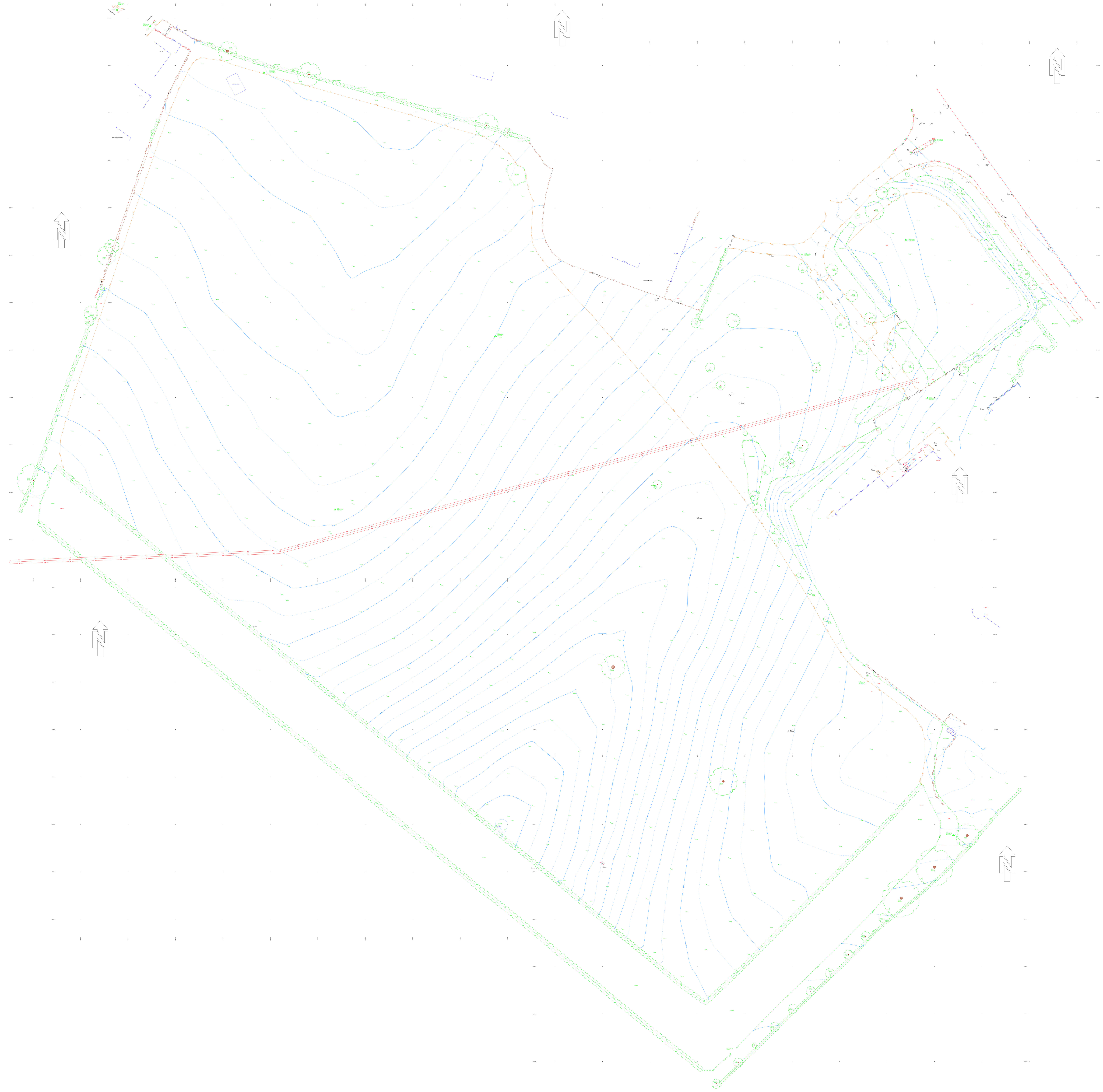
APPENDIX B
TOPOGRAPHICAL SURVEY



Notes:

© This drawing and the building works depicted are the copyright of RPS and may not be reproduced or amended except by written permission. No liability will be accepted for amendments made by other persons.

The Contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts. The Contractor is to comply in all respects with current Building Legislation, British Standard Specifications, Building Regulations, Construction (Design & Management) Regulations, Party Wall Act, etc. whether or not specifically stated on this drawing. This drawing must be read with and checked against any structural, geotechnical or other specialist documentation provided.

This drawing is not intended to show details of foundations, ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor. A suitable method of foundation should be provided allowing for existing ground conditions. Any suspect or fluid ground, contaminates on or within the ground, should be further investigated by a suitable expert. Any earthwork constructions shown indicate typical slopes for guidance only & should be further investigated by a suitable expert.

Where existing trees are to be retained they should be subject to a full Arboricultural inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services. A suitable method of foundation is to be provided to accommodate the proposed tree planting.

Sketch proposals are for illustrative purposes only & as such are subject to detailed site investigation including ground conditions/contaminants, drainage, design & planning/density negotiations. Sketch proposals may be based upon enlargements of OS sheets & visual estimations of existing site features, accuracy will therefore need to be verified by survey. Sketch proposals have not been considered in respect of CDM Regulations.

