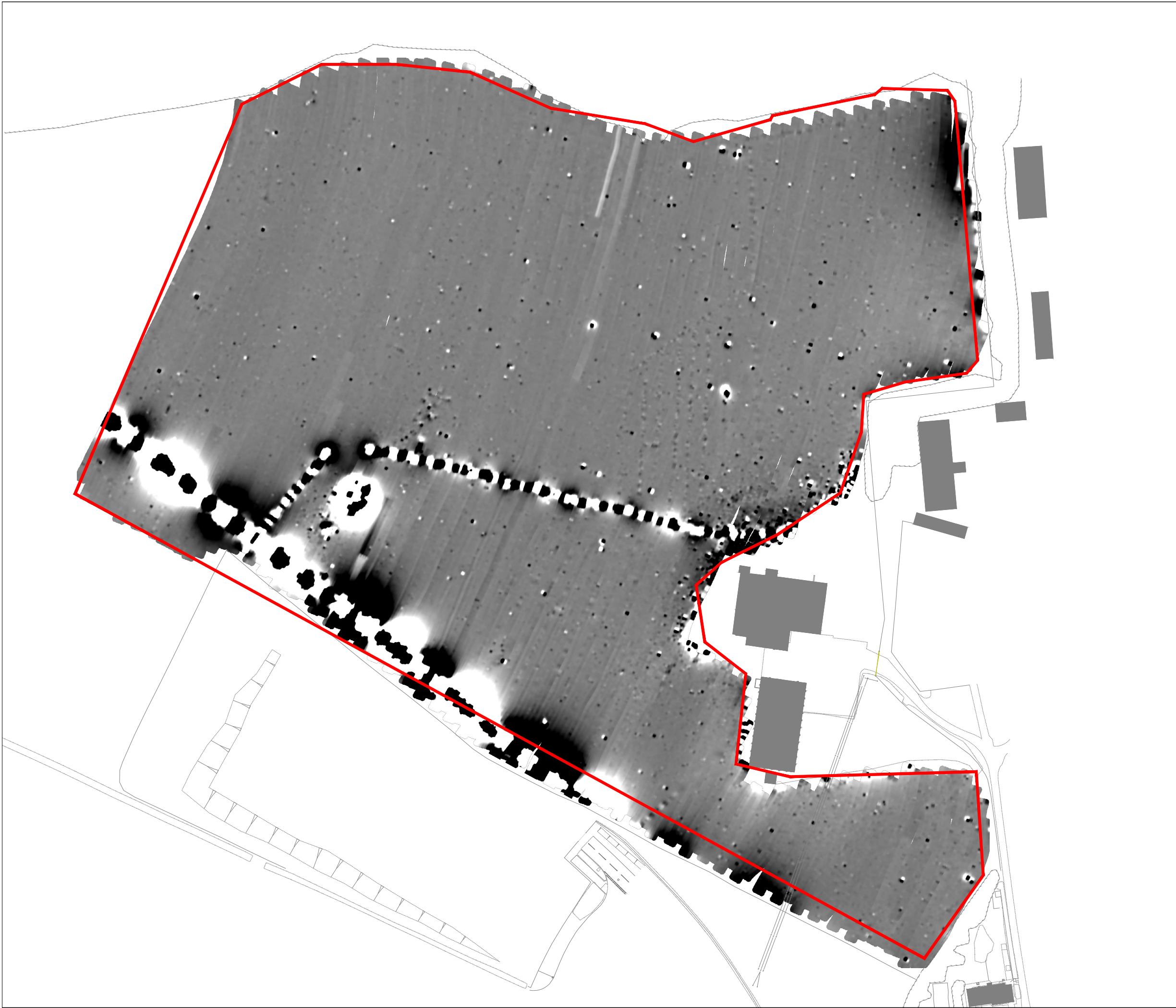
Scale: NOT TO SCALE	Fig No: 05
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c. 1945 - 65, 25 Inch, Ordnance Survey Map ©2022 National Library of Scotland



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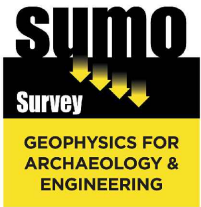
Title:
Minimally Processed Data - Greyscale Plots

Client:
ULAS

Project:
07582 - MIRA, Watling Street, Leicestershire

Scale:
0 metres 75
1:1500 @ A3

Fig No:
06



Title: XY Trace Plots (clipped at +/-15nT)	
Client: ULAS	
Project: 07582 - MIRA, Watling Street, Leicestershire	
Scale: 0 metres 75 1:1500 @ A3	Fig No: 07

Appendix A - Technical Information: Magnetometer Survey Method

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1.0m	0.25m
Magnetometer	Bartington Cart System	1.0m	0.125m

Instrumentation:

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted horizontally, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths.

Bartington Grad 601-2

Hand-Held: Data will be collected using a Bartington Grad 601-2. The instrument consists of two paired sensors and readings are logged at 0.25m centres along traverses 1.0m apart across 30m grids. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution as per Historic England guidelines

Bartington Cart System

Data will be collected using a cart carrying four paired Bartington magnetic sensors. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.
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Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall*, etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

<i>Archaeology / Probable Archaeology</i>	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
<i>Possible Archaeology</i>	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
<i>Industrial / Burnt-Fired</i>	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
<i>Former Field Boundary (probable & possible)</i>	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
<i>Ridge & Furrow</i>	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
<i>Agriculture (ploughing)</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Land Drain</i>	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
<i>Natural</i>	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
<i>Magnetic Disturbance</i>	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
<i>Service</i>	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
<i>Ferrous</i>	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
<i>Uncertain Origin</i>	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of <i>Possible Archaeology / Natural</i> or (in the case of linear responses) <i>Possible Archaeology / Agriculture</i> ; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

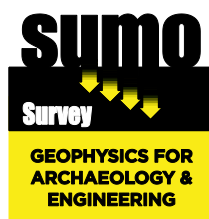
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.

Summary for sumogeop1-507208

OASIS ID (UID)	sumogeop1-507208
Project Name	Geophysical Survey at MIRA, Watling Street, Leicestershire
Sitename	
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	07582
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	16-May-2022 - 16-May-2022
Location	MIRA, Watling Street, Leicestershire NGR : SP 36491 95566 LL : 52.5567120563806, -1.46318939275447 12 Fig : 436491,295566
Administrative Areas	Country : England County : Leicestershire District : Hinckley and Bosworth Parish : Higham on the Hill
Project Methodology	A temporary grid system was established over the site and marked out using canes. The location of the grid will be set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co-ordinates. Data will be collected using a cart carrying four paired Bartington magnetic sensors. Four sensors mounted 1m horizontally apart and very accurately aligned to nullify the effects of the earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. At the end of every data collection a zone of data was recollected as a control.
Project Results	The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. A couple of linear trends have been assigned to the category of uncertain; they are likely to be due to modern agricultural processes. A former field boundary is visible in the magnetic data long with a number of land drains. The routes of service pipes have also been marked.
Keywords	Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types Drainage System - 20TH CENTURY - FISH Thesaurus of Monument Types Pipeline - 20TH CENTURY - FISH Thesaurus of Monument Types
Funder	
HER	Leicestershire HER - unRev - STANDARD
Person Responsible for work	Thomas, Cockcroft
HER Identifiers	



- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL

**ZONE 4, MIRA TECHNOLOGY PARK
HINCKLEY, WARWICKSHIRE**

SOIL HANDLING AND RE-USE STRATEGY

Prepared on behalf of:

THE TERRA FIRMA CONSULTANCY

TOHA Document Ref: TOHA/14/2931/TW

Document Status: Issue 2

Issue Date: 19th July 2022

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TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

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Appendix 1 - Site location plan

Appendix 2 - Soil map

Appendix 3 - Soil Resource Survey

1. INTRODUCTION

1.1 Background

- 1.1.1 The MIRA Technology Park – Zone 4 development will include a variety of soft landscape types and parkland areas.
- 1.1.2 A large proportion of the site is currently used for agricultural production or pasture, with wooded boundaries and contains significant large reserves of topsoil and subsoil. As part of the development strategy, it is the intention to strip, store and re-use the majority of the site topsoil for the site soft landscape scheme. A portion of the topsoil may be sold for landscape construction off-site.

