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Environment Group

Wilson Bowden Developments Ltd
Plot J2 Kingsway Business Park
Rochdale

Phase 2 Geo-Environmental Assessment

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Rochdale
Phase 2 Geo-Environmental Assessment

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EXECUTIVE SUMMARY	
Site Address and Setting	The site is located at Plot J2, Kingsway Business Park, Rochdale. During the ground investigation the site was noted to be undulating and surfaced by mature vegetation. It was bisected by two streams orientated north west to south east; ground conditions were generally soft, becoming boggy in areas of standing water and in close proximity to the streams.
Published Geology, Hydrogeology and Hydrology	British Geological Survey (BGS) 1:50,000 mapping indicates that the site is underlain by superficial Hummocky Glacial Deposits, with two bands of Head Deposits trending north west to south east following the course of the two streams on site. Bedrock is anticipated to comprise the Pennine Lower Coal Measures Formation and Milnrow Sandstone, beneath the south and north of the site respectively. The superficial deposits and bedrock are classified by the Environment Agency as Secondary A Aquifers. The site is bisected by two streams, both flowing into an unnamed secondary river approximately 145m to the north west. The site is considered by the Environment Agency to be at low probability of flooding (Zone 1).
Scope of Investigation Works	Ground investigation comprised six cable percussive boreholes advanced to a maximum depth of 15.50m bgl, thirty machine excavated trial pits to a maximum depth of 4.30m bgl and thirty dynamic cone penetrometer tests.
Ground Conditions Encountered	Ground conditions were recorded to comprise Topsoil or Made Ground to a maximum depth of 1.10m bgl and 1.40m bgl respectively overlying Hummocky Glacial Deposits to a proven depth of 10.00m bgl. The underlying Glacial Till was recorded to a maximum depth of 15.50m bgl, although the base was unproven. Head Deposits, as mapped by the BGS, were encountered on site as Alluvium within the base of the two streams between 0.25m and 3.70m bgl. Groundwater was monitored to rest between 149.63m and 155.02m AOD and is indicated to flow in a northerly direction with a hydraulic gradient of 0.1.
Geotechnical Appraisal	It is anticipated that shallow pad foundations will be taken into the underlying Hummocky Glacial Deposits. Due to its compressible nature the Alluvium will likely require removal prior to development, with the resulting excavation backfilled with engineered fill to an agreed specification. Ground bearing floor slabs are anticipated to be acceptable across the site.
Contamination Sources	Leachate assessment has identified minor exceedances in the screening criteria for copper and lead and groundwater assessment has identified minor exceedances in the screening criteria for copper and nickel; no exceedances were identified by the soil chemical assessment. Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required. Soils and groundwater on site are considered to pose a low to moderate risk to human health and a low risk to controlled waters receptors.
Recommendations	A Remediation Strategy detailing mitigation measures and validation expectations and an Earthworks Strategy should be completed prior to development.
This summary should be read in conjunction with BWB's full report (ref. KBP-BWB-ZJ-XX-RP-YE-0002_Ph2_P2) and reflects an assessment of the site based on information received by BWB at the time of production.	

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1 INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Wilson Bowden Developments Ltd (the Client) to carry out a Phase 2 Geo-Environmental Assessment for the site at Plot J2 Kingsway Business Park, Rochdale. Details of the project brief are included in BWB proposal reference 171221/R1/0001/MCS2210/KES/RTR, dated December 2017.
- 1.2 The proposed development is anticipated to comprise the construction of a new distribution warehouse with associated loading bays, parking and infrastructure. Access will be from James Kearnes Avenue to the south of the site. A proposed Masterplan, current at the time of writing, is presented as **Appendix 1**.

Previous Reports

- 1.3 Familiarity with the following Phase 1 Geo-Environmental Assessment, previously completed by BWB for the site, is assumed:
- 'Phase 1 Geo-Environmental Assessment for Plot J2, Kingsway Business Park, Rochdale' by BWB Consulting Ltd for Wilson Bowden Developments Ltd, reference KBP-BWB-ZJ-XX-RP-YE-0001-Ph1, dated April 2021.

Objectives

- 1.4 The objectives of the report are to assess:
- The prevailing ground and groundwater conditions across the site;
 - The potential presence and extent of contamination in shallow soil and groundwater beneath the site;
 - The significance and magnitude of the observed contamination through comparison of analytical data to appropriate published environmental screening criteria;
 - The strength properties of the soil beneath the site to enable foundation design; and
 - The ground gas regime beneath the site.
- 1.5 The objectives above will allow the preliminary Conceptual Site Model (CSM) presented in the Phase 1 Assessment to be verified and updated. The report has been completed in accordance with BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites, Code of Practice' and CLR11 'Model Procedures for the Management of Land Contamination'.
- 1.6 This report presents the information obtained from a Phase 1 Geo-Environmental Assessment and the supplementary ground investigations and contains relevant factual information from the previous investigations undertaken by others. Sections 2 to 5 of the report, together with the associated Figures and Appendices, constitute a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007.

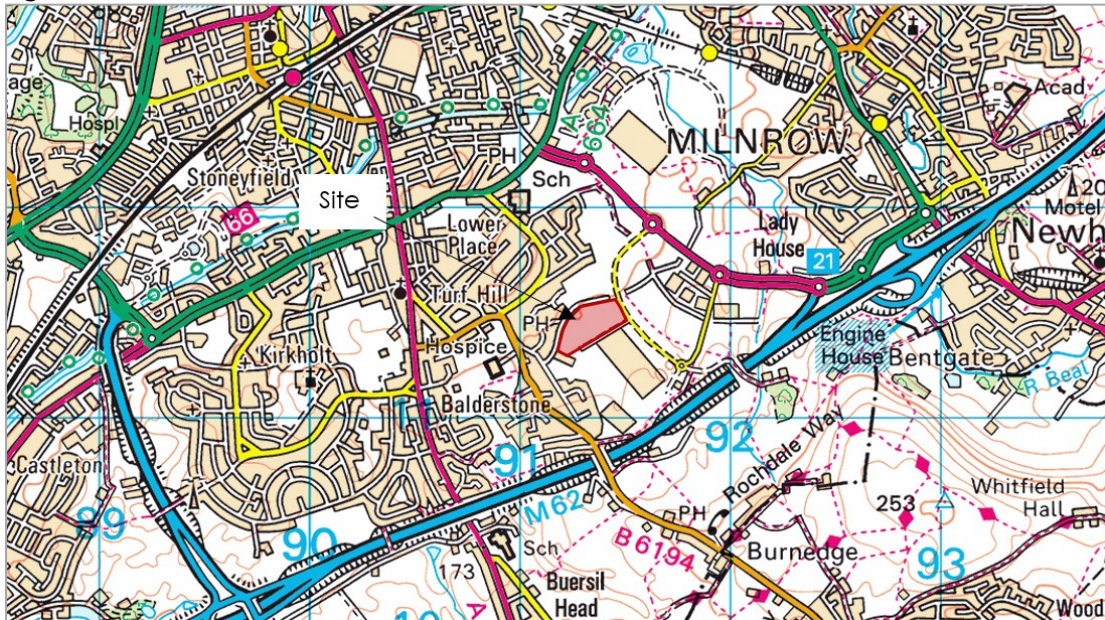
-
- 1.7 The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and recommendations are presented in Sections 6 to 11 of the report, together with the associated Figures and Appendices.

2 THE SITE

Site Location

- 2.1 The site is located at Plot J2 Kingsway Business Park, Rochdale at National Grid Co-ordinates 391310, 411464. The approximate location of the site is shown below in **Figure 1**.

Figure 1 Site Location Plan



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Site Description and Surroundings

- 2.2 The layout of the site with the main features is presented as **Drawing 1**. A detailed description of the key features of the site and its surroundings is included in the Phase 1 Geo-Environmental Assessment.
- 2.3 During the ground investigation the site was noted to be undulating and surfaced by mature vegetation. It was bisected by two streams orientated north west to south east; ground conditions were generally soft, becoming boggy in areas of standing water and in close proximity to the streams.
- 2.4 A temporary footpath was noted to cut through the middle of the site, linking the Asda distribution warehouse with the nearby residential estate.

3 GEO-ENVIRONMENTAL SETTING

Published Geology

- 3.1 British Geological Survey (BGS) 1:50,000 mapping (Sheet 85, Manchester, dated 2011) indicates that the site is underlain by superficial Hummocky Glacial Deposits, with an area of peat identified immediately to the north. BGS 1:10,000 mapping, reviewed within the Phase 1 Geo-Environmental Assessment, also records two bands of Head Deposits trending north west to south east and following the course of the two streams on site.
- 3.2 Bedrock is anticipated to comprise the Pennine Lower Coal Measures Formation and Milnrow Sandstone, beneath the south and north of the site respectively.
- 3.3 Although none has been recorded on available mapping, it is anticipated that limited Made Ground will be encountered in the north east of the site associated with historical development.