Survey carried out to client specification and in accordance with RICS publication:
SURVEYS OF LAND , BUILDING & UTILITY SERVICES AT SCALES 1:500 & LARGER, 3rd EDITION.

Utility Services Location Note:

This survey has been carried out using a combination of observation and detection using electrolocation and ground probing radar equipment. Connections between reference points such as manholes are assumed to be straight unless bends are indicated. The accuracy is limited to the tolerances normally expected from the equipment used.

The following indications of completeness and accuracy are for guidance only:

In areas where there is a large concentration of services, the completeness will be between 80% and 90%. This will be reduced where there are obstructions at ground level.

Positional accuracy will vary with depth and pipe / duct material; an accuracy of +/- 150 mm is achievable in normal circumstances but this will be reduced for plastic pipes.

Existing information from historical plans is likely to be unreliable and is shown for guidance only.

Excavations in the area should be carried out with care and in accordance with HSG 47. No absolute guarantee of accuracy should be inferred from these plans.

The following text is an extract from Surveys of Land, Buildings and Utility Surveys at scales of 1:500 and Larger, 3rd Edition

"Electronic tracing is a reliable, method of locating buried services. ***On Heavy, built up sites 85% completeness is probably all that can be expected.*** *Plan accuracies of +/- 150mm may be achieved but this figure will depend on the depth of the service below ground level.* ***Where similar services run in close proximity, separation may be impossible. Successful tracing of non-metallic pipes may be limited.*** *Existing record information showing underground services is often incomplete and of doubtful accuracy. It should be regarded only as an indication and cannot be guaranteed"*

STANDARD ABBREVIATIONS

AV	AIR VALVE	FP	FLAG POLE	RL	RIDGE LEVEL
AR	ASSUMED ROUTE	G	GULLY	RMP	RESERVOIR MONITORING POINT
BB	BELISHA BEACON	GIP	GAS INLET POINT	RP	REFLECTOR POST
BdL	BED LEVEL	GP	GUIDE POST	RS	ROAD SIGN
BH	BOREHOLE	Grl	GRILLE COVER	RSP	RAILWAY SIGNAL POST
Bol	BOLLARD	GV	GAS VALVE COVER	RW	RETAINING WALL
BP	BOUNDARY POST	Hrl	HAND RAIL	RWP	RAINWATER PIPE
B Pvg	BLOCK PAVING	IC	INSPECTION COVER	Sap	SAPLING
BRck	BICYCLE RACK	IL	INVERT LEVEL	SB	SIGN BOARD
BS	BUS STOP	I/R	IRON RAILING FENCE	Shlt	SHELTER
BT	BRITISH TELECOM COVER	KO	KERB OUTLET	SL	SOFFIT LEVEL
BW	BRICK WALL	Lby	LIFEBUOY	Slt	SILT LEVEL
BWF	BARBED WIRE FENCE	Lck	LOCK GATE	SP	SIGN POST
Cat	CATENARY LEVEL	Ldr	LADDER	SPt	SAMPLING POINT
CATV	CABLE TV COVER	LOR	LOSS OF REFLECTION	SS	STRUCTURE SUPPORT
CB	CONTROL BOX	LOS	LOSS OF SIGNAL	ST	STOP TAP
C/B	CLOSE BOARDED FENCE	LP	LAMP POST	Sti	STILE
Cgd	CATTLE GRID	Mcy	MACHINERY	STP	STAND PIPE
CI	CAST IRON	MH	MANHOLE	StPo	STAY POST
CIP	CABLE INLET POINT	MgP	MOORING POST	Stu	STUMP
CL	COVER LEVEL	Mkr	MARKER POST	StW	STAY WIRE
C/L	CHAIN LINK FENCE	MS	MILESTONE	SV	STOP VALVE
Conc	CONCRETE	MU	ELECTRIC MOTOR	S/W	STONE WALL
CP	CATCHPIT	NP	NAME PLATE	Tac	TACTILE PAVING
CpL	COPING LEVEL	OSA	OFF SURVEY AREA	TBM	TEMPORARY BENCH MARK
Cpsn	CAPSTAN	OSBM	ORDNANCE SURVEY BENCH MARK	TCB	TELEPHONE CALL BOX
Cul	CULVERT	OGC	OVERGROUND CONDUIT	ThL	THRESHOLD LEVEL
CW	CONCRETE WALL	OHca	OVERHEAD CABLE UNIDENTIFIED	TEL	TELECOM COVER
DI	DUCTILE IRON	OHC	OVERHEAD CONDUIT	TL	TRAFFIC SIGNAL POLE
(dilap)	DILAPIDATED	OHE	OVERHEAD ELECTRIC	TM	TICKET MACHINE
(dis)	DISUSED	OHG	OVERHEAD GANTRY	TP	TELEGRAPH POLE
DPC	DAMP PROOF COURSE	OHStruct	OVERHEAD STRUCTURE	Tr	TROUGH
DSW	DRY STONE WALL	OHT	OVERHEAD TELECOM	UTL	UNABLE TO LOCATE
EIC	ELECTRICITY COVER	P	POST	UTR	UNABLE TO RAISE
EL	EAVES LEVEL	Pcg	PEDESTRIAN CROSSING	UTS	UNABLE TO SURVEY
EOT	END OF TRACE	P/F	PANEL FENCE	UTT	UNABLE TO TRACE
EP	ELECTRICTY POLE	PP	PETROL PUMP	VC	VITRIFIED CLAY
ER	EARTH ROD	P/R	POST & RAIL FENCE	VDP	VEHICLE DETECTION PAD
ESP	ELECTRICITY SUPPLY POINT	Psk	PENSTOCK	VP	VENT PIPE
ESW	ELECTRICITY SWITCH BOX	PV	VERTICAL PIPE	VW	VALVE WHEEL
FB	FOOTBRIDGE	Pyl	PYLON	WM	WATER METER COVER
FFL	FINISHED FLOOR LEVEL	PZ	PIEZOMETER	W/M	WIRE MESH FENCE
FH	FIRE HYDRANT	RE	RODDING EYE	WO	WASH OUT COVER
		RG	RAIN GAUGE	WSR	WATER LEVEL SENSOR