1.2 Reference Material

- 1.2.1 The following information has been reviewed as part of this *Soil Handling and Re-use Strategy*:
- *Tim O'Hare Associates – Soil Resource Survey report: MIRA Project, Hinckley, Warwickshire, Issue 1 (dated December 2010, referenced TOHA/10/2774/TW);*
 - *Hinckley and Bosworth Borough Council, Outline Planning Permission, Date of Application – 9th May 2011, Application No. 11/00360/OUT – Condition 30;*
 - *Geddes Architects, Horiba – Mira Ltd, Infrastructure – Indicative Masterplan. Ref: 21.017(P)120 D1;*
 - *The Terrafirma Consultancy MIRA Infrastructure 2022. Gatehouse – Landscape Proposals dwg No. 1238-TFC-I2-XX-DR-L-1001;*
 - *The Terrafirma Consultancy – MIRA Infrastructure 2022. Landscape Proposals - Linear Park 1238-TFC-I2-XX-DR-L-3001,*
 - *The Terrafirma Consultancy – MIRA Infrastructure 2022. Landscape Proposals – Gatehouse Arrival 1238-TFC-I2-XX-DR-L-3002,*
 - *The Terrafirma Consultancy – MIRA Infrastructure 2022. Landscape Proposals – NW Service Road 1238-TFC-I2-XX-DR-L-3003,*
 - *The Terrafirma Consultancy – MIRA Infrastructure 2022. Landscape Proposals Linear Park Pond 1238-TFC-I2-XX-DR-L-3004,*
 - *Diversity Environmental Consultants. MIRA Business Park. Landscape masterplan. Dwg no: d285/ Dated 08/08/13.*
 - *MK Surveys, MIRA Technology Park, Topographical Survey, project number: 19942, Dated July 2014 DRAFT;*
 - *Defra, Construction Code of Practice for the Sustainable use of Soils on Construction Sites September 2009;*
 - *Turley Associates Environmental Statement. MIRA Project Section 8. Agricultural Land;*
 - *Geotechnics Ground Investigation at MIRA LIF 1 Factual Report. Project Number PC145675 October 2014. DETS Certificate of Analysis Number 14-16995. Sample Number 707123 to 707126.*

1.3 Report Purpose and Limitations

1.3.1 The purpose of this *Soil Handling and Re-use Strategy* document is to set out the methodology for the correct procedures for topsoil recovery (stripping and storage), resspreading and amelioration as well as treatments for the subsoil. The aim is to ensure that the existing soil resource is protected and managed, and a suitable soil profile is produced in new landscape areas to promote successful plant establishment.

1.3.2 This document fulfills the requirements for a 'soil handling and re-use strategy' as set out in the *Hinckley and Bosworth Borough Council, Outline Planning Permission. Application No. 11/00360/OUT* (Condition 30), which states:

No development shall commence until a soil handling and re-use strategy has been submitted to and agreed in writing by the local planning authority. All existing site soils then be managed and re-used in accordance with this strategy at all times thereafter.

1.3.3 The soil handling and re-use strategy also meets the criteria for a 'Soil Resource Plan' as defined by the Defra *Construction Code of practice for the sustainable use of soils on construction sites* to supplement the site *Materials Management Plan* (MMP) and/or *Site Waste Management Plan* (SWMP).

1.3.4 This document has been developed in conjunction with the findings of the *Soil Resource Survey* (see Appendix 3) and the current landscape design proposals. As such, it is based on the available Landscape Concept and provides information on soil management requirements for this site and the emerging landscape proposals at this stage.

1.3.5 This document provides guidance for the earthworks operations and landscape construction works required for the current area of the Development Application site (red line area shown in Appendix 1 Site Location Plan). Soil management measures would also be relevant to the wider site area (blue line).

2. SITE SOIL RESOURCES

2.1 Topsoil Characteristics

- 2.1.1 The *Soil Resource Survey* for this site (TOHA Ref: *TOHA/10/2774/TW/Dec*) identified large volumes of topsoil distributed over the site.
- 2.1.2 The overall composition of the topsoils was generally consistent however the survey determined some variability in topsoil fertility status based on their phosphorus contents. The characteristics of the site topsoils are summarised below:
- slightly acid to slightly alkaline soil reaction;
 - non-saline;
 - slightly stony (rounded to subangular stones up to 60mm in diameter);
 - heavy clay loam to clay soil textures, with moderate-developed structures;
 - moderate levels of organic matter, nitrogen, potassium and magnesium;
 - variable phosphorus contents;
 - topsoil depths ranged from 210mm to 410mm, with an average of 320mm.
- 2.1.3 At present, the topsoils have adequate soil structures and these should be maintained for future landscape works.
- 2.1.4 Providing the physical condition of these topsoils is maintained through the earthworks phase, the topsoils should need only routine cultivations prior to re-use and would be considered suitable for many of the proposed planting types (see page 6).
- 2.1.5 The fertility status of the topsoils allows further categorisation of the topsoil resource as fertile (arable agricultural land – *Topsoil 1*) and infertile (grassland and pasture – *Topsoil 2*).
- 2.1.6 The overall fertility status of the topsoils would require amelioration with appropriate fertilisers and compost prior to tree and shrub planting and amenity grass seeding / turfing purposes.

2.2 Subsoil Characteristics

- 2.2.1 The subsoil was consistently found to be of a *clay* soil texture. The soakage potential of this soil will be restricted and the soil is likely to suffer from seasonal waterlogging, particularly after periods of prolonged or heavy rainfall. Any damage to the structure of this soil will further reduce its drainage properties.
- 2.2.2 All subsoils should be left in an uncompacted state. This will involve deep ripping all subsoil following topsoil spreading. Provided the subsoils are left with adequate soil structures, they should provide sufficient drainage from the topsoil for many of the proposed landscape purposes. The site subsoils will not provide adequate drainage for landscape types and plant species which demand or prefer free draining soils, including tree pits.
- 2.2.3 Further sampling of the site subsoil was carried out as part of the Geotechnics geotechnical ground investigation (Geotechnics Project Number PC145675). The testing confirmed the subsoil to be alkaline in reaction and containing low to moderate levels of organic matter and all major plant nutrients (*intermediate* fertility status in respect to the creation of species-rich habitats).

3. LANDSCAPE CONSTRUCTION

3.1 Development Proposals and Landscape Concept

3.1.1 Current proposals for this site include:

- Development plots;
- Internal Infrastructure works;
- Landscape enhancements to the gatehouse

3.1.2 To facilitate development proposals, the topsoil will be stripped from extensive parts of the site and stored in temporary stockpiles before re-use for landscape construction on-site or offsite.

3.1.3 From a review of the supplied *Geddes Architects, Infrastructure – Indicative Masterplan* and *The Terraforma Consultancy MIRA Infrastructure 2022. Gatehouse – Landscape Proposals*, the soft landscape elements of this project currently comprise the following landscape types:

- specimen trees;
- avenue trees in gatehouse;
- plantations;
- liner park;
- gatehouse flowering trees;
- plot 8-9 – *Quercus robur*;
- woodland vegetation (trees and shrubs);
- native hedgerow;
- planted mounds at gatehouse;
- shrub borders;
- ornamental grasses;
- amenity grass,
- species-rich flowering meadow;
- ecological ponds;
- aquatic planting.

3.1.4 The proposed landscape types will require a number of soil types (varying in terms of drainage characteristics and fertility status) in order to meet the soil demands of the current landscape concept.

3.2 Soil Suitability

3.2.1 It is assumed that wherever possible, the selected planting types and species will be suited to slightly acid to slightly alkaline, fertile soils and tolerant of heavy, moisture retentive soil (subject to seasonal waterlogging). The site/soils would not be suited to species that prefer or demand light-free draining planting conditions or infertile soils. All deficiencies will be addressed with appropriate applications of compost and/or fertiliser.

-
- 3.2.2 The most demanding of the proposed planting environments are semi-mature pit planted trees. Trees of this size and age have grown accustomed to optimum growing conditions in the nursery, and these need to be replicated when the rootballed or containerised tree is planted in the pit. In particular, aeration and drainage around the rootball to a depth of between 0.5m to 1.0m are critical. Without these properties, trees will very quickly suffer and possibly die during their first few growing seasons after planting. In this instance, the site topsoil and subsoil are not suitable for this purpose on account of their poor drainage and aeration performances and vulnerability to physical degradation once placed under the tree rootball. Imported sandy soils would be needed for planting semi-mature trees on this site, with appropriate soil improvement measures to reduce risk of waterlogging such as drainage installation and topsoil 'mounding' (see section 3.3 below).
- 3.2.3 Where trees are planted into hard landscape areas, the tree pit back fill has to meet two roles simultaneously: to act as a growing for the tree and to support the overlying hard surface. None of the site topsoil or subsoil is suitable for this purpose.
- 3.2.4 Containerised native structure shrubs are generally more tolerant of a wider range of soil-types, and they require less topsoil to root into than trees. Appropriate species selection will be essential to minimise the risk of poor establishment and die-back, as well as adequate soil preparation to maintain aeration and drainage within the rooting zone. Additional drainage/mounding may also be required, depending on local conditions.
- 3.2.5 Woodland and hedgerows are usually planted as small container grown specimens or as bare-root whips and transplants. These are typically less demanding, native planting types, for which a broad range of soil types are considered acceptable. Topsoil mounding may be desirable for certain species and locations.
- 3.2.6 The proposed species-rich wildflower grassland and marginal pond planting requires soil with a low fertility status (phosphorus in particular) in order to reduce competition from aggressive species, and to maximise floristic diversity of the habitat. Soils used for marginal pond planting within or in close proximity to water bodies should also be of a low fertility status to prevent nutrient leaching and eutrophication of the water. In this instance, *Topsoil 2* should be used for these purposes and *Topsoil 1* would be considered to be too fertile and therefore unsuitable for these habitats. The subsoil would also be suitable for these purposes following with amelioration with a light application of green compost to stimulate microbial activity.
- 3.2.7 The area of long meadowland grass is to be a 'low maintenance' type without particular soil requirements. The grassland is intended to develop a low level of floristic diversity and therefore soils with a wide range of fertility status would be considered acceptable.
- 3.2.8 The soil requirements of mown amenity grass may vary according to planned usage. As such, formal lawns which are anticipated to receive high rates of footfall (for example, office break out zones, picnic sites and event areas) require sandy soil with better performance in terms of aeration, drainage and compaction resistance. Amenity grass areas with low levels of use (for example, general parkland, roadside verges for instance) have much lower soil demands and a wider range of soil textures may be used.
-