Hydrogeology

- 3.4 The underlying ground conditions have been classified by the Environment Agency (EA) as follows:
- Head Deposits: Secondary A Aquifer;
 - Hummocky Glacial Deposits: Secondary A Aquifer;
 - Pennine Lower Coal Measures Formation: Secondary A Aquifer; and
 - Milnrow Formation: Secondary A Aquifer.
- 3.5 Two abstraction licences were historically present on site associated with a historical well at Castle Farm. The site is not located within 500m of a Source Protection Zone.

Hydrology

- 3.6 The site is bisected by a stream running through the centre of the site, with another along the northern boundary, both flowing towards the north west. Although the stream running through the centre of the site is identified by the Groundsure report as being culverted, it was recorded as being above ground during the ground investigation. Both streams flow into an unnamed secondary river approximately 145m to the north west.
- 3.7 The site is considered by the Environment Agency to be at low probability of flooding, with the chance of flooding defined as being less than 1 in 1000 in any given year (Zone 1).

4 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

- 4.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 4.2 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development. Plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters are based on the data gained from the Phase 1 Geo-Environmental Assessment. At this stage the assessment is qualitative and aimed to determine all relevant pollutant linkages, irrespective of significance or allowing for uncertainty.
- 4.3 Three impact potentials exist for any given site; these are:
- The site impacting upon itself;
 - The site impacting on its surroundings; and
 - The surroundings impacting on the site.
- 4.4 All three impacts need to be considered in a risk assessment.
- 4.5 A Source, Pathway, Receptor analysis has been undertaken for the site to develop a CSM based on the information provided in the Phase 1 Geo-Environmental Assessment. This is presented as **Table 1**.
- 4.6 **Sources (S);** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 4.7 **Pathways (P);** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 4.8 **Receptors (R);** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Table 1 *Preliminary Conceptual Site Model*

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Sources S1a: Made Ground associated with former site use, including Castle's Farm and Agriculture. Contaminants of potential concern (CoPC) may include heavy metals, petroleum hydrocarbons, PAHs, phenols, sulphates, pesticides, herbicides, asbestos and ACMs. Made Ground and deeper coal measures may represent a source of ground gas.	P1: Dermal contact, incidental ingestion, and inhalation of particulates.	R1: Construction workers	Mi	Li	M/L	The exposure to construction workers can be mitigated by utilising appropriate PPE and maintaining good hygiene levels. Contaminants are unlikely to be present at significant concentrations based on the current and historical site use.
		R2: Future site users (commercial)	Mi	Lw	L	Pesticides and herbicides may be present in low enough quantities that they will not pose a significant risk. Ground investigation should be undertaken in order to characterise the chemical status of the Made Ground. If significant asbestos is recorded, the requirements of CAR 2012 should be complied with.
	P2: Inhalation of Vapours	R1: Construction workers	Mi	Lw	L	Made Ground may represent a potential source of hazardous ground gases and vapours that could pose a risk to construction workers and future site users, through accumulation and subsequent asphyxiation and/or explosion. The risk should be mitigated against by conducting a gas assessment in accordance with CIRIA guidance, including a suitable period of ground gas monitoring.
		R2: Future site users (commercial)	Mi	Lw	L	
	P3: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation	R1: Construction workers	Sv	UI	M/L	
		R2: Future site users (commercial)	Sv	UI	M/L	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
	(carbon dioxide) or explosions (methane).					elevated concentrations of hazardous ground gases being identified.
	P4: Vertical migration of contaminants in the soil leachate.	R3: Underlying Secondary A Aquifers	Mi	Lw	L	No groundwater data is currently available for the site. Ground investigation and subsequent monitoring would confirm whether potentially unacceptable risks are present.
	P5: Lateral migration of contaminated groundwater.	R4: Surface water features (Culvert/tertiary/secondary rivers)	Mi	Lw	L	The recommendations of EA document PPG6: <i>Construction and Demolition Sites: Prevent Pollution</i> should be considered during construction.
	P4: Direct contact.	R5: Water utility pipes	Mi	Lw	L	Organic compounds in the shallow soils could taint the water supply. A ground investigation and subsequent laboratory analysis should be undertaken to inform the design of new services.
		R7: Buried structures/foundations.	Mi	Lw	L	Sulphates and low pH in the ground could accelerate the degradation of buried concrete structures (e.g. foundations). Ground investigation should include an assessment of the concrete design class.
Off-site Sources S2a: Agricultural and farm works with an associated tank.	P1: Incidental ingestion and inhalation of particulates.	R1: Construction workers.	Mi	UI	VL	Based on the expected presence of Made Ground at the Site and the historical/current potentially contaminating land uses, it is considered that concentrations of CoPC are likely to be higher on Site than from off-site
		R2: Future site users	Mi	UI	VL	
	P2: Inhalation of vapours.	R1: Construction workers	Mi	UI	VL	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
CoPC are likely to be similar to those encountered on site. S2b: Peat 50m to the north. Peat may present a source of ground gas generation including methane and carbon dioxide.		R2: Future site users	Mi	UI	VL	sources. Therefore, the risk from off-site sources is considered to be very low.
	P3: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation (carbon dioxide) or explosions (methane).	R1: Construction workers	Sv	UI	M/L	Ground investigation should include exploratory hole locations adjacent to the site boundaries, where possible, to allow for interpretation of potential soil/groundwater contamination and ground gases.
		R2: Future site users	Sv	UI	M/L	
	P5: Lateral migration of contaminated groundwater.	R3: Underlying Secondary A Aquifers	Mi	UI	VL	
		R1: Construction workers	Mi	UI	VL	

VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely

Pollutant Linkage Assessment Summary

When considered in the context of the CSM and the historical activities that have taken place at the site (former castle and farm), the proposed development is considered to pose a moderate/low risk to human health and low risk to controlled waters.

It is considered that the main driver for the risk rating for human health is the unknown contamination associated with the Made Ground and Topsoil from the previous activities onsite and the potential for elevated ground gas concentrations to accumulate within enclosed spaces.

It is recommended that a ground investigation be undertaken to quantify the identified pollutant linkages and assess likely mitigation measures.

5 PHASE II ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

Scope of Works

- 5.1 Intrusive ground investigation works were undertaken between 8th January and 12th January 2018 and comprised the following works:
- Clearance of investigation locations by a specialist buried services tracing company;
 - Collection of coordinates and elevations of exploratory hole locations;
 - The advancement of six cable percussive boreholes (BH01 to BH06 inclusive) to a maximum depth of 15.50m bgl with in-situ standard penetration tests (SPTs) and installation of gas and groundwater monitoring wells;
 - The advancement of 30 machine excavated trial pits (TP01 to TP30 inclusive) to a maximum depth of 4.30m bgl;
 - TRL dynamic cone penetration (TRL DCP) testing at selected locations to infer California bearing ratio (CBR) values;
 - Collection of environmental soil and groundwater water samples for chemical analysis at a UKAS and MCERTS accredited laboratory;
 - Collection of bulk and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory; and
 - Four post investigation ground gas and groundwater level monitoring visits.
- 5.2 An exploratory hole location plan is presented as **Drawing 2**. BWB exploratory hole records are presented as **Appendix 2**, Drillers' Logs are presented as **Appendix 3**, the SPT calibration certificates are presented in **Appendix 4**, and the post investigation gas and groundwater monitoring data is presented as **Appendix 5**.
- 5.3 The site investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites'.

Chemical Sampling and Analytical Strategy

Soil Strategy

- 5.4 Exploratory holes were positioned and representative samples collected from across the site to determine the site wide soil chemical status. Where encountered, samples of Made Ground were submitted for asbestos screening.
- 5.5 Selected soil samples collected from exploratory hole locations were sent to i2 Analytical Laboratories Ltd (UKAS and MCERTS accredited) for chemical analysis. The following chemical analytical testing was undertaken:
- 15 soil samples were tested for a soil suite (BWB Standard Suite) comprising arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), total phenols, total free and complex

cyanide, fraction of organic carbon, pH, polycyclic aromatic hydrocarbons (United States Environment Protection Agency priority 16 compounds, USEPA 16 PAH) and total petroleum hydrocarbons (TPH) C6-C40;

- 5 soil samples were tested for speciated US Criteria Working Group (TPHCWG) aliphatic and aromatic compounds;
- 7 soil samples were submitted for asbestos screening; and
- 6 soil samples were tested for a suite of common leachable contaminants, namely arsenic, barium, beryllium, water soluble boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate, total sulphate, total cyanide and pH.

5.6 The results of the soil chemical testing are presented as **Appendix 6**.

Groundwater Strategy

5.7 Groundwater samples obtained using a bailer following the removal of 3 times the well volume of water or the well bailed dry and was allowed to recharge. The groundwater samples were sent to i2 Analytical Laboratories Ltd (UKAS and MCERTS accredited) for the following suite of groundwater chemical testing:

- Six water samples tested for arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, conductivity, sulphate, ammoniacal nitrogen, total phenols, total cyanide, pH, total organic carbon, USEPA 16 PAH; and
- Six water samples tested for TPHCWG.

5.8 The results of the groundwater chemical testing are presented as **Appendix 7**.

Geotechnical Strategy

5.9 The cable percussive borehole locations were positioned beneath the proposed building footprints to assess underlying ground conditions for geotechnical purposes. The trial pits were positioned to assess relatively shallow ground conditions, strength properties and characteristics across the wider site, with the CBR tests undertaken within the proposed service yards and car parking areas to allow for pavement design.