Utility Lines:

	SURVEY EXTENTS	D=1.00m	DEPTH INFORMATION
BT	BRITISH TELECOM	HW	HOT WATER
BT(r)	TAKEN FROM RECORDS	HW(r)	TAKEN FROM RECORDS
CTV	CATV CABLE	O/F	OPTIC FIBRE
CTV(r)	TAKEN FROM RECORDS	O/F(r)	TAKEN FROM RECORDS
CTV	CCTV CABLE	OIL	OIL PIPELINE
CTV(r)	TAKEN FROM RECORDS	OIL(r)	TAKEN FROM RECORDS
CW	COMBINED WATER	PWR	POWER FEATURE
CW(r)	TAKEN FROM RECORDS	SW	SURFACE WATER
DUC	EMPTY DUCT	SW(r)	TAKEN FROM RECORDS
DUC(r)	TAKEN FROM RECORDS	T	TELECOMMUNICATION CABLE
EA	EARTHING FEATURE	T(r)	TAKEN FROM RECORDS
EA(r)	TAKEN FROM RECORDS	TLM	TELEMETRY CABLE
E	ELECTRIC CABLE	TRA	TRAFFIC SIGNALS
E(r)	TAKEN FROM RECORDS	TRA(r)	TAKEN FROM RECORDS
FL	FUEL LINE	UK	UNKNOWN SERVICE
FL(r)	TAKEN FROM RECORDS	UK(r)	TAKEN FROM RECORDS
FW	FOUL WATER	VNT	VENT
FW(r)	TAKEN FROM RECORDS	VNT(r)	TAKEN FROM RECORDS
GAS	GAS	W	WATER
GAS(r)	TAKEN FROM RECORDS	W(r)	TAKEN FROM RECORDS
GPR	GPR FEATURE	11kV	11KV HV ELECTRIC
GPR(r)	TAKEN FROM RECORDS	11kV(r)	TAKEN FROM RECORDS
Helium	HELIUM FEATURE	PHOTO	PHOTO POSITION
Helium(r)	TAKEN FROM RECORDS	VIDEO START/END	VIDEO START/END
	SUB SURFACE ANOMALY		
REF:GPR02	REFERENCE TO GPR DATA IN REPORT		

Grid:
Local Grid
Deirived from NG GPS Observations to OS Active Network (OSTN02)

Datum:
Ordnance Datum
By GPS Observations to the to the OS Active Network (OSGM02) Stn1 =116.083m

Revision:	Amendments:	Date:	Name:
-	-	-	-
-	-	-	-
-	-	-	-
A	ORIGINAL ISSUE	April '14	JGC

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THE SURVEY ASSOCIATION AFFILIATE MEMBER