3.3 Summary of Soil Suitability

3.3.1 The suitability of the site topsoils for the various proposed landscape environments is summarised below.

Soil Type	Topsoil 1 (Fertile)	Topsoil 2 (Infertile)	Subsoil (re-used as subsoil)	Subsoil (re-used as topsoil)
Semi-mature tree planting (soft landscape)	X	X	X	NA
Semi-mature tree planting (hard landscape)	X	X	X	NA
Tree planting 14/16 – 18/20cm girth / multistem trees	✓^	✓^	X	NA
Native structure shrubs	✓^	✓^	✓^	NA
Woodland and hedgerows	✓^	✓^	✓^	NA
Marginal planting	X	✓	✓	✓
Species-rich wildflower grassland	X	✓	✓	✓+
Mown amenity grass (low footfall)	✓	✓	✓	NA
Mown amenity grass (high footfall)	X	X	✓^	NA
(Unmown) long meadowland grass	✓	✓	✓	NA

- ✓ Suitable for this purpose provided the physical condition of the soil is adequate at seeding and planting and any nutrient deficiencies are remedied where necessary. Species selected must be tolerant of moisture retentive soils.
- ✓^ Suitable for this purpose provided the physical condition of the soil is adequate at planting / seeding and any organic matter and nutrient deficiencies are remedied. Species selected must be tolerant of moisture retentive soils. Topsoil may benefit from mounding for tree pits, shrub beds and native shrubs and hedgerows, to improve aeration and reduce risk of waterlogging. Additional drainage measures may be needed for amenity grass (high footfall) and tree pits, and shrub beds at certain locations.
- ✓+ Suitable for this purpose provided the physical condition of the soil is adequate at seeding and the soil is of a suitable low to intermediate fertility status. Species selected must be tolerant of moisture retentive soils. Amelioration with suitable compost at a low rate would be advisable.
- X Not suitable for this purpose due to inappropriate drainage characteristics or fertility status.

3.4 Soil Improvements

- 3.4.1 The poor drainage and aeration properties of these soils will restrict their re-use potential to hardy planting types only. There seem to be a number of options to improve the physical aspects of the soils in order to broaden their re-use potential, including:
- 3.4.2 Installation of artificial drainage. Drainage may be installed at key locations or specifically for particularly vulnerable planting types. The type, design and depth of the drainage should be suitable to the proposed application. Such drainage would require a suitable outfall / discharge point.
- 3.3.3 Localised mounding of topsoil. The topsoil may be mounded locally for vulnerable species. This effectively 'lifts' the plants, and reduces the risk of harm from waterlogging and improves aeration within the rooting zone.

3.5 Soil Volumes

- 3.5.1 At this stage it is not certain where topsoil will be stripped from as part of the development of this site. The total quantities of *Topsoil 1* and *Topsoil 2* present are shown below and have been calculated from the area of each topsoil type and the average topsoil depth recorded.

Topsoil Type	Area (m ²)	Average Topsoil Depth (m)	Estimated Topsoil Volume (m ³)
Topsoil 1 (High fertility)	356,735	0.33	117,722
Topsoil 2 (Low fertility)	69,529	0.30	20,859

4. IMPACTS ON SOIL QUALITY BY CONSTRUCTION ACTIVITY

4.1 Degradation of Soils

4.1.1 Soil is a vulnerable and non-renewable resource and therefore care must be taken throughout all handling, transporting and stockpiling activities to ensure that the soil resources of the site are protected and conserved. Findings from the *Soil Resource Survey* for this site indicate that the site soils (clay dominated with heavy soil textures) are particularly vulnerable to physical degradation during intensive soil handling operations such as stripping, storage and resspreading.

4.1.2 Heavy soils, such as these, are entirely reliant on their soil structures and natural porosity to allow Drainage and facilitate gaseous exchange with the atmosphere. Any damage to their structures would reduce their aeration and drainage characteristics and increase the risk of waterlogging and anaerobism (oxygen depletion).

4.2 The Potential Impacts of Soil Degradation

4.2.1 Many general construction activities have the potential to damage soils. These include: compacting soils through trafficking of plant or vehicles, mixing soil with construction materials such as cement or aggregate, or mixing different qualities of soil during handling and storage, including subsoil with topsoil.

4.2.2 Failure to protect soils during disturbance can lead to their degradation with consequential environmental impacts both on-site and off-site, such as:

- soil erosion;
- loss of soil organic matter; leading to loss of nutrients and a decline in soil fertility;
- soil compaction leading to loss of soil structure and permeability to water (waterlogging) and restricted aeration and rooting potential;
- loss of soil biological activity;
- poor re-establishment of vegetation;
- visual impact of slope failure or soil erosion (bare soil surfaces).

4.2.3 Measures are provided in this *Soil Handling and Re-use Strategy* to ensure, as far as is practicable, that soils on site will be stripped, handled and stored appropriately so that they can be re-used for landscape construction purposes.

5. SOIL MANAGEMENT STRATEGY

5.1 Outline

- 5.1.1 This section highlights the sequential treatments for the recovery, storage and re-use of the existing soil resources. These practices are based on the DEFRA *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites* (2009).

5.2 Pre-treatment of Existing Vegetation

- 5.2.1 It is good practice to reduce the quantity of vegetation entering the storage stockpiles in order to minimise the formation of anaerobic conditions during storage. As such, in advance of soil stripping the topsoil should be cleared of surface vegetation by a method suited to the vegetation type present.
- 5.2.2 All arable/grassland areas should be close mown (< 150mm) and the cuttings collected where necessary for removal to a suitable green-waste recycling facility.
- 5.2.3 Any trees/woodlands/hedges should be pre-treated before soil stripping, in two stages :
1. Each tree should be felled and removed from site, including all branches/brash;
 2. Tree stumps and associated large roots (> 20mm diameter) should be lifted using a suitable excavator fitted with a hydraulic grab.
 3. All woody materials (tree trunks, stumps, branches and brash, etc), including wood chippings, should be removed from site to a suitable green-waste material processing facility for recycling.
- 5.2.4 To minimise anaerobism during storage and preserve the quality of the topsoil as a growing medium, woody materials should not be incorporated with the soils during stripping. This includes any chippings left on the surface after clearance of woodland/hedgerows.

5.3 General Site Soil Handling

- 5.3.1 It is important to avoid soil physical degradation during all phases of soil handling (e.g. stripping, storage, respreading and planting). Soil handling operations should ideally be carried out when the soil is reasonably dry and non-plastic (friable) in consistency.
- 5.3.2 The soils (topsoil and subsoil) should not be unnecessarily compacted by trampling or trafficking by site machinery.
- 5.3.3 If, during the course of the earthworks, the soil is structurally damaged, it should be suitably cultivated to relieve the compaction and restore the structure prior to any planting, turfing or seeding.

5.4 Topsoil Stripping

- 5.4.1 The two topsoil types (*Topsoil 1* and *Topsoil 2* – see *Soil Map* in Appendix 2) should be stripped separately from one another and kept separate from the other soils or engineering arisings on the site.
- 5.4.2 The loose tip method, using dump trucks and hydraulic excavators, should be used to strip, transport and stockpile the topsoil.
- 5.4.3 The loose-tipping method involves the use of a tracked hydraulic excavator, fitted with a flat edged grading bucket to strip the topsoil and load it into a dump truck. Alternatively, a tracked dozer may be used to strip the soils.
- 5.4.4 The dump truck, running along a pre-designated route, then transports the topsoil to the desired stockpile location.
- 5.4.5 This operation should be monitored to ensure that the soil is recovered without the inclusion of other soils (subsoil) or wastes. Cross contamination with other soil could significantly degrade the quality of the topsoil.
- 5.4.6 Any large stones (>50mm), waste or non-topsoil materials or soil heaps should be removed from areas to be stripped prior to topsoil stripping.
- 5.4.7 Topsoil stripping and stockpiling should be carried out whilst the soil is reasonably dry and friable. However, if due to construction programme constraints topsoil stripping needs to be carried out whilst the topsoil is wet, an alternative method for topsoil *stockpiling* should be used (Section 5.8).

5.5 Depth of Topsoil Strip

- 5.5.1 The depth of strip should be set at **300mm** for all areas of *Topsoil 1* and *Topsoil 2*. This will enable the majority of the topsoil to be recovered without the inclusion of significant quantities of subsoil.
- 5.5.2 Based on the colour differences between the topsoil and subsoil the topsoil strip should be reviewed by the machine operator on a continuous basis to ensure that the topsoil recovery is efficient.

5.6 General Considerations for Topsoil Stockpiling

- 5.6.1 The topsoils should be stored temporarily prior to re-spreading into landscape areas when they become available. The two topsoil types (*Topsoil 1* and *Topsoil 2*) should be stored separately from one another and kept separate from the other soils/materials on the site (subsoils or engineering arisings).
- 5.6.2 The Contractor should determine a suitable location to store the topsoil (and subsoil). All soils should be stored in an area of the site where they shall not interfere with other site operations so that they can be left undisturbed during other construction activities.
- 5.6.3 The area that is to be used for storing soils should be cleared of vegetation, in-situ topsoil and any waste arising from the development e.g. building rubble and fill materials.