5.10 In-situ soil strength testing comprising SPTs were undertaken in the cable percussive boreholes. SPT 'N' values are included on the exploratory hole logs presented as **Appendix 2**.

5.11 Selected disturbed and bulk samples were collected from the investigation locations and sent to the geotechnical project laboratory (i2 Analytical Laboratories Ltd), which is UKAS accredited. The following geotechnical testing was undertaken;

- 14 samples tested for moisture content;
- 8 samples tested for Atterberg (liquid and plastic) limits;
- 10 samples tested for particle size distribution by sieve and pipette;
- 11 samples tested for a BRE Suite comprising aqueous sulphate and pH;
- 6 quick undrained triaxial compaction tests; and
- 10 compaction tests (2.5kg rammer) and particle density tests.

-
- 5.12 The results of the geotechnical testing are included as **Appendix 8**.

Limitations and Uncertainty

- 5.13 The cable percussive boreholes BH01 and BH02 could not be positioned beneath the proposed building in the north of the site due to boggy ground conditions; both boreholes were moved to firmer areas as close to the proposed building footprint as possible.

6 GROUND CONDITIONS ENCOUNTERED

Geological Summary

- 6.1 The ground conditions recorded generally confirmed the published geology discussed in the Phase 1 Geo-Environmental Assessment, although bedrock was not encountered during the ground investigation.
- 6.2 The recorded ground conditions are summarised in **Table 2** below and **Sketch 1** presents a geological cross section through the site. Uncorrected SPT results collected from the borehole locations are presented on the exploratory hole records presented in **Appendix 2**.

Table 2 Summary of Ground Conditions

Stratum	Top Depth (m)		Base Depth (m)		Thickness (m)		SPT 'N' Value	
	Min	Max	Min	Max	Min	Max	Min	Max
Topsoil	0.00		0.25	1.10	0.25	0.80	NR	
Made Ground	0.00		0.25	1.40	0.25	1.40	NR	
Alluvium	0.25	0.80	2.60	3.70	1.80	3.45	NR	
Hummocky Glacial Deposits	0.25	2.60	0.55	10.50	0.90	10.00	4	27
Glacial Till*	6.40	10.50	15.00	15.50	4.50	9.50	16	51
*Base unproven								

Geological Descriptions

Topsoil

- 6.3 Topsoil was encountered consistently across the site at thicknesses of between 0.25m and 0.80m, only absent from TP02 to TP04, TP21, TP27, TP29 and TP30 where Made Ground was recorded from ground level. It was generally recorded to comprise dark brownish grey slightly gravelly silty sand and soft slightly gravelly sandy clay with abundant rootlets and rarely an organic odour. Gravel was recorded as subangular and subrounded fine to coarse granite, quartz, shale and sandstone.

Made Ground

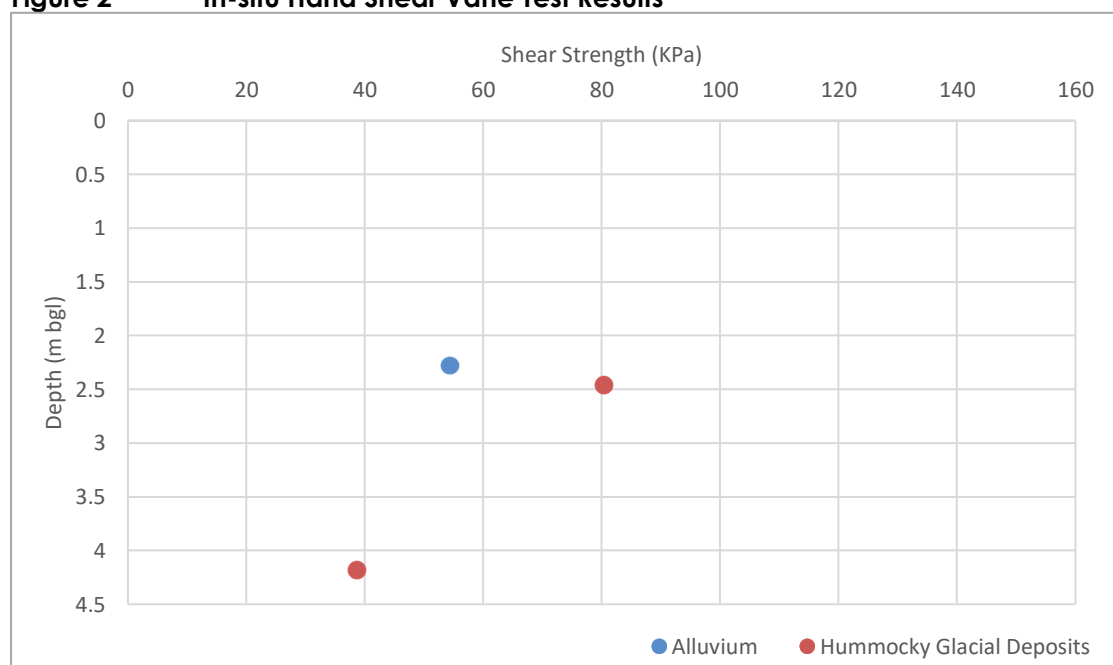
- 6.4 Made Ground was encountered at TP02 to TP04, TP21, TP29 and TP30 with thicknesses ranging between 0.25m and 1.40m. It was generally recorded to comprise brownish grey clayey gravelly sand and soft slightly sandy slightly gravelly clay, frequently with

rootlets. Gravel was noted to include brick, quartz, sandstone, slate and granite with occasional textile, glass, metal and tile.

Alluvium

- 6.5 Alluvium was recorded at exploratory hole locations TP01 and TP02, associated with the stream mapped in the north east of the site. Although mapped by the BGS as Head Deposits, it is considered likely that the material encountered is more representative of Alluvium.
- 6.6 Alluvium was generally encountered as very soft to soft brownish grey and light bluish grey slightly gravelly sandy clay, silty gravelly sand and very sandy gravel with rare black mottling, plant remains, wood fragments up to 0.50m in length and an organic odour. Gravel was recorded as subangular and subrounded fine to coarse quartz and sandstone. A low subrounded sandstone cobble content was recorded within granular material.
- 6.7 Hand shear vane (HSV) tests were undertaken where suitable cohesive deposits were encountered. Each comprised three tests with the average taken and presented as a graph below as **Figure 2**. The HSV results obtained at trial pits are presented on the exploratory hole records presented in **Appendix 2**.

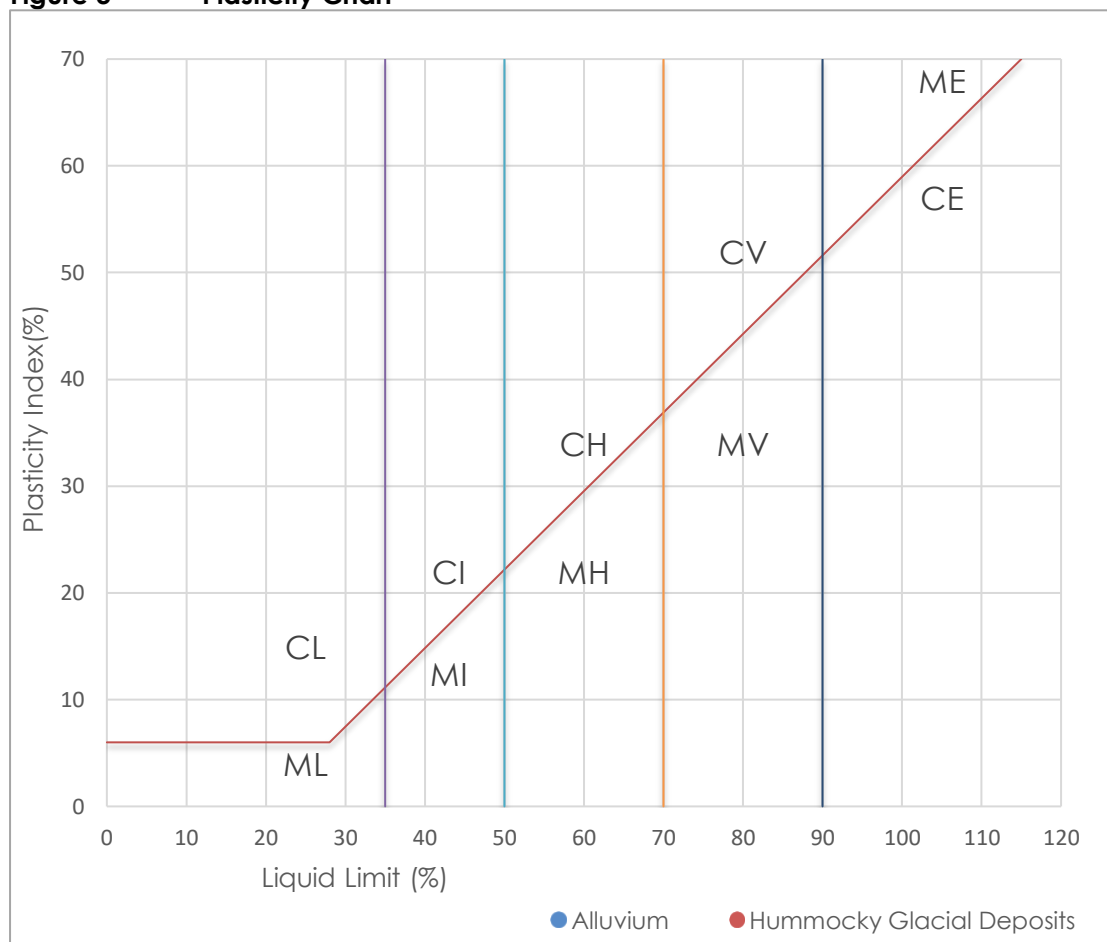
Figure 2 In-situ Hand Shear Vane Test Results