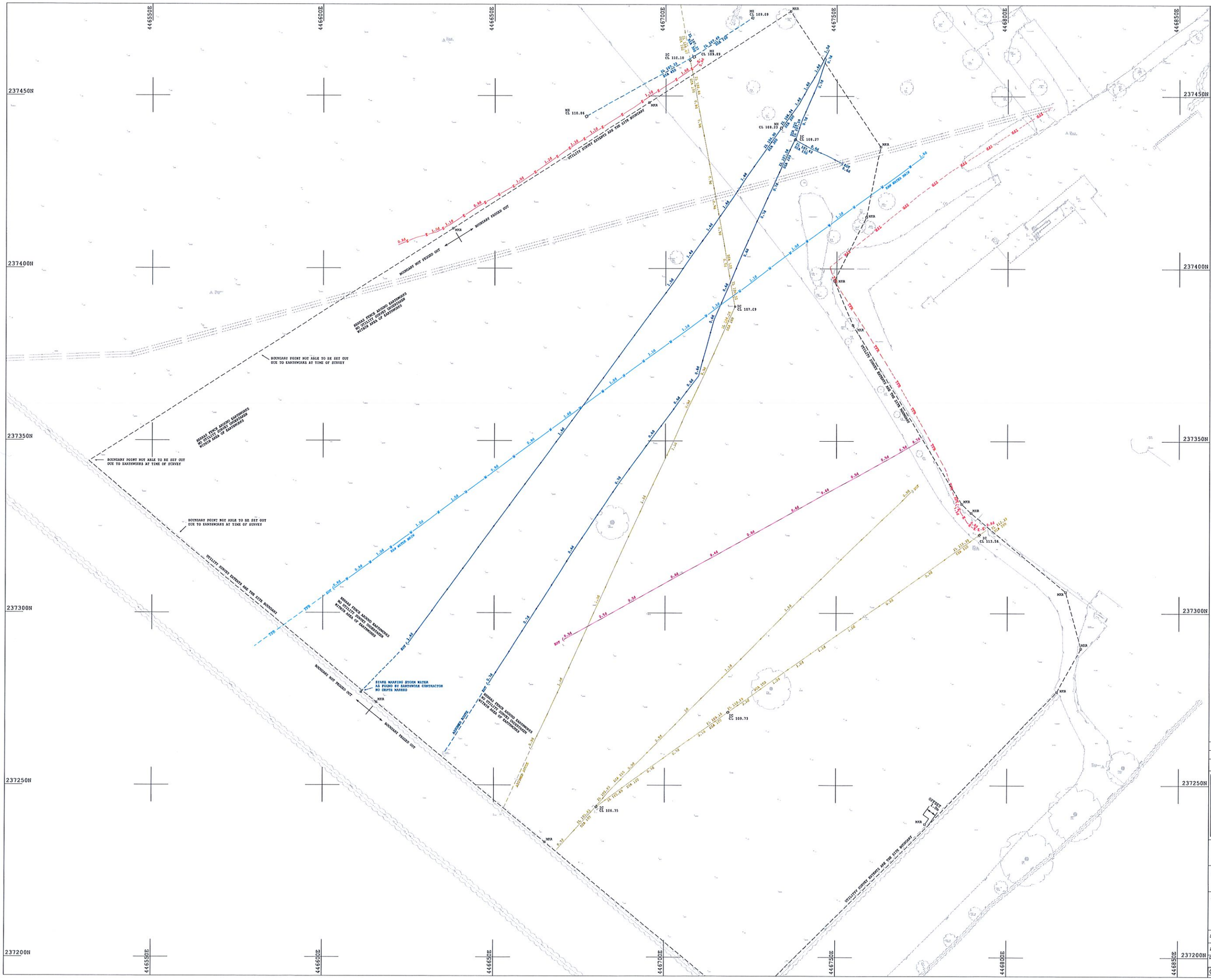
CLIENT:
RPS Planning & Development
(Abingdon)

PROJECT:
Cotefield Farm Phase II
Bodicote
Nr, Banbury

TITLE:
Topographical
Survey

Drawn:	JGC	Checked:	SP
Date:	April 2014	Scale:	1:600 @ A0
Drg No:	UAG3091_A_2D	Sheet:	1

ASSET & INFRASTRUCTURE MAPPING



KEY (Where Applicable)

UTLITIES AND SERVICES

NB - DASHED LINES ON UTILS INDICATE TAKEN FROM RECORD

A	UNDERGROUND ABANDONED SERVICE
TV	UNDERGROUND CABLE TELEVISION
C	UNDERGROUND COMMS CABLES
D	UNDERGROUND DUCTING
E	UNDERGROUND ELECTRICITY
FO	UNDERGROUND FIBRE OPTIC CABLE
FS	UNDERGROUND FUEL SUPPLY
G	UNDERGROUND GAS
AG	ABOVE GROUND GAS
	UNDERGROUND COMBINED WATER
	UNDERGROUND FOUL WATER
	UNDERGROUND SURFACE WATER
T	UNDERGROUND TELECOMS
S	UNDERGROUND TRAFFIC SIGNALS
	TRENCH SCAR
U	UNDERGROUND UNIDENTIFIED SIGNAL
W	UNDERGROUND WATER SUPPLY
AW	ABOVE GROUND WATER SUPPLY
	OVERHEAD ELECTRIC WIRES
	OVERHEAD TELEGRAPH CABLES
EOT	END OF TRACE
TFR	ROUTE TAKEN FROM RECORDS OR ASSUMED. (DASHED LINE WITH APPROPRIATE STYLE)
d	REQUESTED SURVEY AREA DEPTH. NB: SEE ACCURACY STATEMENTS AND ASSOCIATED REPORT.
	SITE BOUNDARY (LINE BETWEEN MARKER PEGS)

DISCLAIMER

DEPTH ESTIMATIONS, WHERE QUOTED, SHOULD BE TAKEN AS APPROXIMATE, DUE TO THE VARYING METHODS OF DETECTION USED MEASURING TO DIFFERENT POINTS ON THE SERVICE. GENERALLY DEPTHS SHOWN ALONG DRAINS AND SEWERS ARE TO THE INVERT LEVELS OF THE RELEVANT PIPE. ELECTROMAGNETIC DETECTION METHODS ESTIMATE THE DEPTH TO THE CENTRE OF THE SERVICE AND ALLOWANCE SHOULD BE MADE FOR THE TOP OF LARGE DIAMETER SERVICES BEING SHALLOWER THAN THE ESTIMATED DEPTH. GROUND PENETRATING RADAR DEPTH ESTIMATIONS ARE TAKEN TO THE TOP OF THE DETECTED SERVICE.
IT SHOULD BE NOTED THAT THE PLAN POSITION OF A DETECTED SERVICE IS, AS A GENERAL RULE, GOOD TO +/- 10% OF ITS ESTIMATED DEPTH. WHERE SERVICES HAVE NOT BEEN ABLE TO BE DETECTED FROM ONSITE SEARCHES, THEN A COMBINATION OF INFORMATION TAKEN FROM RECORD DRAWINGS, RELEVANT SURFACE DETAILS AND TRENCH SCARS HAS BEEN USED WHILST EVERY EFFORT HAS BEEN MADE TO LOCATE ALL SERVICES THE COMPLETENESS OF ANY UTILITY SURVEY CANNOT BE GUARANTEED AND SAFE EXCAVATING PROCEDURES SHOULD BE EMPLOYED IRREGARDLESS OF THE INFORMATION SHOWN ON THIS DRAWING.