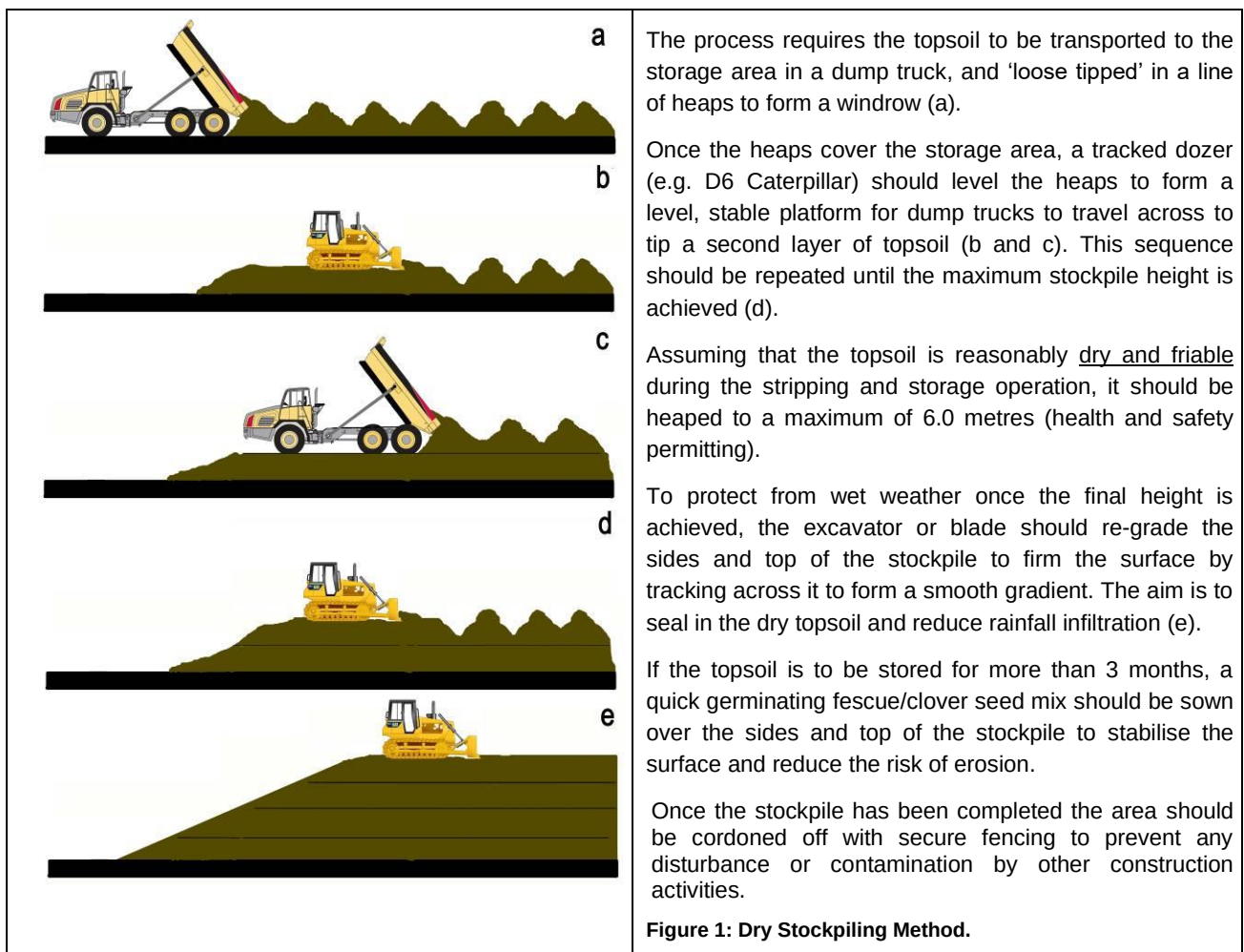
5.6.4 The topsoil should be transported to the storage area in a dump truck and should be 'loose tipped' in a series of heaps, starting at the furthest point and working back towards the storage area access.

5.6.5 There are two options for stockpiling the topsoil depending on the **moisture content** and **plasticity**. These are *dry soil stockpiling* and *wet soil stockpiling*. These methods are each considered and detailed below. **The Dry Soil Stockpiling is the preferred method and requires less time, space, work and cost to perform.**

5.7 Dry Soil Stockpiling

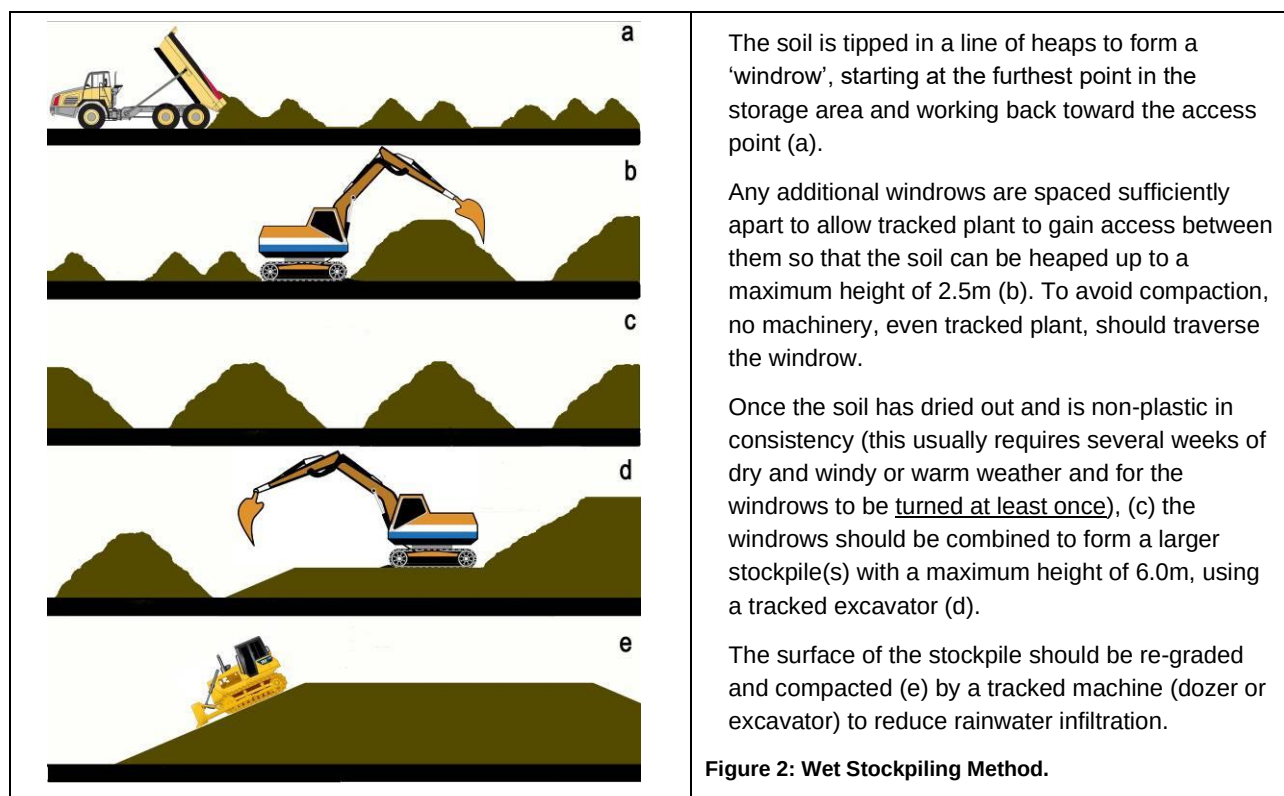
5.7.1 For dry/non-plastic soils the aim of the method is to create a large core of dry soil, and to restrict the amount of water that can get into the stockpile during the storage period.

5.7.2 The dry stockpiling method is illustrated below (*Figure 1*).



5.8 Wet Soil Stockpiling

5.8.1 The wet soil stockpiling method is illustrated below (*Figure 2*); whereby wet soils are tipped for temporary storage as windrows until the topsoil has dried out. This technique minimises the amount of compaction caused by stockpiling wet/plastic soil, as well as maximising the surface area of the stockpile to enable soil to dry out. The reconditioning operation should be timed during the summer months (May to September), to allow enough time for the topsoil to dry out effectively.



5.9 Grading Subsoil

- 5.9.1 Subsoil should be placed and graded in accordance with the Engineer's requirements. Grade to smooth flowing contours to achieve the desired formation levels and falls and the specified finished levels of topsoil.
- 5.9.2 Any large stones and other debris larger than 75mm brought to the surface during subsoil spreading should be stone picked or raked and removed. The stones should either be re-used on site or they should be removed off-site to a suitably licensed waste facility.