- 6.8 The peak shear strength value was obtained within a test at 0.80m bgl in TP01, recorded as 21kPa, based on the average of three results.
- 6.9 Geotechnical laboratory testing on one sample from TP01 (0.75 – 0.85m bgl) has indicated a moisture content of 83%, plastic limit of 37%, liquid limit of 77% and plasticity index of 40%, indicating a clay of very high plasticity. The large difference between

plastic limit and natural moisture content is indicative of high volume change potential of the material. A Plasticity Chart is presented below as **Figure 3**.

Figure 3 Plasticity Chart



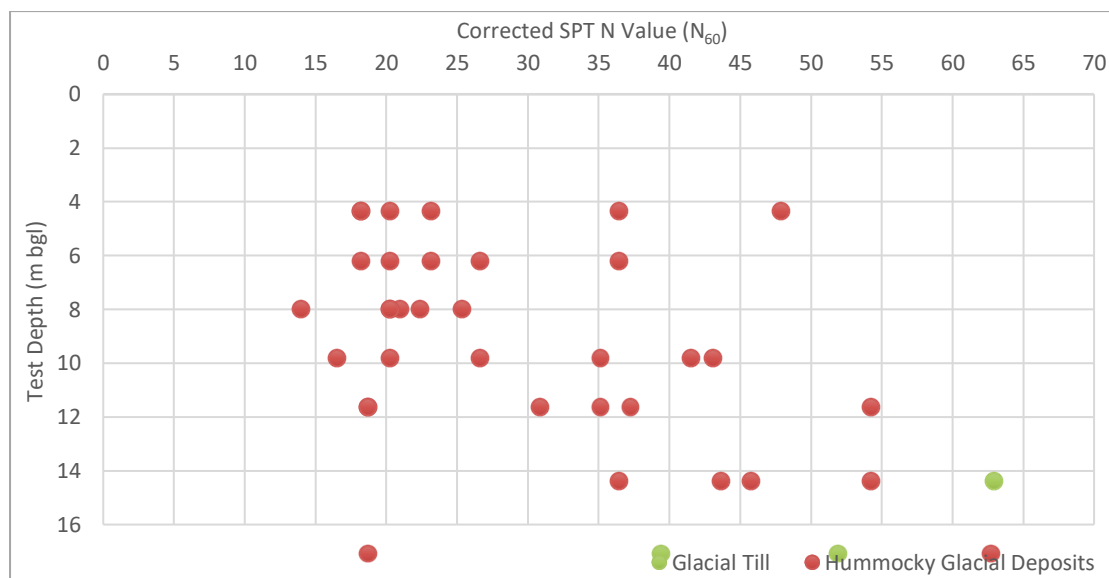
- 6.10 One particle size distribution (PSD) tested on a sample of non-cohesive Alluvium from TP01 (1.75 to 1.85m bgl) indicated the sample to comprise 74% sand, with minor constituents of gravel (12%), silt (10%) and clay (4%). This correlates with descriptions made during the ground investigation. The test curve indicates poorly graded material, predominantly comprising fine to medium sand.

Hummocky Glacial Deposits

- 6.11 Hummocky Glacial Deposits were encountered at all locations, ranging in thickness from 0.90m to 10.0m. The deposits were generally described as reddish and orangish brown silty very gravelly sand and very sandy gravel, occasionally with subangular and subrounded granite and sandstone cobbles. Gravel was recorded to comprise angular to subrounded fine to coarse siltstone, quartz, sandstone, granite, mudstone and shale.
- 6.12 Although generally granular in the north east and south west of the site, cohesive bands were recorded at BH02, BH03, BH05, TP08, TP12 to TP14 and TP16 to TP27. Cohesive material was generally identified to comprise reddish brown slightly gravelly sandy silt.

- 6.13 Where suitable cohesive deposits were encountered, hand shear vane tests were undertaken. The tests are summarised above in **Figure 2**.
- 6.14 SPT N_{60} values within the Hummocky Glacial Deposits were recorded in the range of 5 to 32 blows. The values were between 5 and 32 within the granular deposits and from 7 to 20 within the cohesive deposits. A plot of corrected SPT 'N₆₀' Value vs Depth is presented as **Figure 4** below.

Figure 4 Corrected SPT 'N' Value (N_{60}) Versus Depth



- 6.15 The geotechnical laboratory testing has indicated moisture contents to range between 12% and 17%, liquid limits to range between 23% and 30% and plasticity indices to be in the range of 9% to 15% (low plasticity). A Plasticity Chart is presented above as **Figure 3**.
- 6.16 Nine PSD tests were undertaken on samples of Hummocky Glacial Deposits; a summary of the results is provided in **Table 3** below.

Table 3 PSD Results Summary

Location	Depth (m)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Earthworks Classification
TP01	1.75 – 1.85	11.70	74.00	9.90	4.40	1A
TP03	3.00 – 3.10	6.90	64.50	19.50	9.10	2A&2B
TP07	1.90 – 2.00	35.80	57.20	6.90		1A
TP10	2.15 – 2.25	2.10	86.60	9.30	2.00	1A
TP16	2.60 – 2.40	23.90	58.30	12.60	5.20	2C
TP21	1.20 – 1.30	0.00	98.40	1.60		1A
TP23	2.40 – 2.50	57.10	34.00	8.90		1A

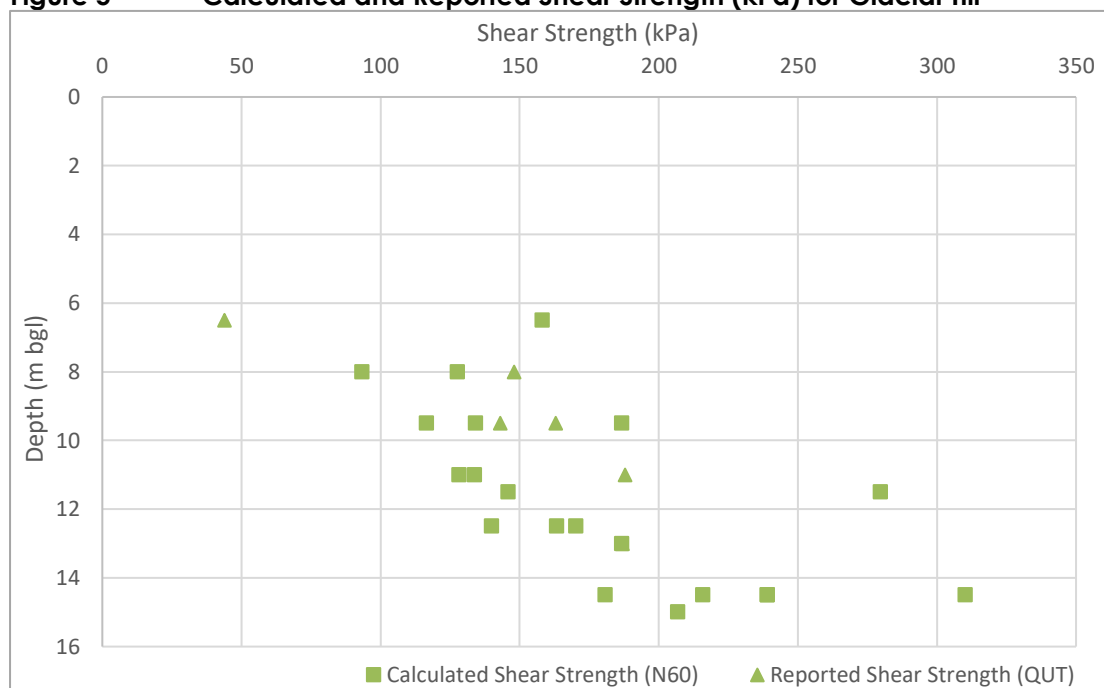
Location	Depth (m)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Earthworks Classification
TP25	1.40 – 1.50	0.00	56.60	29.20	14.20	2A&2B
TP26	1.85 – 1.95	1.70	52.90	32.90	12.50	2A&2B
TP29	1.80 – 1.90	15.60	37.80	31.30	15.30	2A&2B

- 6.17 Material was identified to predominantly comprise slightly clayey slightly gravelly silty sand, which correlates with descriptions made during the ground investigation.
- 6.18 Ten 2.5kg compaction tests were undertaken; results indicate that the majority of material is wet of optimum, although two samples were noted to be dry of optimum. Maximum dry densities were recorded to range between 1.72Mg/m³ and 2.04Mg/m³.
- 6.19 The SPT N₆₀ values obtained during the ground investigation have been used to derive angles of internal friction for the Hummocky Glacial Deposits, using the correlations proposed by Peck, Hanson and Thornburn (1963). N₆₀ values were recorded in the range of 5 to 32 blows, equating to a phi angle range of 29° to 37°.