REPORT

ALWAYS REFER TO THE REPORT THAT ACCOMPANIES THIS DRAWING.

NOTES

DATUMS

ALL LEVELS RELATED TO PREVIOUS CONTROL.
COORDINATES RELATED TO PREVIOUS CONTROL.
DATA PRESENTED ON A LOCAL PLANE GRID.
DATUMS DETERMINED BY OTHERS.

No	INFORMATION	By	Date	Chkd

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CLIENT: RIDDINGS MIDLANDS LTD

LOCATION: LAND OFF OXFORD ROAD, BODICOTE, BANBURY

DRAWING TITLE: UTILTIY SURVEY & BOUNDARY SURVEY

SCALE: 1:500	SHEET SIZE: A1
DATE: 30.11.2017	DRAWING No: 17/065_01 REV
DRAWN BY: ED / CHECKED BY: AH	

APPENDIX C
EXTRACTS FROM THE GROUND INVESTIGATION

Executive Summary and Conceptual Site Model

SITE INFORMATION AND SETTING	
Report Purpose	Phase 2 interpretative ground investigation and risk assessment.
Client	Crest Nicholson
Site Name and Location	Bodicote, Banbury, Oxfordshire.
Proposed Development	A development of 96 residential houses with associated infrastructure and gardens.
PHASE 2 – GROUND INVESTIGATION	
Hydrock Site Works	The Hydrock ground investigation comprised: • 18 trial pits to a maximum depth of 3.2m bgl; • 4 infiltration tests; • chemical testing of soils and leachates and geotechnical testing of soils;
Ground Conditions Encountered (All Data)	Marlstone Rock Formation – to >3.2 bgl , comprising brown gravelly clays with limestone beds. Dryham Formation – >3.2m bgl , blue grey silty clays.
Groundwater Encountered (All Data)	Groundwater was encountered at between 1.6m bgl and 3.0m bgl during the investigation.
GEO-ENVIRONMENTAL ASSESSMENT AND CONCLUSIONS	
Conclusions of Contamination Generic Risk Assessment	**Human health:** Pervasive arsenic. **Plant growth:** There are no chemicals of potential concern to plant life. **Ground gases or vapours:** Negligible risk from ground gases **Radon:** The site is in a Radon Affected Area (>10% of existing homes affected). **Water supply pipes:** Greenfield site with no significant contaminants of concern and standard pipework is envisaged. However, confirmation should be sought from the water supply company at the earliest opportunity.
Proposed Mitigation Measures	Full radon protective measures are necessary according to current guidance.

GEOTECHNICAL CONCLUSIONS	
Obstructions	Limestone beds are present within the ground at varying depths.
Groundworks and Earthworks	Excavation to proposed founding depth generally should be readily achievable with standard excavation plant. Heavy duty excavation plant/breaking equipment may be required to excavate the Limestone beds. Water seepages into excavations are likely to be adequately controlled by sump pumping.
Foundations	Strip/trench fill foundations from 0.90 m bgl, subject to the presence of existing trees within medium volume change potential soils. Piled foundations may be required where tree influence makes foundation depths greater than 2.50m. Allowable net bearing pressure of 100 kN/m^2 should be available, keeping total and differential settlement within acceptable limits. Deepening of foundations/heave protection is likely to be required to allow for the effects of trees.
Ground Floor Slabs	Suspended because of depth of presence of medium shrinkage potential clay soils. Suspended over a void where within the influencing distance of trees.
Road Pavement Design (CBR)	it is considered likely an equilibrium CBR of over 2.5% will be achievable over most of the site which can be used for preliminary design purposes, subject to in situ testing during construction.
Soakaways	Soakaway drainage is considered unsuitable for this site.
Buried Concrete	Design Sulfate Class - DS-1 and ACEC Class AC-1. Equivalent to Design Chemical Class DC-1 for a 50 year design life.
FUTURE CONSIDERATIONS	
Uncertainties and Limitations	There is insufficient gas monitoring to fully characterise the site in accordance with CIRIA Report665.
Further Work	The following further works will be required: • further investigation with boreholes and trial pits, together with further laboratory testing and monitoring to provide further information on the issues outlined in this report, particularly the extend and depth of the Head Deposits in the base and sides of the on-site valley feature; • discussions with piling contractors regarding their method for designing and emplacing piles; • discussions with service providers regarding the materials suitable for pipework etc.; • discussions with regulatory bodies regarding the conclusions of this report; • foundation depth in relation to trees assessment, following a tree survey to BS 5837:2012; and • detailed design of foundations.

This Executive Summary forms part of Hydrock Consultants Limited report number R/05995/001 (Issue 1) and should not be used as a separate document.