5.10 Subsoil Depths

5.10.1 Minimum required depths of subsoil following all earthworks (after settlement) should be:

Landscape Type	Subsoil Depth /mm	Soil Type
Semi-mature tree planting (soft landscape areas)	600	Imported Subsoil
Semi-mature tree planting (hard landscape)	400	Washed Sand
Native structure shrubs	400	Subsoil
Woodland and hedgerows	400	Subsoil
Marginal planting	150	Subsoil
Species-rich wildflower grassland	150	Subsoil
Mown amenity grass (low footfall)	150	Subsoil
Mown amenity grass (high footfall)	200	Subsoil
Long meadowland grass	150	Subsoil

5.11 Topsoil Respreading

5.11.1 Two weeks prior to topsoil respreading, the stockpile should be treated with a non-residual herbicide and green waste removed.

5.11.2 A hydraulic excavator fitted with a toothed-bucket should be used to load the topsoil from the stockpile into a dump truck.

5.11.3 The dump truck should transport the topsoil to the desired location and tip it in a line of heaps.

5.11.4 The topsoil should be spread by a second tracked excavator or tracked dozer working from the subsoil layer.

5.11.5 The topsoil should be spread in smooth flowing contours with falls for adequate drainage and removing any minor ridges or hollows.

5.12 Topsoil Depths

5.12.1 Topsoil depths (after settlement) should be:

Landscape Type	Topsoil Depth /mm	Soil Type
Semi-mature tree planting (soft landscape areas)	400	Imported Topsoil
Semi-mature tree planting (hard landscape)	600	Urban Tree Soil
Native structure shrubs	300	Topsoil 1 or Topsoil 2
Woodland and hedgerows	300	Topsoil 1 or Topsoil 2
Marginal pond planting	200	Topsoil 2 or Subsoil
Species-rich wildflower grassland	150	Topsoil 2 or Subsoil
Mown amenity grass (low footfall)	150	Topsoil 1 or Topsoil 2
Mown amenity grass (high footfall)	200	Imported Topsoil
Long meadowland grass	150	Topsoil 1 or Topsoil 2

5.12.2 If surplus topsoil needs to be re-used on site, the topsoil depths for mown amenity grass (low footfall) and long meadowland grass could be increased up to a maximum depth of 300mm.

5.12.3 For the establishment of species-rich wildflower grassland and marginal ponding planting, the aim is to provide a soil profile with suitable low fertility soil at the surface. Where *Topsoil 2* is unavailable, the soil conditions required for the species-rich wildflower grassland may be constructed by either of the following two options:

- Option 1. Spread 150mm suitable, low fertility *Subsoil* over the existing soil profile;
- Option 2. Strip back the existing *Topsoil 1* to expose the *Subsoil*.

5.12.4 For Option 1, once placed, the soil profile should be prepared in accordance with sections 5.13 to 5.14. The surface 150mm should be cultivated following the guidance given in section 5.15.

5.12.5 For Option 2, the surface 150mm should be cultivated following the guidance given in section 5.15.

5.12.6 For species-rich wildflower grassland seeding only (Option 1 and Option 2) for the subsoil should be ameliorated following section 5.17.2.

5.13 Decompaction of the Soil Profile

5.13.1 The subsoil and topsoil will have been compacted during their placement and profiling. The soil profile should be decompacted (ripped) to a minimum depth of 0.4 m (grassland / marginal areas and planting beds) or 0.6 m (tree planting and woodland areas) at 0.6 m centres to break up the compaction and to improve the interface between the soil layers.

5.14 Decompaction Equipment

5.14.1 On the larger areas a wing-tined subsoiler mounted on either a tracked dozer or large tractor should be used.



Plate 1 : Wing-tined subsoiler



Plate 2 : Tractor drawn subsoiler

5.14.2 A suitably-sized tracked excavator fitted with a single rigid tine should be used to loosen the soil profile in smaller inaccessible areas, such as field boundaries, corners of the site, steep slopes or adjacent to roads and pathways.



Plate 3: Tracked excavator with single rigid tine



Plate 4 : Single rigid tine in use

5.14.3 Rips should be preferably made at 90 degrees in 2 directions, and at 45 degrees to direction of slopes on mounds from the toe of the mound.

5.14.4 Repeated passes may be needed to break up the subsoil sufficiently. This should be largely dependent on the strength of the soil and its resistance to cultivation at the time of the operation.

5.15 Topsoil Cultivation

5.15.1 After respreading topsoil, any large, compacted lumps should be broken down using suitable tillage equipment (e.g. shakaerator, power harrow or set of discs) to break down larger clods and produce a fine tilth suitable for planting (<40mm), turfing and seeding (<10mm).



Plate 5: Example of power harrow

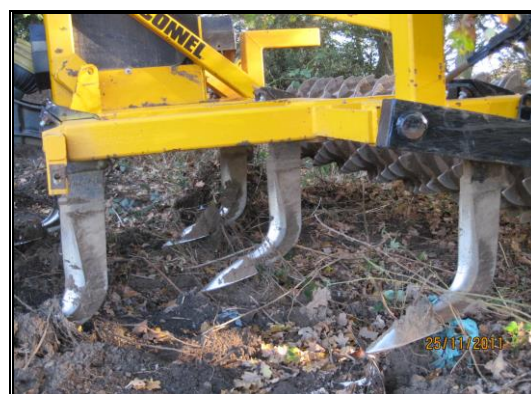


Plate 6 : Example of shakaerator

5.15.2 Small less accessible areas should be cultivated by hydraulic excavator fitted with a landscape rake attachment or similar and approved.



Plate 7: Example of landscape rake (1)



Plate 8 : Example of landscape rake (2)

- 5.15.3 Any undesirable material brought to the surface during this exercise should be removed by picking or raking. For example, stones, fill materials and coarse vegetation larger than 50mm in any dimension.

5.16 Fertiliser Application

- 5.16.1 Where **Topsoil 1** is used for ornamental shrub and native woodland shrub planting, and hedgerows, to address the nutrient deficiencies and to help promote effective plant establishment, the compound, slow release fertiliser *Everris Enmag CRF* (11%N:22%P₂O₅:9%K₂O:6%MgO) should be applied and incorporated at a rate of 50 g/m² and to a depth of 200mm. Where **Topsoil 2** is used for these purposes, the application rate should be 100 g/m².
- 5.16.2 Where **Topsoil 1** is used for mown amenity grass, to address the nutrient deficiencies the pre-seeding grass fertiliser *Everris Sportsmaster Pre-seeder* (8%N:12%P₂O₅:8%K₂O+3%MgO) should be applied prior to seeding or turfing at a rate of 35 g/m² and incorporated to a depth of 100mm. Where **Topsoil 2** is used for this purpose, the application rate should be 50 g/m².
- 5.16.2 No fertiliser application is required or desired for areas of species-rich wildflower grassland or for marginal planting.

5.17 Compost Application

- 5.17.1 Where **Topsoil 1** and **Topsoil 2** is used for ornamental shrub and native woodland shrub planting, and hedgerows a suitable compost (e.g. PAS100:2011 /Landscape Institute/WRAP grade (10mm screened) green compost) should be applied and incorporated into the upper 200mm of topsoil. The compost should be applied at a rate of **15 %**, which roughly equates to a layer 30mm thick.
- 5.17.2 Where **Subsoil** is used for species-rich wildflower grassland seeding, a suitable compost (e.g. PAS100:2011 /Landscape Institute/WRAP grade (10mm screened) green compost) should be applied and incorporated into the upper 100mm of subsoil. The compost should be applied at a rate of **10 %**, which roughly equates to a layer 10mm thick.
- 5.17.3 Compost incorporation should be done using suitable and approved tillage equipment. Organic matter should only be incorporated when the soils are dry and friable. This is to enable even incorporation and avoid encouraging the development of anaerobic conditions (oxygen depleted).

6. SITE SOIL MONITORING

6.1 Soil Scientist Site Monitoring

- 6.1.1 An appropriately experienced soil scientist should be appointed to oversee the implementation of the Soil Handling and Re-use Strategy.
- 6.1.2 A soil scientist should carry out site inspections and liaise with the landscape architect/ site engineer/ contractor during the earthworks and landscape phases.
- 6.1.3 A soil scientist should inspect the site during the following operations:
- Pre-treatment of existing vegetation;
 - Soil stripping and storage;
 - Topsoil placement and preparation;
 - Soil profile decompaction;
 - Soil cultivation (and amelioration);
 - Limited soil testing to confirm fertility status and horticultural properties;
 - Tree pit construction.
- 6.1.4 A short report should be produced after each site inspection to ensure that work is satisfactory and compliant with the soil handling and re-use strategy and specification. At the end of the contract, a completion report should be issued to confirm that a suitable soil quality has been achieved and that the soils are compliant with the specification and fit for the landscape scheme.