Glacial Till

- 6.20 Glacial Till was recorded in BH01 to BH06 to a maximum unproven depth of 15.50m bgl; **Drawing 3** presents the depth to the Glacial Till.
- 6.21 It was generally recorded as firm to stiff greyish brown slightly gravelly sandy clay, although at one location was recorded as firm greyish brown slightly sandy silt. Gravel was recorded as angular to subrounded fine to coarse granite, sandstone, mudstone, siltstone and shale.
- 6.22 SPT N₆₀ values within the Glacial Till were recorded in the range of 16 to 51 blows. A plot of corrected SPT 'N₆₀' Value vs Depth is presented above as **Figure 4**.
- 6.23 The geotechnical laboratory testing has indicated moisture contents to range between 12% and 16%.
- 6.24 Based on the empirical relationship between plasticity index and shear strength, as developed by Stroud (1971, for over-consolidated clays), a conservative f1 factor of 5.0 has been adopted. The corrected SPT N₆₀ values indicate the Glacial Till to have potential shear strengths ranging between 93kPa and 310kPa. These are presented below as **Figure 5**.

Figure 5 Calculated and Reported Shear Strength (kPa) for Glacial Till



- 6.25 Six single stage triaxial tests were undertaken on samples of Glacial Till. Calculated undrained shear strengths were found to range between 44kPa and 188kPa and were noted to increase with depth. These have been included above on **Figure 5**.

In Situ Testing

Dynamic Cone Penetrometer Testing

- 6.26 Dynamic Cone Penetrometer Tests were undertaken adjacent to all trial pit locations in order to infer California bearing ratio (CBR) values to inform pavement design. The testing was undertaken in accordance with Transport Research Laboratory (TRL) methodology. The results of the testing are presented as **Appendix 9** and are summarised in **Table 4** below.

Table 4 Summary of DCP Results

Location	Total Depth (mm bgl)	Strata	Min CBR (%)	Max CBR (%)
TP01	800	TS / AL	0.7	5.1
TP02	420	MG	2.1	7.7
TP03	785	MG / HGD	5.5	41.5
TP04	822		0.9	12.4
TP05	693	TS / HGD	2.3	>100
TP06	747		2.1	19.2
TP07	729	TS / HGD	2.2	

Location	Total Depth (mm bgl)	Strata	Min CBR (%)	Max CBR (%)
TP08	861		1.5	17.3
TP09	661		3.3	11.1
TP10	704		4.4	38.5
TP11	857		1.2	12.1
TP12	870		0.8	17.7
TP13	795		2.2	29.0
TP14	726		1.6	24.4
TP15	746		4.1	42.1
TP16	705		2.7	26.8
TP17	822		3.0	30.0
TP18	725		4.1	22.7
TP19	617		1.0	23.4
TP20	749		3.7	18.5
TP21	698	MG / HGD	1.8	6.7
TP22	714	TS / HGD	2.8	27.2
TP23	680		4.6	20.3
TP24	690		3.9	23.2
TP25	675		3.0	50.5
TP26	776		4.6	34.6
TP27	821		3.8	7.2
TP28	673		5.2	31.7
TP29	648	MG / HGD	2.3	20.1
TP30	779	MG	3.7	64.1

TS = Topsoil, MG = Made Ground, AL = Alluvium, HGD = Hummocky Glacial Deposits

- 6.27 Results obtained from TP01, TP02 and TP21, where Topsoil was recorded to overlie Alluvium, recorded maximum CBR values of 7.7%. At all other locations the maximum CBR value was found to exceed 10%, with the minimum CBR values generally corresponding to the overlying Topsoil.

Hydrogeology

- 6.28 Groundwater was encountered in BH01, BH02 and BH05 during drilling and at a number of trial pit locations during the ground investigation. This data and the subsequent monitored groundwater levels are summarised below in **Table 5**.

Table 5 Groundwater Strikes and Post Ground Investigation Monitoring

Location	Strike Depth (m bgl)	Inflow Rate	Stratum	Monitored Groundwater Levels (m AOD)	
				Min	Max
BH01	3.60	-	HGD	149.74	149.89
BH02	4.80	-	HGD	151.31	151.56
BH03	NR	-	-	149.63	149.66
BH04	Obscured	-	-	151.18	151.37
BH05	3.30	-	HGD	153.63	155.02
BH06	Obscured	-	-	150.88	153.00
TP01	3.40	Slow	ALL	-	-
TP02	1.85	Fast	ALL	-	-
TP03	3.05	Seepage	HGD	-	-
TP06	1.70	Seepage	HGD	-	-
TP07	2.30	Seepage	HGD	-	-
TP08	2.50	Very slow	HGD	-	-
TP12	1.30	Slow	HGD	-	-
TP13	1.35	Slow	HGD	-	-
TP14	1.85	Fast	HGD	-	-
TP17	3.70	Very slow	HGD	-	-
TP19	2.50	Very slow	HGD	-	-
TP21	1.05	Seepage	HGD	-	-
TP22	1.00	Seepage	HGD	-	-
TP23	0.80	Seepage	HGD	-	-
	2.50	Slow		-	-
TP24	3.85	Medium	HGD	-	-
TP27	3.65	Slow	HGD	-	-
TP30	3.00	Medium	HGD	-	-
HGD = Hummocky Glacial Deposits, ALL = Alluvium, NR = Not Recorded. All response zones targeted the Hummocky Glacial Deposits. Pink cells highlight overall maximum and minimum values.					

- 6.29 Although a groundwater strike was not recorded at BH03, BH04 and BH06 it is likely that it was obscured by the addition of water to the borehole during the drilling process.
- 6.30 The monitoring data has been used to infer the likely groundwater flow profile across the site. The groundwater is indicated to flow in a northerly direction, falling from approximately 155m AOD in the south to 150m AOD in the north on a hydraulic

gradient of approximately 0.1. The inferred groundwater flow profile at the site is presented as **Drawing 4**.

Hydrology

- 6.31 No surface water features were monitored as part of this investigation.

Contamination Observations

- 6.32 No visual or olfactory evidence of contamination was noted during the ground investigation, groundwater sampling visit or subsequent gas and groundwater monitoring period.

7 GEOTECHNICAL ASSESSMENT

Introduction

- 7.1 The proposed development is anticipated to comprise the construction of a new distribution warehouse with associated loading bays, parking and infrastructure. Access will be from James Kearnes Avenue to the south of the site.
- 7.2 Column loads for the proposed development are indicated to be in the region of 500kN, with an anticipated floor slab load of 30kN/m².
- 7.3 **Drawing 3** shows the depth to Glacial Till beneath the site and **Sketch 1** presents a cross-section through the site.

Ground Model

- 7.4 Due to variations in topography across the site a cut and fill exercise is likely to be required prior to development; as such two scenarios have been discussed below to account for the variation in ground conditions.

Areas of Cut

- 7.5 Areas of cut are likely to be focused in the centre and west of the site. **Sketch 2** shows the position of the proposed development in relation to the present topography; should the Masterplan be finalised in its present layout then the structures in the south west of the site are likely to be located in areas of cut. The below Ground Model, presented as **Table 6**, identifies likely ground conditions in areas of cut.

Table 6 *Ground Model for Areas of Cut*

Stratum	Depth (m bgl)	Bulk Unit Weight (kN/m ³)	Shear Strength Range (kPa)	Mv Range (m ² /MN)	Phi Angle (°)
Hummocky Glacial Deposits	0.0 – 7.0	19	-	-	29 - 37
Glacial Till*	7.0 - >15.0	19	45 - 310	0.1071 - 0.0322	-
*Base unproven.					

- 7.6 Groundwater has been monitored to rest at approximately 3.0m bgl, with the flow direction indicated to be towards the north.
- 7.7 Hummocky Glacial Deposits have been recorded to predominantly comprise granular material, although bands of cohesive material were recorded within the stratum, particularly in the south of the site.

Areas of Fill

- 7.8 The main areas of fill are likely to be located in the north east and centre of the site, in association with the two streams that bisect the site. Trial pits in these locations

recorded up to 3.0m of Alluvium comprising very soft to soft brownish grey and light bluish grey slightly gravelly sandy clay, silty gravelly sand and very sandy gravel with rare black mottling, plant remains, wood fragments up to 0.50m in length and an organic odour.

- 7.9 In these areas the Alluvium should be excavated and subsequently backfilled with engineered fill in accordance with the agreed Earthworks Specification.

Foundation Solutions

- 7.10 Shallow pad foundations have been considered the most economically feasible solution, however, alternative foundations solutions such as vibro-stone columns or piled foundations may have to be investigated should the proposed loadings exceed the values presented below.