4.0 GROUND INVESTIGATION RECORDS AND DATA

4.1 Physical Ground Conditions

4.1.1 Summary of Strata Encountered

The following sections present a summary of the ground and groundwater conditions encountered and their properties, based on field observations, interpretation of the field data and laboratory test results, taking into account, excavation and sampling methods, transport, handling and specimen preparation.

All relevant data from the Hydrock investigation detailed in Section 3.0 as well as any suitable previous investigations mentioned in Section 1.4 are used from this point forward.

For the purposes of property designation, soils are divided into fine soils (clays and silts) and coarse soils (sands, gravels, cobbles and boulders) in accordance with BS 5930:2015.

Soil plasticity class for fine soils is based on the classification system of BS 5930:2015, adopting modified plasticity index values (based on percentage passing 425 µm sieve). Volume change potential of fine soils on change of moisture content has been assessed using guidance provided in NHBC Standards/BRE Digest 240 - Part 1.

The ground conditions proven during the current investigation are in general accordance with the published geological literature and expectations from the desk study and previous investigation works. However, a stratum derived from Head or solifluction deposits (flow of soil down a slope) was identified and is identified on the exploratory hole logs in Appendix C.

Details of the strata are described in the logs in Appendix C; a summary is presented in Table 4.1 and the individual strata are described in the sections below. Relevant geological cross sections are presented in Appendix A.

Table 4.1: Strata Encountered

Stratum	Summary Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)
Topsoil	Soft dark brown sandy gravelly clay and clayey gravelly sand with rootlets.	0	0.20 - 0.35	0.20 – 0.35
Head Deposits (southwest area of site on lower slopes)	Stiff greenish grey mottled orange silty sandy gravelly clay	0.30	>1.80 - >2.70	>1.50 - >2.40
	Orange brown clayey gravelly sand			
	Soft blue grey / purple gravelly clay / silt			
Marlstone Rock Formation	Firm to stiff orange brown to greenish grey silty sandy gravelly CLAY, with fine to coarse angular to rounded gravel of limestone and ironstone.	0.20 - 0.30	0.70 - >3.10	0.50 - >2.80
	Orange brown clayey silty gravelly sand with limestone and ironstone gravel.			
	Moderately strong fractured grey brown limestone			
Dyrham Formation	Stiff blue grey silty CLAY, weathered to firm orange brown clay near the upper surface.	0.60 – 2.60	>2.00 > 3.20	>0.20 - >1.60

Head Deposits, derived from solifluction deposits, were identified in exploratory holes SA104, TP201 and TP202. It is likely that they are present along the lower parts of the slope and the base of the valley feature. Where Head Deposits were encountered, their thickness was not fully proven but as they are generally in the lower parts of the site they are likely to be mostly underlain by the Dyrham Formation.

The level of the boundary between the Marlstone Rock and the underlying Dyrham Formation away from the area potentially affected by cambering and solifluction is between 105.4mOD and 107.2mOD, with an average of approximately 106mOD. Possible cambering in the lower parts of the site may result in the boundary occurring at a slightly lower level.

4.1.2 Topsoil

For the purposes of this report, topsoil is defined in accordance with BS5930: 2015 as the upper layer of an *in situ* soil profile, usually darker in colour and more fertile than the subsoil layer below and which is a product of natural chemical, physical, biological and environmental processes. The topsoil identified in the logs does not imply compliance with BS 3882:2015. Subsoil has not been identified as a separate layer.

4.1.3 Possible Made Ground

Based on local anecdotal information, Made Ground may be present across the eastern corner of the site, although it was not identified in any of the exploratory holes.

4.1.4 Head Deposits

Head Deposits were identified in TP 201, TP202 and SA104. They were encountered in the lower parts of the valley feature in the southwestern part of the site.

The Head Deposits are formed by the down-slope migration of soils from higher up the slope and hence they are of variable composition and formed of disturbed mixtures of the cohesive and granular source materials. Their classification properties are considered to be similar to those described in the following sections, but in TP201 a layer of soft clay was noted between 1.50m and 1.60m depth, resulting from softening caused by water in the sand materials above and below the clay.

In SA104 a single hand shear vane reading of 75kPa was obtained indicating medium strength.

One plasticity index test on Head Deposits showed a plastic limit of 20%, liquid limit 33%, 93% passing the 425um sieve and a modified plasticity of 12% with a natural moisture content of 26%, showing it to be of medium plasticity and of low volume change potential.

However, the materials are inherently variable and its geotechnical properties are likely to vary.

4.1.5 Marlstone Rock Formation

'Marlstone Rock Formation' was encountered underlying the topsoil in the topographically higher parts of the site. This generally consisted of brown sandy gravelly clays with limestone and ironstone gravel and beds of ferruginous limestone.

Natural moisture contents in the fine units of these materials range from 20% to 41%, and modified plasticity indices range from 12% to 29%. On this basis, these soils are classified as of low to high plasticity (CL-CH soils) and of low to medium volume change potential.

Undrained shear strength parameters of the cohesive units of the Marlstone Rock Formation materials based on seven *in situ* hand vane tests undertaken on samples recovered from trial pits recorded values between 76kPa and 103kPa indicating high strength.

4.1.6 'Dyrham Formation'

'Dyrham Formation' strata were encountered underlying the Marlstone Rock Formation. This generally consisted of stiff blue grey silty clay.