Tim White
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Senior Associate

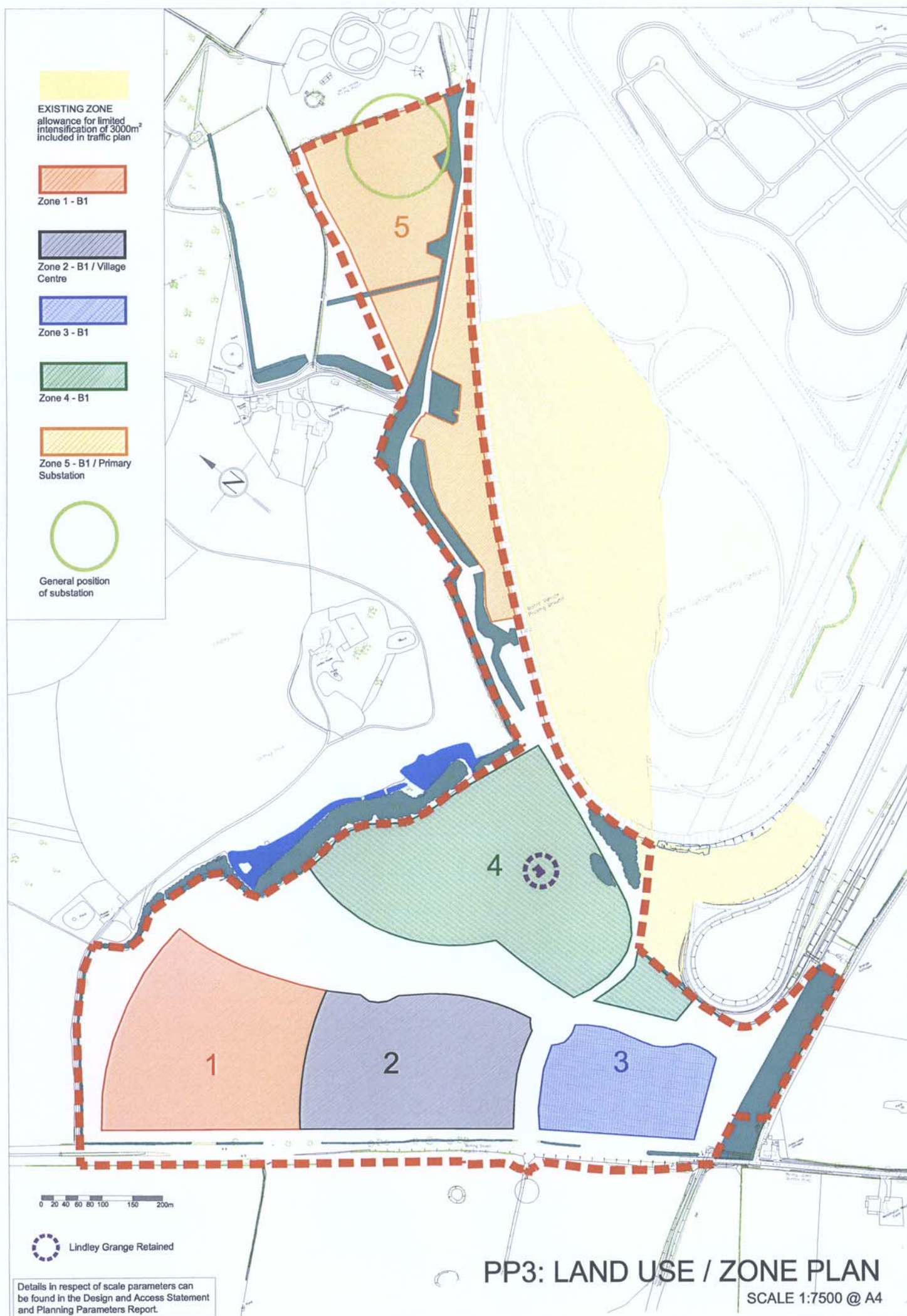
For & on behalf of Tim O'Hare Associates LLP

Report Qualifications

This Soil Handling and Re-use Strategy considers the re-use of the site won topsoil and subsoil for the soft landscape proposals at the Zone 4, MIRA Technology Park site. It will not therefore be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of our client The Terra Firma Consultancy. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this report is relied upon by a third party or is used in circumstances for which it was not originally intended.

Appendix 1

Site Location Plan

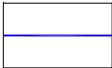
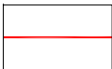


Appendix 2

Soil Map



LEGEND

-  MIRA ownership boundary
-  Development boundary
-  Topsoil 1 (Fertile)
356,735 m²
-  Topsoil 2 (Infertile)
69,529 m²



Revision	Date	Notes

Client	The terra firma Consultancy Ltd.
Site	MIRA Technology Park
Drawing Title	Soil Map
Job ref.	TOHA/14/2931/TW
Drawing No.	2931/2
Scale	1:7,500 @ A3
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Appendix 3

Soil Resource Survey

Landscape Report



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SOIL RESOURCE SURVEY

For the

**MIRA PROJECT
HINCKLEY, WARWICKSHIRE**

On behalf of

THE TERRA FIRMA CONSULTANCY

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Appendix 1 - Site Plans Showing Trial Hole Locations

Appendix 2 – Laboratory Analysis Results

EXECUTIVE SUMMARY

Tim O'Hare Associates LLP was commissioned by The Terra Firma Consultancy to undertake a soil resource survey at the Mira Ltd site near Hinckley, Warwickshire. A large portion of this site is to be developed, for which it is proposed to submit an outline planning application and carry out an Environmental Impact Assessment (EIA).

The existing site is largely under agricultural production or pasture with wooded boundaries and, as such, appears to have large reserves of topsoil and subsoil. There is currently no information available on the horticultural quality, variability and suitability of the soils for landscape purposes within a business park development.

The protection of soil as a natural resource is of increasing importance, driven by the requirements of European and national environmental impact legislation, the EU Soil Framework Directive, Defra's Soil Action Plan and the emerging Soil Strategy for England. These initiatives have prompted Defra to develop *The Code of Practice for the Sustainable Use of Soils on Construction Sites*. The Code of Practice indicates that Soil Resource Survey should be carried out to determine the nature and quality of site soil resources (topsoil and subsoil). The findings should be subsequently incorporated into a Soil Resource Plan for the site.

The site soil resources were consistent over four identified areas and may be described as slightly acid to slightly alkaline, heavy textured topsoils (*heavy clay loam* to *clay* soil texture classes), with low to moderate levels of fertility and low stone contents. The topsoil was an average of 320mm deep, overlying slightly acid *clay* subsoil.

The potential to re-use these soils for landscape purposes is restricted by their heavy soil texture and high clay content. Heavy textured soils, such as these, are particularly vulnerable to damage if handled when moist and plastic in consistency. Therefore soil moisture content during handling operations (soil stripping storage, resspreading and preparation for planting/seeding) will be a crucial factor in determining final soil quality. This should be taken into account when determining the earthworks programme and should target what are typically drier months (May/June to September/October) for these operations.

In their current condition, the soils are suitable for most of the proposed landscape types including shrub beds, woodland establishment, woodland coppice, amenity lawns (low foot traffic) and wildflower meadow seeding (topsoil from existing paddocks/grassed areas only). This is providing the physical condition of the soils is maintained and species tolerant of heavy, moisture retentive soils are selected.

The topsoil and subsoil is not suitable for backfilling tree pits, where imported free draining sandy soils would be required. Given the impaired soakage characteristics of the subsoils, it is likely that provision for land drainage or other improvement will need to be included in the design of tree pits and shrub beds so that they do not act as sumps for surface draining water.

1.0 INTRODUCTION

Tim O'Hare Associates LLP was commissioned by The Terra Firma Consultancy to undertake a soil resource survey at the Mira Ltd site near Hinckley, Warwickshire. Our authority to carry out the work is contained in an email instruction from The Terra Firma Consultancy dated 23rd November 2010.

1.1 Purpose

We understand that it is proposed to submit an outline planning application for the project and to carry out an Environmental Impact Assessment (EIA).

The existing site is largely under agricultural production or pasture with wooded boundaries and, as such, appears to have large reserves of topsoil and subsoil. However, there is currently no information available on the horticultural quality, variability and suitability of the soils for landscape purposes within a business park development.

The protection of soil as a natural resource is of increasing importance, driven by the requirements of European and national environmental impact legislation, the EU Soil Framework Directive, Defra's Soil Action Plan and the emerging Soil Strategy for England. These initiatives have prompted Defra to develop *The Code of Practice for the Sustainable Use of Soils on Construction Sites*. The aim of the Code of Practice is to give the construction sector (including planners and designers) guidance on the ways in which damage and loss of soils should be minimised and managed on construction sites. The Code recommends the preparation of two documents:

- Soil Resource Survey – to determine the location, composition and overall quality of on-site soil resources (topsoil and subsoil).
- Soil Resource Plan – showing the areas and type of topsoil and subsoil to be stripped, haul route, the methods to be used, and the location, type and management of each soil stockpile.

This Soil Resource Survey is intended to form part of the planning submission and to assist the EIA. It should also guide on-going design and cost analysis by providing information on the existing site soil resources and their potential for re-use within the new landscape scheme.

With reference to the *Project Trinity Masterplan* document, a significant portion of the development will be soft landscaped with a range of landscape types, including specimen trees, formal shrub planting, amenity grass, wildflower meadows and coppice woodland.

1.2 Actions

Tim O'Hare Associates LLP has evaluated the quality and suitability of the soils by assessing a number of key chemical and physical soil properties, through on-site investigation and laboratory analysis.

This report issues the findings of the soil investigation, including our site observations and soil descriptions, results and interpretation of all analyses, discussion on soil quality and implications for soil management on this site.

2.0 REFERENCE MATERIAL

We have reviewed the published geological and soil survey data for this site.