Shallow Pad Foundation – Areas of Cut

- 7.11 It is generally not recommended that foundations are constructed bearing into untreated Made Ground in order to avoid unpredictable and excessive total and differential settlements. Similarly, the Alluvium would not be considered suitable for the support of the proposed structures. It is therefore anticipated that foundations will be taken into the underlying Hummocky Glacial Deposits, although it should be noted that this stratum was variable in composition and foundations should bear onto similar material to avoid differential settlement.
- 7.12 Indicative loads achievable within 25mm settlement are presented within **Table 7** below.

Table 7 Achievable bearing Capacities

Size of Pad	Depth (m bgl)	Bearing Capacity (kN/m ²)	Load (kN)
1m x 1m	1.0	250	250
	2.0	285	285
	3.0	350	350
2m x 2m	1.0	140	560
	2.0	165	660

- 7.13 Detailed foundation design will be required upon receipt of loadings for the proposed development.

Shallow Pad Foundations – Areas of Engineered Fill

- 7.14 Due to its compressible nature the Alluvium will likely require removal prior to development. The resulting excavation will need to be backfilled with engineered fill to a specification determined by an Earthworks Specification. Earthworks should be designed to achieve a minimum undrained shear strength of 75kN/m² that would likely to provide a safe bearing capacity of the order of 130kN/m².

- 7.15 Differential movements between varying strata such as engineered fill and natural Hummocky Glacial Deposits should be accommodated within the design.

Floor Slabs

- 7.16 Ground floor slabs laid on any untreated Made Ground or soft Alluvium risk unacceptable total and differential settlements.
- 7.17 No details of floor slab are available at this stage, however, a design load of 30kN/m² has been assumed. A ground bearing floor slab bearing on to the underlying Hummocky Glacial Deposits or engineered fill represents a potential solution, however, there will be a risk of differential settlement owing to potential variation between these two strata; potential differential movements would need to be accommodated within the slab design. The choice of final floor slab solution will be dependent on final slab loadings.
- 7.18 Ground gas assessment (Section 8.0) has classified the site as Characteristic Situation 2. Based on a Type D development a point score of 1.5 will need to be achieved. A cast in situ ground bearing floor slab with nominal mesh reinforcement would provide 0.5 points.

Roads and Pavements

- 7.19 Dynamic Cone Penetrometer Tests were undertaken in accordance with Transport Research Laboratory (TRL) methodology adjacent to a number of exploratory hole locations in order to infer California Bearing Ratio (CBR) values to inform road and pavement design.
- 7.20 Based on the variability of the results and the likelihood that earthworks will occur on site, it is recommended that a subgrade CBR value of 3% is adopted. This will need to be further confirmed via in-situ testing when subgrade levels are available.

Drainage

- 7.21 No soakaway testing was conducted during the ground investigation and due to the shallow depth of groundwater it is considered unlikely that soakaways will be feasible at the site.

Excavations

Ease and Stability of Excavation

- 7.22 Use of a conventional backhoe machine is anticipated to be suitable for removal of all soils on site.
- 7.23 Excavations displayed generally poor stability during the site investigation due to running sands and are likely to become unstable within a short period of time.

Legislation on Personnel Entry to Excavations

- 7.24 Excavations should not be entered by personnel unless full risk assessments and method statements have been completed.
- 7.25 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented.
- 7.26 Where personnel entry is required for inspection, excavations should be sufficiently enlarged and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

Groundwater

- 7.27 Groundwater is indicated to flow in a northerly direction with a hydraulic gradient of 0.1. It is likely that groundwater will affect excavations at the site which are progressed to depths greater than 2.0m bgl and left open for extended periods, although seasonal variations may alter this depth.

Chemical Attack on Buried Concrete

- 7.28 Water soluble sulphate concentrations in soils varied from 6.9 mg/l to 53 mg/l with soil pH values ranging from 4.6 to 8.6. Total sulphur concentration ranged from 0.007 % to 0.075 %.
- 7.29 Sulphate concentrations in the groundwater ranged from 1.7 mg/l to 105 mg/l with groundwater pH values ranging from 5.9 to 7.7.
- 7.30 In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

Earthworks

- 7.31 The majority of material was found to be Class 1A or 2A&2B, however, further assessment is likely to be required prior to development.
- 7.32 Due to significant variations in topography across the site, earthworks are anticipated to be required prior to development to create a suitable development platform; an Earthworks Strategy will be required to support this.

8 GROUND GAS ASSESSMENT

Introduction

- 8.1 A ground gas assessment has been undertaken to assess the risks associated with ground gases to new buildings and their occupants. The results obtained have been assessed in line with relevant guidance (notably CIRIA C665).
- 8.2 CIRIA C665 guidance indicates that for a site with very low gas generation potential, as identified in the Desk Study and based on the potential for limited Made Ground, and a low sensitivity development (the proposed commercial unit), a typical monitoring programme may comprise four visits over a period of one month.
- 8.3 BWB have undertaken four visits over a period of one month and therefore this assessment is considered to be sufficient to satisfy planning conditions for the proposed development.

Methodology

- 8.4 All boreholes were installed with ground gas monitoring wells with response zones within the superficial Hummocky Glacial Deposits. Exploratory hole records showing monitoring well constructions are presented in **Appendix 2**.
- 8.5 The assessment of potential ground gas generation is based on the observation of trends and changes in gas evolution by the direct measurement of ground gases from gas wells. The works included measurement of methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flows and barometric pressure. Volatile organic compounds were also measured using a photoionisation detector (PID).

Results

- 8.6 The minimum and maximum steady state concentrations recorded for borehole flow, oxygen, carbon dioxide and methane are summarised below in **Table 8**.

Table 8 Summary of Recorded Ground Gas Results

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
BH01	HGD	<0.1	5.1	0.3	4.7	<0.1	<0.1
BH02	HGD	<0.1	<0.1	0.9	1.8	<0.1	<0.1
BH03	HGD	<0.1	2.6	2.9	4.0	<0.1	<0.1
BH04	HGD	<0.1	0.1	2.3	3.9	<0.1	<0.1
BH05	HGD	<0.1	<0.1	1.8	3.3	<0.1	<0.1
BH06	HGD	<0.1	-0.3	<0.1	13.1	<0.1	<0.1

Atmospheric Pressure and Flow

- 8.7 During the monitoring programme completed at the site the atmospheric pressure ranged between 976mb (recorded on 18/01/2018) and 1005mb (recorded on 29/01/2018). Steady flow rates ranged between <0.1l/hr (recorded at multiple locations on multiple occasions) and 5.1l/hr (recorded at BH01 on 29th January).
- 8.8 Three monitoring visits were undertaken when atmospheric pressure was recorded below 1000mB, representing a low pressure event and the worst case scenario for the site.
- 8.9 The pressure was recorded as rising during one monitoring visit, as static during two monitoring visits and falling during one monitoring visit.
- 8.10 On this basis, the monitoring is considered likely to have captured the worst case gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure falls and particularly when the pressure drops below 1000mB.

Hazardous Ground Gas and Volatile Vapours

- 8.11 Steady carbon dioxide concentrations recorded ranged between <0.1% v/v (recorded at BH06 on 29th January) and 13.1% v/v (recorded at BH06 on 18th January).
- 8.12 Steady methane concentrations were not recorded above <0.1%v/v and hydrogen sulphide concentrations were not recorded above the limit of detection of the equipment during the monitoring visits.
- 8.13 Carbon monoxide concentrations were generally not recorded above the limit of detection of the equipment during the monitoring visits with the exception of BH06 (10ppm on 18th January).
- 8.14 PID concentrations were not recorded above <0.1ppm (the limit of detection of the equipment).
- 8.15 Ground gas monitoring results are presented in **Appendix 5**.

Risk Assessment

- 8.16 CIRIA Report 665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" presents current best practice on the assessment of ground gases for commercial and residential buildings (with the exception of low rise traditional housing). The report presents a risk based approach based on gas screening levels which depend on both the concentration and emission rate of gas from the ground. Gas screening levels are calculated as follows:

$$\text{Gas screening value (l/hr)} = \frac{\text{gas concentration (\%)} \times \text{measured borehole flow rate (l/h)}}{100}$$

- 8.17 A maximum gas screening level of 0.66l/hr (for carbon dioxide) was recorded, giving a classification of Characteristic Situation 2. Based on this data, gas protection measures are required to be included within all new structures.

Recommendations

- 8.18 Gas protection measures should be installed in accordance with BS848:2015. Based on a Type D development (the proposed commercial units) and the CS2 classification, a gas protection score of 1.5 will need to be achieved.
- 8.19 There are a range of mitigation measures available which offer varying degrees of protection and corresponding number of points. It should be noted that no one single gas protection measure is likely to offer a sufficient number of points and, therefore, a combination of techniques may need to be adopted.
- Cast in Situ ground bearing floor slab – 0.5 points;
 - Cast in situ raft or suspended floor slab with minimal penetrations – 1.5 points;
 - Pressure relief pathways (geo composite blankets / strips) – 0.5 points;
 - Passive subfloor venting layer (void former / no fines gravel) – 1.5 points; and
 - Gas resistant membrane installed and verified in accordance with CIRIA 735 – 2 points.
- 8.20 It should be noted that depending on the selected method of gas protection and risks posed to occupants of the proposed development, visual inspection and integrity testing of the gas membrane may need to be undertaken.