Natural moisture contents in the fine units of these materials range from 21% to 29%, and the plasticity index in one sample was 22%. On this basis, these soils are classified as of intermediate plasticity (CI) and of medium volume change potential.

Based on comparison of the plasticity indices with the moisture content, the clays in the Dyrham Formation are stiff to very stiff and a characteristic value of its shear strength is considered to be 75kPa.

4.2 Obstructions

Four of the trial pits encountered obstructions during excavation in the Marlstone Rock Formation as summarised in Table 4.2.

Table 4.2: Obstructions Encountered During Hydrock Investigations

Exploratory Hole	Depth (m)	Description	Stratum
SA101	2.00	Limestone bed.	Marlstone Rock Formation
TP203	1.80	Limestone bed.	Marlstone Rock Formation
TP204	1.00	Limestone bed.	Marlstone Rock Formation
TP205	2.60	Limestone bed.	Marlstone Rock Formation

4.2.1 Sulfate Content

In accordance with BRE (Special Digest 1), the Design Sulfate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification derived from laboratory tests undertaken are presented in Table 4.3. The assessment summary sheet is presented in Appendix D.

Table 4.3: Aggressive Chemical Environment Concrete Classification

Stratum	No. Tests	DS	ACEC
Marlstone Rock Formation	6	DS-1	AC-1

4.3 Groundwater

4.3.1 Groundwater Levels

Groundwater strikes encountered during the investigation are summarised in Table 4.5.

Table 4.2: Groundwater Data

Stratum	Exploratory Hole	Fieldwork
		Depth Groundwater Encountered (m bgl)
Marlstone rock	TP206	1.60
	TP212	3.00
	SA103	2.00

Where groundwater was not encountered, the groundwater level can be assumed to be deeper than the base of the trial pits. On this basis, the depth to groundwater where not encountered in the trial pits varies between >0.70m and >3.20m below existing ground level.

4.3.2 Infiltration Tests

The results of the infiltration testing undertaken are summarised in Table 4.5. The results sheets are presented in Appendix D. All testing was carried out in accordance with Hydrock's 1-day assessment methodology. This is in general accordance with BRE Digest 365 (BRE 2007) where infiltration rates allow three test runs during a working day (or where there is no infiltration), but where low infiltration rates were encountered the available time may not have been sufficient to fully comply with the BRE test method.

Where less than three tests were possible in a particular location the results provided should be considered indicative only and should not be used for design purposes. Further discussion concerning the suitability of infiltration testing at the site is provided in Section 7.7.

Table 4.5: Infiltration Test Results – Marlstone Rock Formation

Stratum	Trial Pit no.	Depth	Infiltration Rate (m/s)		
			Test 1	Test 2	Test 3
Limestone	SA101	2.0	Drainage too fast to measure	Drainage too fast to measure	Drainage too fast to measure
Clay	SA102	2.4	Too slow to measure	-	-
Clay	SA103	2.0	Too slow to measure	-	-
Clay	SA104	2.1	Too slow to measure	-	-

These results indicate fast infiltration into the limestone beds where these occur as the outflow from the pit was greater than the inflow that could be gained from a water bowser. The clay horizons in the Marlstone Rock Formation are effectively impermeable for soakaway purposes.

4.4 Geo-Environmental Results

The chemical test results for soil, leachate and groundwater are given in Appendix F, which also includes summary tables of the data.

Concentrations of the following determinands in soils were reported as below the laboratory limits of detection:

- Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene, Cadmium (aqua regia extractable), Chromium (hexavalent); and Selenium (aqua regia extractable).

4.5 Updated Ground Model

The preliminary conceptual site model initially developed from the desk study and walk-over survey (Section 2.0) has been confirmed using the findings of the ground investigation.

APPENDIX D
FOUL & SURFACE DRAINAGE STRATEGY LAYOUT

KEY:

Extent of development covered by current planning application.

Adjacent Development Phase

NOTES:

The foul & surface water design has been based on the approved principles outlined within the Flood Risk Assessment & Drainage Strategy undertaken by Forge Engineering Design Solutions.

Foul Water:
The foul water flows from each property will drain via gravity through the private house drainage before out–falling to a new sewer located typically within the development road network. All foul flow from the development gravitates in a southerly direction to a new foul outfall sewer constructed as part of the adjacent Cala Homes Development.

The development foul drainage network will be offered to Thames Water for adoption under a Section 104 agreement of the Water Industry Act 1991.

Surface Water:
The surface water drainage strategy sets of general principles for the designs. The sub strata is unsuitable for infiltration type SUDs and will therefore require a more traditional approach.

Due to the steepness of the development roads and drives permeable type paving is unsuitable. The surface water flows from each property will drain via gravity through the private house drainage before out–falling to a new storm drain located typically within the development road network. The development storm drainage discharges to an attenuation tank located towards the southern end of the site within the open space. Storage cells to be placed below POS avoiding LEAP and to be an off line design. Detail design to be subject to Thames Water approval.

The controlled surface water discharge from the development will outfall to a new surface water outfall sewer constructed as part of the adjacent Cala Homes Development.

The following SUDs techniques are proposed for the development site and form part of the drainage treatment train.