Geology

The British Geological Society (BGS) categorises the geology of the site under the following classifications for bedrock geology and superficial geology:

Bedrock Geology - Mercia Mudstone Group	Triassic rocks (undifferentiated) mudstone, siltstone and sandstone
Lithological Description	Dominantly red, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite widespread; sandstones are also present.
Definition of Lower Boundary	Gradational on Sherwood Sandstone Group, taken where mudstone and siltstone become dominant over sandstone.
Definition of Upper Boundary	Overlain sharply by Penarth Group (incoming of marine lithologies).
Thickness	1350m+
Geographical Limits	British Isles.
Parent Unit	NEW RED SANDSTONE SUPERGROUP
Superficial deposits - Diamicton	Poorly-sorted sediment with wide particle size range. Composition not defined.

Soils

The Soil Map of England and Wales (1:250,000 scale) classifies the soils as:

Major Group	<i>Brown soils</i>
Group	<i>Argillic brown earths</i>
Subgroup	<i>Stagnogleyic argillic brown earths</i>

Brown soils are widespread and are mostly in agricultural use. *Argillic brown earths* are loamy or loamy over clayey soils with a subsurface horizon showing significant clay enrichment.

Further definition places the site within an area of the *WHIMPLE 3* Soil Association, which is described as 'Reddish fine loamy and silty soils with slowly permeable subsoils and seasonal waterlogging.'

3.0 SITE INVESTIGATION

3.1 Site Visit

We visited the site on the 9th and 10th December 2010 during a period of freezing and bright weather. The site was located to the north east of Hinckley in Warwickshire and was accessed from the A5.

3.2 The Site

Four distinct areas were identified for the survey, comprising:

Area 1 – agricultural land adjacent to the A5. This area is irregular in shape and divided into 2 no. plots. The area slopes downwards from west to east (total fall is around 10m) and at the time of our visit, had been sown with a winter cereal crop.

Area 2 – soft landscape adjacent to Track 1. This area is long and thin (tapering at both ends) running north to south along the west edge of Track 1. The majority of this area is roughly level, with a series of landscape bunds located on its west boundary. A mown grass sward was present over much of this area, whilst the tops of the bunds were vegetated with established trees and scrub.

Area 3 – agricultural land and paddocks, north of Lindley. This roughly square area is divided into agricultural fields and number of horse paddocks, bounded by fences. This area was generally level and had been sown with a winter cereal (fields) or was vegetated with a short grass sward (paddocks).

Area 4 – grass pasture, north west of Lindley. This area is irregular in shape and is divided into a number of unequal sized fields. The area was roughly level and vegetated with a grass sward.



Plate 1 : Area 1 – agricultural land adjacent to A5



Plate 2 : Area 2 Soft landscape next to Track 1

3.3 Soil Conditions

We examined the soils by constructing a total of 43 no. hand-dug trial holes (TH) at representative locations within the survey areas to a maximum depth of 1200mm where possible. The locations of our trial holes are indicated on site plans in Appendix 1.

At each trial hole, the soils were examined with reference to the Soil Survey Field Handbook. Important physical soil characteristics were recorded, including texture, structure, compaction, waterlogging, anaerobism, topsoil depths and the presence of deleterious materials. At the same time, representative soil samples were taken for laboratory analysis.

Soil Descriptions

The soil profiles were generally consistent between locations, comprising reasonably undisturbed topsoil over subsoil and were typically described as:

Topsoil GL – 210/410mm Average depth : 320mm	Brown to dark reddish brown (Munsell Colour 7.5YR 4/2 to 7.5YR 3/2) moist to wet, plastic HEAVY CLAY LOAM to CLAY, with a moderately developed, granular and blocky structure. Slightly stony with occasional rounded to subangular stones (up to 60mm). No observable deleterious materials. Rusty root mottles were frequently observed at the topsoil/subsoil interface.
Subsoil 210/410mm – 1200mm	Brown to yellowish red to reddish brown (Munsell Colour 7.5YR 4/2 to 5YR 5/6 to 2.5YR 4/4) moist, plastic CLAY with a moderately developed, granular and blocky structure to poorly developed columnar structure becoming massive (structureless). Stoneless to virtually stone-free and no observable deleterious materials. Manganese concretions and prominent reddish grey mottles were frequently observed within the subsoil.



Plate 3 : Area 1 – Occasional stones at surface



Plate 4 : Area 1 - Typical soil profile (TH1)



Plate 5 : Area 2 Typical soil profile (TH30)



Plate 6 : Subsoil

3.4 Topsoil Depths

The following topsoil depths (mm) were recorded during our survey

TH1	290	TH16	310	TH31	310
TH2	320	TH17	270	TH32	260
TH3	380	TH18	360	TH33	410
TH4	240	TH19	290	TH34	220
TH5	310	TH20	360	TH35	390
TH6	270	TH21	330	TH36	210
TH7	350	TH22	320	TH37	310
TH8	360	TH23	320	TH38	290
TH9	250	TH24	320	TH39	340
TH10	330	TH25	380	TH40	330
TH11	310	TH26	340	TH41	290
TH12	340	TH27	360	TH42	310
TH13	350	TH28	340	TH43	330
TH14	340	TH29	370		
TH15	320	TH30	290		
<u>Average Topsoil depth : 320mm</u>					

4.0 LABORATORY ANALYSIS

4.1 Analytical Schedule

A total of 7 no. representative samples of topsoil and subsoil were submitted to the laboratory for analysis.

The samples were analysed in accordance with the following schedule:

- particle size analysis and stone content;
- pH and electrical conductivity values;
- major plant nutrients - N, P, K, Mg (Topsoil only);
- organic matter content.

The results are presented on the Certificates of Analyses in Appendix 2 and our interpretation of the results is given below.

4.2 Results of Analysis – Topsoils

Particle Size Analysis and Stone Content

The topsoil samples fell into the *heavy clay loam* to *clay* texture classes, and are described as heavy in texture. Such soils usually have good water and nutrient retention capacities, but they are slow-draining and can suffer from seasonal waterlogging following periods of prolonged or heavy rainfall. They are also prone to structural degradation and compaction during handling, and especially when plastic in consistency. Given the high clay content of these topsoils, they will tend to form strong structures when dry that may be difficult to break down by mechanical cultivation.

The soils would be only suitable for less-demanding planting types, including shrubs, whips and native transplants (including most species normally used for woodland coppice) and amenity grass, provided the structural condition of the soil is satisfactory and provided only plant species tolerant of moisture retentive, heavy soils are selected.

These soil texture classes are not suitable for species or landscape types which demand free-draining conditions, including tree pits, where a lighter, sandy soil would be required.

If it is desired to plant non-robust species, it would be essential that the topsoil is in its optimum physical condition at planting. However, these species are unlikely to achieve their maximum growth potential if planted into heavy soil such as this and are likely to be more prone to damage from environmental factors such as frost.

The structural condition of all the topsoils is currently moderate, and would need to be maintained by careful handling and management to ensure they are fit for planting/seeding. In particular, stripping the *Topsoil* in its current *plastic* state would cause severe damage to the soil structure.

The samples were virtually stone-free to slightly stony and stone content should therefore not restrict the use of these soils for landscape purposes.

pH and Electrical Conductivity

The samples were slightly acid to slightly alkaline in reaction (pH 6.3 – 7.2) with a pH range that would be ideal for general landscape purposes.

The electrical conductivity (salinity) values were all low, indicating that soluble salts were not present at levels that would be harmful to plants.

Organic Matter and Nutrient Status

The topsoil samples contained moderate levels of organic matter and total nitrogen, with high levels of extractable magnesium. All of the samples were deficient in extractable potassium. Samples from Area 2, Area 3 (Paddock area) and Area 4 were all deficient in extractable phosphorus. Both samples from Area 1 contained moderately high levels of extractable phosphorus.

For planting and amenity grass establishment, the deficiencies will need to be remedied by appropriate applications of compost or fertiliser.

The topsoils within Area 2, Area 3 (Paddock area) and Area 4 are considered to be *infertile* in relation to species-rich grassland establishment (wildflower meadows). As such, the fertility status of these soils is suitable for this purpose and should help to encourage floristic diversity over time.

The topsoil within Area 1 is considered to be *fertile* in relation to species-rich grassland establishment, where a low fertility soil is needed, particularly in relation to levels of phosphorus. Infertile soil is required to prevent domination of the sward by grasses and aggressive weeds such broad-leaved dock (*Rumex obtusifolius*) and stinging nettle (*Urtica dioica*).

4.3 Results of Analysis – Subsoils

Particle Size Analysis and Stone Content

The samples of *Subsoil* all fell into the *clay* texture class and, as such, are heavy in texture. These soils are typically slow-draining and often suffer from seasonal waterlogging following periods of prolonged or heavy rainfall. They are also prone to structural degradation and compaction during handling, and especially when plastic in consistency. As such, they are restricted in terms of their potential for re-use for landscape purposes.

The site subsoils would be suitable for less-demanding planting, including whips and transplants, shrub planting, amenity grass seeding and species-rich grassland establishment, provided the structural condition of the soil is satisfactory and provided species tolerant of water retentive soils are selected. The site subsoils are unsuitable for plant species or landscape environments that require or prefer light or free-draining soils. Furthermore, there is likely to be a need for additional subsoil drainage to promote a healthy rooting environment, particularly in tree pits and any ornamental planting beds.

The subsoil samples were virtually stone-free and so stones will not constitute a limitation for the proposed landscape scheme.

pH and Electrical Conductivity

The samples were slightly alkaline in reaction (pH 7.2 – 7.4) with a pH range that is suitable for a wide range of plant species.