9 HUMAN HEALTH RISK ASSESSMENT

9.1 Soil contaminant data have been compared against Generic Site Assessment Criteria (GSAC) developed by BWB using the CLEA model 1.071 and the updated CLEA framework (2009) for assessing risk from soil contamination to human health. Details of the derivation of the GSACs are presented in **Appendix 10**. The results of the soil chemical laboratory results are provided within **Appendix 6** with a table summarising the results presented as **Appendix 11**.

9.2 The GSACs have been developed with the following assumptions which have been changed from the CLEA default parameter set. Soil type is a sandy loam with an organic matter content of 1%. This is considered to be more representative of shallow Made Ground found on most Brownfield sites than the CLEA default of 6% organic matter.

Pathways

9.3 Contamination data have been compared to generic site assessment criteria (GSAC) for a commercial end use (i.e. using all pathways for that end use) based on an organic matter content of 1%. The building type for a commercial development is assumed to be a post 1970s office which is representative of new commercial buildings.

9.4 The site is to be developed for commercial end use and therefore the key receptor is considered to be an adult female worker and GSACs for a commercial industrial end use have been adopted.

9.5 Exposure pathways considered in this assessment are presented in **Table 9**.

Table 9 Commercial Exposure Pathways

Source	Shallow Soils		Deep Soils
Pathway	Commercial / Industrial with managed landscaped areas	Commercial / Industrial with Hard standing areas	Commercial / Industrial
Ingestion of Soil	✓	✗	✗
Ingestion of site derived household dust	✓	✗	✗
Ingestion of contaminated vegetables	✗	✗	✗
Ingestion of soil attached to vegetables	✗	✗	✗
Dermal contact with Soil	✓	✗	✗
Dermal contact with site derived household dust	✓	✗	✗

Source	Shallow Soils		Deep Soils
Inhalation of fugitive soil dust	✓	✗	✗
Inhalation of fugitive site derived household dust	✓	✗	✗
Inhalation of vapours outside	✓	✓	✓
Inhalation of vapours inside	✓	✓	✓

- 9.6 The whole site is considered to be one averaging area due to the limited dataset and similarity in site conditions.

Summary

- 9.7 None of the samples submitted for testing were found to exceed the applied screening criteria.
- 9.8 No asbestos was recorded to be within the seven samples submitted for asbestos screening.
- 9.9 Based on the above findings it is considered that the recorded contaminant concentrations do not pose an unacceptable risk to human health receptors.

10 CONTROLLED WATERS RISK ASSESSMENT

- 10.1 The results of soil leachate analysis and groundwater sampling are presented as **Appendix 6** and **Appendix 7** respectively.
- 10.2 The controlled waters assessment considers the potential impact of on-site contamination to pertinent controlled waters receptors identified at the site including:
- Underlying Secondary A Aquifers, including superficial Hummocky Glacial Deposits and underlying bedrock comprising the Pennine Lower Coal Measures Formation and Milnrow Formation; and
 - On site tertiary watercourses, which flow into an un-named secondary river approximately 145m to the north west.

Pathways

- 10.3 Controlled water risk assessment has been undertaken through assessment of leachable concentrations of contaminants in soil referring to exposure pathways considered and referencing **Table 10**.

Table 10 **Controlled Water Exposure Pathways**

Controlled Waters Exposure Pathway	Receptor
Leaching of soil contamination into recharge infiltration	✓
Vertical migration of impacted pore water through unsaturated zone into underlying aquifer	✓
Horizontal migration of groundwater through aquifer to off site receptors	✓

- 10.4 The site is underlain by superficial Hummocky Glacial Deposits (Secondary A Aquifer) and bisected by a number of tertiary watercourses which flow into a secondary river approximately 145m to the north west.
- 10.5 In the absence of a sensitive potable supply it is considered appropriate to adopt environmental quality standards (EQS) for freshwater when assessing groundwater quality and soil leachate concentrations. Where EQS are not available, World Health Organisation Standards (WHO) and UK Drinking Water Standards (DWS) have been adopted as the relevant screening criteria.

Soil Leachability

- 10.6 A summary of the soil leachate concentrations and adopted guideline concentrations are presented within **Appendix 12**; exceedances of the soil chemical laboratory results are presented in **Table 11** below.

Table 11 Summary of Leachate Chemical Testing Results

Contaminant	No. of Samples	Range of Concentrations (µg/l)	Generic Screening level (µg/l)	No. of Exceedances
Copper	5	5.90 – 37.00	1.00	5
Lead	5	1.20 – 6.70	1.20	4

- 10.7 Although exceedances of mercury and cyanide were noted, this is due to the screening criteria being below the laboratory limits of detection; as such, they have not been considered as exceedances.
- 10.8 The recorded concentrations of copper and lead are marginally above the applied screening criteria. Given the anticipated end use of the site and the likelihood of a significant area of the site being covered by hardstanding, rainwater infiltration rates will be significantly reduced.
- 10.9 As no source of contamination has been identified within soils on site, the above exceedances have been attributed to naturally elevated background levels.

Groundwater

- 10.10 A summary of the groundwater concentrations and adopted guideline concentrations are presented within **Appendix 13**; exceedances of the groundwater results are presented in **Table 12** below.

Table 12 Summary of Groundwater Chemical Testing Results

Contaminant	No. of Samples	Range of Concentrations (µg/l)	Generic Screening level (µg/l)	No of Exceedances
Copper	6	2.50 – 10.00	1.0	6
Nickel	6	1.40 – 12.00	4.0	4

- 10.11 Although exceedances of benzo(a)pyrene and fluoranthene were noted, this is due to the screening criteria being below the laboratory limits of detection; as such, they have not been considered as exceedances.
- 10.12 The recorded concentrations are only marginally higher than the applied water quality standards for copper and nickel and therefore are still considered to be at acceptable concentrations.
- 10.13 As no source of contamination has been identified within soils on site, the above exceedances have been attributed to naturally elevated background levels.

Surface Water

- 10.14 No surface water monitoring was conducted as part of this ground investigation.

Summary

- 10.15 Based on the above findings it is considered that the recorded contaminant concentrations do not pose an unacceptable risk to controlled waters receptors.

11 ENVIRONMENTAL RISK ASSESSMENT

- 11.1 An updated assessment of identified pollutant linkages has been made following completion of a ground investigation. The preliminary risk assessment presented in **Section 3** has been updated in the light of the findings of the ground investigation and the revised conceptual site model developed, as presented in **Table 13**.

Sources

- Marginally elevated carbon dioxide concentrations.

Pathway

- Accumulation and inhalation of ground gases within new development.

Receptor

- Future site users.

Summary of Potentially Significant Pollutant Linkages

- 11.2 The potentially significant pollutant linkages are summarised below.

Potential Accumulation of Hazardous Ground Gas to Future Site Users

- 11.3 There is a risk that carbon dioxide concentrations could accumulate within enclosed spaces within the proposed development and present a risk to future site users through asphyxiation.
- 11.4 The recorded concentrations indicate that the site is categorised as a CS2 site, whereby enhanced ground gas protection measures are required to mitigate against the risk.
- 11.5 Ground gas protection measures should be installed in accordance with CIRIA C735 and verified by an accredited third party.

Table 13 **Revised Conceptual Site Model**

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Sources Natural soil conditions of the Hummocky Glacial Deposits.	P1: Vertical migration of contaminants in the soil leachate.	R1: Underlying Secondary A Aquifers	Mi	Lw	L	Leachate assessment has identified minor exceedances in the screening criteria for copper and lead. Given the anticipated end use of the site and the likelihood of extensive hardstanding being incorporated into the development, rainwater rates are likely to be significantly reduced, thus limiting vertical migration.
	P2: Direct contact.	R2: Water utility pipes	Mi	Lw	L	Barrier pipes are not considered to be required as part of the development when considered in the context of the guidance presented as Appendix 14 .
		R3: Buried structures / foundations.	Mi	Lw	L	Soils at the site have been classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater (assuming mobile groundwater in non-pyritic soils).
	P3: Lateral migration of contaminated groundwater.	R4: Surface water features (culvert/ tertiary/ secondary rivers)	Mi	Lw	L	Groundwater assessment has identified minor exceedances of the screening criteria for copper and nickel. Recorded concentrations are considered to be reflective of background levels and as such are not considered to pose a significant risk to controlled waters receptors.

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
On-Site Ground gases associated with the Alluvium that bisects the site.	P4: Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide).	R5: Future site users (commercial)	Sv	UI	M/L	Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required.
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely						
Pollutant Linkage Assessment Summary When considered in the context of the conceptual site model and the historical activities that have taken place at the site (former agricultural activities), the proposed development is considered to pose a moderate to low risk to human health and a low risk to controlled waters. It is considered that the main driver for the risk rating for human health is the potential for marginally elevated carbon dioxide concentrations to accumulate within enclosed spaces.						