- Piped storm drainage with associated deep trapped gullies and catchpits
- Cellular attenuation (1 in 100 + 40% climate change)
- Flow control
- Downstream defender

The final surface water runoff from the development will be strictly controlled via the above Sustainable Drainage Systems. The runoff rate is at the equivalent agreed Greenfield runoff rate and be designed to manage the 1 in 100 year return storm plus an extra allowance of 40% for the potential predicted increase in peak rainfall up to 2115.

KEY:

Proposed Adoptable Sewers:

Foul sewer

Storm sewer

Road Gully
(no distinction between private or adopted at this time)

Storm Attenuation
(see plan for details)

Proposed Private Drainage:

Foul drain

Storm drain

Diversionary Works to Existing:

RAW Water Main
(subject to Thames Water approval)

Private Storm

Highway DN300

DN300 HIGHWAY

DN150 SWS

RAW MAIN

CELLULAR STORM ATTENUATION TANK 61.6m² PLAN AREA AT 2.2m DEEP

ROUTE OF RAW WATER MAIN DIVERSION T.B.C.

TERMINATION OF EXISTING SEWER DIVERSION T.B.C.

DOWNSTREAM DEFENDER

HYDROBRAKE MANHOLE LIMITING DISCHARGE TO 12 LITRES/PER SECOND

STORM & FOUL OUTFALLS IN ACCORDANCE WITH CALA HOMES'S SECTION 104 PROPOSALS

SECTION 104 - NOT APPROVED
SECTION 38 - NOT APPROVED

PRELIMINARY - FOR PLANNING

REV. No.	DATE	DESCRIPTION	INITIALS
J	20.07.18	Revised in accordance with current planning layout.	AJW
H	**.**.**	Interim design issue.	JRV
G	12.06.18	Revised in accordance with current planning layout.	JRV
F	12.06.18	Revised in accordance with current planning layout Rev. Z.	JRV
E	25.05.18	Additional RAW diversion details proposed. Drainage layout updated.	AJW
D	09.05.18	Storm water system remodeled to remove from LEAP/LAP extents, in accordance with Planning comment.	AJW
C	24.04.18	Revised in accordance with current planning layout.	AJW
B	02.04.18	Revised in accordance with current planning layout.	AJW
A	23.01.18	Revised in accordance with current planning layout (extents and layout).	AJW

Client: CREST NICHOLSON

Project: Bodicote, Banbury

Title: Proposed Drainage Strategy Plan (Phase 1)

MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS
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Scale: 1:500 @A1
Date: Nov' 2017
Drawing No.: 5692:P70
Rev: J
Checked: KTG
Drawn: AJW

KEY:

Extent of development covered by current planning application.

Adjacent Development Phase

NOTES:

The foul & surface water design has been based on the approved principles outlined within the Flood Risk Assessment & Drainage Strategy undertaken by Forge Engineering Design Solutions.

Foul Water:
The foul water flows from each property will drain via gravity through the private house drainage before out–falling to a new sewer located typically within the development road network. All foul flow from the development gravitates in a southerly direction to a new foul outfall sewer constructed as part of the adjacent Cala Homes Development.

The development foul drainage network will be offered to Thames Water for adoption under a Section 104 agreement of the Water Industry Act 1991.

Surface Water:
The surface water drainage strategy sets of general principles for the designs. The sub strata is unsuitable for infiltration type SUDs and will therefore require a more traditional approach.

Due to the steepness of the development roads and drives permeable type paving is unsuitable. The surface water flows from each property will drain via gravity through the private house drainage before out–falling to a new storm drain located typically within the development road network. The development storm drainage discharges to an attenuation tank located towards the southern end of the site within the open space. Storage cells to be placed below POS avoiding LEAP and to be an off line design. Detail design to be subject to Thames Water approval.

The controlled surface water discharge from the development will outfall to a new surface water outfall sewer constructed as part of the adjacent Cala Homes Development.

The following SUDs techniques are proposed for the development site and form part of the drainage treatment train.

- Piped storm drainage with associated deep trapped gullies and catchpits
- Cellular attenuation (1 in 100 + 40% climate change)
- Flow control
- Downstream defender

The final surface water runoff from the development will be strictly controlled via the above Sustainable Drainage Systems. The runoff rate is at the equivalent agreed Greenfield runoff rate and be designed to manage the 1 in 100 year return storm plus an extra allowance of 40% for the potential predicted increase in peak rainfall up to 2115.

KEY:

Proposed Adoptable Sewers:

Foul sewer

Storm sewer

Road Gully
(no distinction between private or adopted at this time)

Storm Attenuation
(see plan for details)

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Foul drain

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RAW MAIN

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ROUTE OF RAW WATER MAIN DIVERSION T.B.C.

TERMINATION OF EXISTING SEWER DIVERSION T.B.C.

DOWNSTREAM DEFENDER

HYDROBRAKE MANHOLE LIMITING DISCHARGE TO 12 LITRES/PER SECOND

STORM & FOUL OUTFALLS IN ACCORDANCE WITH CALA HOMES'S SECTION 104 PROPOSALS

SECTION 104 - NOT APPROVED
SECTION 38 - NOT APPROVED

PRELIMINARY - FOR PLANNING

REV. No.	DATE	DESCRIPTION	INITIALS
A	20.07.18	Revised in accordance with current planning layout.	AJW

Client: CREST NICHOLSON

Project: Bodicote, Banbury

Title: Proposed Drainage Strategy Plan (Phase 2)

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Checked: KTG | Drawn: AJW

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