The electrical conductivity (salinity) values were all low, indicating that soluble salts were not present at levels that would be harmful to plants.

Organic Matter Content

The subsoil samples were found to contain low levels of organic matter.

5.0 DISCUSSION

It is proposed to expand the site of Mira Ltd into the agricultural land adjacent to the A5 at the south of the site (Area 1). It is envisaged that the required site preparation work will strip, temporarily store and re-use topsoil from these fields for soft landscape purposes. At this stage, the emerging landscape scheme is to include a number of planting types and landscape environments including:

- Specimen trees
- Formal shrub planting
- Coppice woodland
- Wildflower meadows
- Amenity grass

There is currently little detailed information on the quality, variability and suitability of the site soils, so the purpose of the investigation was to assess the existing soil conditions, and advise on their potential for re-use.

5.1 Summary of Findings

From our investigation, the site contained significant reserves of topsoil and underlying subsoil. As such, the site soils were found to be reasonably consistent in nature, comprising a *heavy clay loam* to *clay* topsoil, overlying *clay* subsoil.

The visual examination and subsequent laboratory analysis confirmed that the composition of the site topsoils were largely consistent and, as such, can be described as slightly acid to slightly alkaline, non-saline, slightly stony *heavy clay loams* to *clays*, with low to moderate fertility levels.

From our site observations, the current *physical condition* of the topsoil was considered to be adequate. However, examination of the soil profile found signs of restricted drainage and aeration.

The site subsoils can generally be described as slightly alkaline, stone-free, CLAYS, with moderate to poor soil structures.

5.2 Re-use of the Site Soils

The following section considered the potential to re-use the site soils for landscape purposes.

Topsoils

The *Topsoils* all contained moderately high to high clay contents and for a significant proportion of the year, these soils will be vulnerable to compaction caused by soil handling. In their current condition these soils would be described as *imperfectly drained* and may be expected to be seasonally waterlogged for approximately 3 months of the year. Once disturbed and respread, the damage caused to these soils would further reduce their drainage characteristics, making them 'Poorly Drained to Very Poorly Drained', depending on their final physical condition. As such, once disturbed, these soils may remain waterlogged for up to 6 months of the year.

Based on our findings, the topsoils have potential for re-use for most of the proposed planting environments, provided their physical condition is adequate at planting or seeding and plants tolerant of heavy, moisture retentive soils are selected. For shrub planting, woodland establishment, woodland coppice and amenity grass areas, the deficiencies in major plant nutrients should be remedied by appropriate applications of fertiliser and/or compost.

The topsoil found at Area 2, Area 3 (paddocks) and Area 4 appears to have the greatest potential for species rich grassland establishment on account of their *infertile* fertility status. The topsoils within Area 1 and Area 3 (agricultural fields) are *fertile* and have a low potential for this purpose.

The topsoils are not suitable for areas of amenity grass which would receive high levels of foot traffic, on account of their vulnerability to compaction and waterlogging.

Subsoils

The subsoils across the site were heavy in texture and, as such, will demonstrate restricted drainage characteristics, particularly if left in a compacted condition. This will therefore present their own limitations with respect to landscaping the site as tree pits could act as sumps for surface and subsurface draining water.

The subsoils have potential for re-use as subsoil for most of the proposed planting environments, including shrub planting, woodland establishment, woodland coppice, amenity grass areas and species-rich grassland establishment. To reduce periods of waterlogging, it will be important that the subsoils are cultivated using appropriate tillage equipment to break up any panning (compaction) before planting/seeding.

Given the impaired soakage characteristics of the subsoils, it is likely that provision for drainage or other improvement will need to be included in the design of tree pits and shrub beds so that they do not act as sumps for surface draining water. The level of modification required would depend on the level of soakage achieved during soil preparations.

In addition, the subsoils will be prone to self-compaction if placed below the weight of a tree root ball and so are not considered suitable for use as backfill in tree pits. We recommend that an appropriate free-draining sand or sandy subsoil is used to backfill the lower portion of all tree pits.

5.3 Soil Structure & Physical Degradation

It is essential to provide a structured, uncompacted topsoil for the successful establishment and subsequent growth of plants and grass. Adequate soil structure is a key element for healthy plant growth to ensure aeration and drainage within the rootzone. If the site's development programme requires the soils to be disturbed by activities such as excavation, storage and resspreading, soil structure can easily be destroyed by compaction. Any damage to soil structure will reduce the drainage rate of this topsoil.

Almost all soils are physically degraded during intensive handling and the potential quality and the ultimate suitability of the topsoil for re-use will depend on how well its soil structure is preserved during the earthworks phase. These heavy topsoils will be particularly prone to structural damage if handled and moved when wet. In this situation, the larger (air containing) soil pores are destroyed and replaced by smaller (water retentive) pores. This will restrict gaseous exchange with the atmosphere and cause the topsoil to become anaerobic (oxygen depleted). In addition, the lack of larger pores prevents effective drainage and results in an increased risk of waterlogging.

Waterlogged and anaerobic conditions, if they persist, can be severely detrimental to plants in two main ways. Firstly, aerobic bacteria are replaced by anaerobic bacteria that produce ammonia and methane gases which are harmful to plants. Secondly, without oxygen plant roots are unable to take up water and nutrients.

5.4 Topsoil Handling & Programming

Despite the inevitable degradation caused by stockpiling, provided the topsoils are stripped, stored and resspread correctly and cultivated to break up any compacted lumps, these topsoils should return to a healthy, aerobic state in a matter of days.

If the site topsoils are to be re-used successfully, structural degradation must be kept to a minimum. In order to achieve this, it is best practice for topsoil to only be handled when it is dry and non-plastic in consistency. The most appropriate time to carry out the topsoil strip will therefore be during the summer months (May/June to September/October), and then only when the topsoil is dry. If the topsoil is dry when it goes into the temporary stockpile, it can be kept dry until it is resspread.

If the development's programme requires the topsoil to be stripped and stockpiled when wet, it is inevitable that significant damage is likely to occur to the structure of the topsoil. This damage will be potentially irreparable (particularly in the short to medium term), and planning the programme of earthworks should therefore be carefully considered by the project team at the earliest stage.

Even if the topsoil is stripped when wet, it may still be possible to repair the damage provided there is sufficient time and dry weather. It will therefore be essential that the *Topsoil Respreading Phase* take place during a summer season, to allow enough time for the soil to dry out effectively and be thoroughly cultivated before soil cultivation and planting/seeding takes place in autumn (grass seeding) and winter (planting).

If the project's programme results in topsoil having to be stripped and stockpiled when wet, and then respread for planting/seeding in the wetter/colder, winter or following spring months, there is unlikely to be any opportunity to recondition and prepare the topsoil to address the structural degradation caused by the stripping/stockpiling process. Planting into such adverse conditions is likely to result in poor establishment rates of both planting stock and grass.

5.5 Soil Quality

The best scenario for re-using this topsoil would be to strip and stockpile it dry, as it will then be dry when it is to be re-used. When dry, the soil will be relatively easy to spread and cultivate, and should re-aerate rapidly. If the soil is stockpiled when wet, the soil will suffer from physical degradation that will have to be repaired before further work is carried out. This remediation work will be difficult to achieve in the short term, requiring favourable weather conditions and possibly a series of cultivations.

5.6 Vegetation Removal

Before the topsoil is stripped, it is important to take action to minimise the amount of organic material that is incorporated with the topsoil and, this will involve removing as much of the existing vegetation as is practical.

6.0 RECOMMENDATIONS

In accordance with the *Code of Practice for the Sustainable Use of Soils on Construction Sites*, we recommend that the information from this Soil Resource Survey is used to prepare a Soil Resource Plan to inform best practice in the management and protection of the site soil resources. This document should identify opportunities and constraints of re-using the existing soils within the new development, with consideration for the proposed range of landscape types (street trees, planting beds, grass lawns, wildflower meadows, native woodland establishment, woodland coppice).

The Soil Resource Plan should also cover the following topics:

1. Maps showing topsoil and subsoil types and the areas to be stripped and left in-situ.
2. Methods for stripping and stockpiling soils.
3. Location of soil stockpiles and content.
4. Schedules of volumes for each material.
5. Methods for respreading soils.
6. Soil treatment techniques to ensure a well structured, uncompacted rooting zone is provided for future landscape construction.
7. Soil amelioration measures including options to improve the quality of the soils by adding fertiliser, compost or sand etc.

We would like to thank The Terra Firma Consultancy and Mira Ltd for entrusting our practice with this commission. We trust this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if we can be of further assistance.

Tim White
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Senior Associate

For and on behalf of Tim O'Hare Associates LLP

Report Qualifications

Our interpretation of the soil conditions is based on observations made during our site investigation and the results of laboratory tests. This report presents our site observations and test results and our interpretation of those observations and results. On any site there may be variations in soil conditions between these exploratory positions. We can therefore not accept any responsibility for soil conditions that have not been exposed by this investigation.

This investigation considers the re-use of the soils for landscaping. It should not therefore be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of our client The Terra Firma Consultancy. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this report is relied upon by a third party or is used in circumstances for which it was not originally intended.

Appendix 1

Site Plans Showing Trial Hole Locations