12 ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT CONSTRAINTS

Statutory Liability

12.1 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated.

12.2 Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:

'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under land, that:

- a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- b) Pollution of controlled waters is being or is likely to be, caused'.*

12.3 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:

'Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property'.

12.4 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.
- Class B appropriate persons are the owners(s) or occupier(s) of the land.

12.5 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

12.6 Based on the information available regarding the site, the potential for Statutory Authority action based on 'pollution of controlled waters' or 'significant harm' as defined by Part IIA of the Environmental Protection Act 1990 is considered to be **LOW**.

Third Party Liability

12.7 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be **LOW** when considering the limited contamination present on site and surrounding land use.

Public Relations

- 12.8 The likelihood of public relations being tarnished due to contamination issues at the site are considered to be **LOW**.

Development Implications

- 12.9 The Alluvium recorded at the base of the streams on site is not anticipated to be suitable as a founding stratum and as such will need removing and replacing with engineered fill to an agreed specification prior to development.
- 12.10 Excavations at the site are likely to exhibit significant instability with running sands prevailing. Where excavations advance below 2.0m, temporary shoring may be required for even short periods. Significant problems with running sands may be encountered below 2.0m (from existing levels) and suitable groundwater control measures such as well pointing/dewatering wells may be required to enable excavations to be dug; it may be that the issue is highly seasonal/subject to inclement weather. Care should be taken to avoid the removal of excessive fines by the pumping process which could lead to further localised and general instability of the area.
- 12.11 Due to the variable topography across the site it is anticipated that earthworks will be required at the site and therefore an Earthworks Strategy will need to be provided prior to development.

13 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- 13.1 Ground conditions were recorded to comprise Topsoil or Made Ground to a maximum depth of 1.10m bgl and 1.40m bgl respectively overlying Hummocky Glacial Deposits to a proven depth of 10.00m bgl. The underlying Glacial Till was recorded to a maximum depth of 15.50m bgl, although the base was unproven.
- 13.2 Head Deposits, as mapped by the BGS, were encountered on site as Alluvium within the base of the two streams between 0.25m and 3.70m bgl.
- 13.3 Groundwater was monitored between 149.63m and 155.02m AOD and is indicated to flow in a northerly direction with a hydraulic gradient of 0.1.

Environmental

- 13.4 Leachate assessment has identified minor exceedances in the screening criteria for copper and lead and groundwater assessment has identified minor exceedances in the screening criteria for copper and nickel; no exceedances were identified by the soil chemical assessment. As such, the soils and groundwater on site are considered to pose a low risk to human health and controlled waters receptors.
- 13.5 Recorded concentrations are considered to be reflective of background levels and are not considered to pose a significant risk to controlled waters receptors. In addition, rainwater infiltration is likely to be significantly reduced given the anticipated end use of the site and the likelihood of extensive hardstanding, thus limiting vertical migration.
- 13.6 Ground gas monitoring has identified the site to be subject to a Characteristic Situation 2 gassing regime, whereby ground gas protection measures will be required; this presents a moderate to low risk to human health receptors.

Geotechnical

- 13.7 Column loads for the proposed development are indicated to be in the region of 500kN; shallow pad foundations taken into the underlying Hummocky Glacial Deposits have been considered the most economically feasible solution, however, this may need to be reviewed if final loadings are significantly higher.
- 13.8 At this stage a design load of 30kN/m² has been assumed for the floor slab. A ground bearing floor slab bearing on to the underlying Hummocky Glacial Deposits or engineered fill represents a potential solution, however, there will be a risk of differential settlement owing to potential variation between the two strata.
- 13.9 Soils at the site have been classified as Design Sulphate Class DS-1 and ACEC Class AC-2z for soils and groundwater (assuming mobile groundwater in non-pyritic soils).
- 13.10 No soakaway testing has been conducted and due to the shallow depth of groundwater it is considered unlikely that soakaways will be feasible at the site.

- 13.11 Excavations at the site are likely to exhibit significant instability with running sands prevailing. Where excavations advance below 2.0m, temporary shoring may be required for even short periods. Significant problems with running sands may be encountered below 2.0m (from existing levels) and suitable groundwater control measures such as well pointing/dewatering wells may be required to enable excavations to be dug; it may be that the issue is highly seasonal/subject to inclement weather. Care should be taken to avoid the removal of excessive fines by the pumping process which could lead to further localised and general instability of the area.
- 13.12 Earthworks are anticipated to be required prior to development due to significant variations in topography across the site.
- 13.13 Based on the variability of the DCP results and the likelihood that earthworks will occur on site, it is recommended that a subgrade CBR value of 3% is adopted.

Recommendations

Environmental

- 13.14 Based on a Characteristic Situation 2 gassing regime and a Type D development a point score of 1.5 within protection measures installed will need to be achieved.
- 13.15 A gas verification plan should be produced and agreed with the regulators before gas protection is installed.

Geotechnical

- 13.16 An Earthworks Strategy will be required to inform the proposed development, detailing specifications for engineered fill.
- 13.17 Contingency arrangements for groundwater control should be considered.

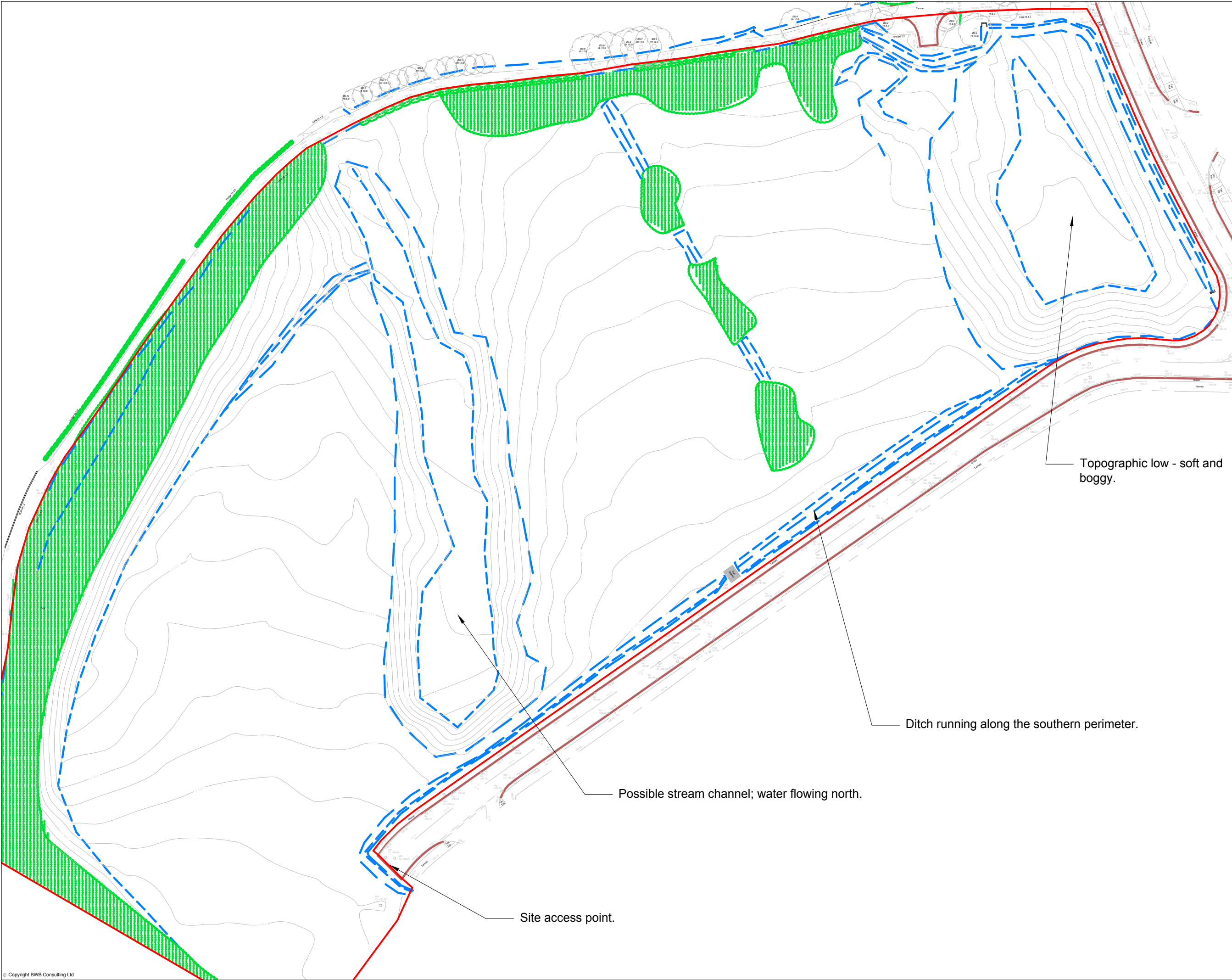
14 REFERENCES

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DRAWINGS

DRAWING 1
SITE LAYOUT PLAN



- Notes**
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.

Legend

**Site Boundary**

V1	12/02/18	FINAL	LJW	XX
Rev	Date	Details of issue / revision	Drw	Rev

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Project Title

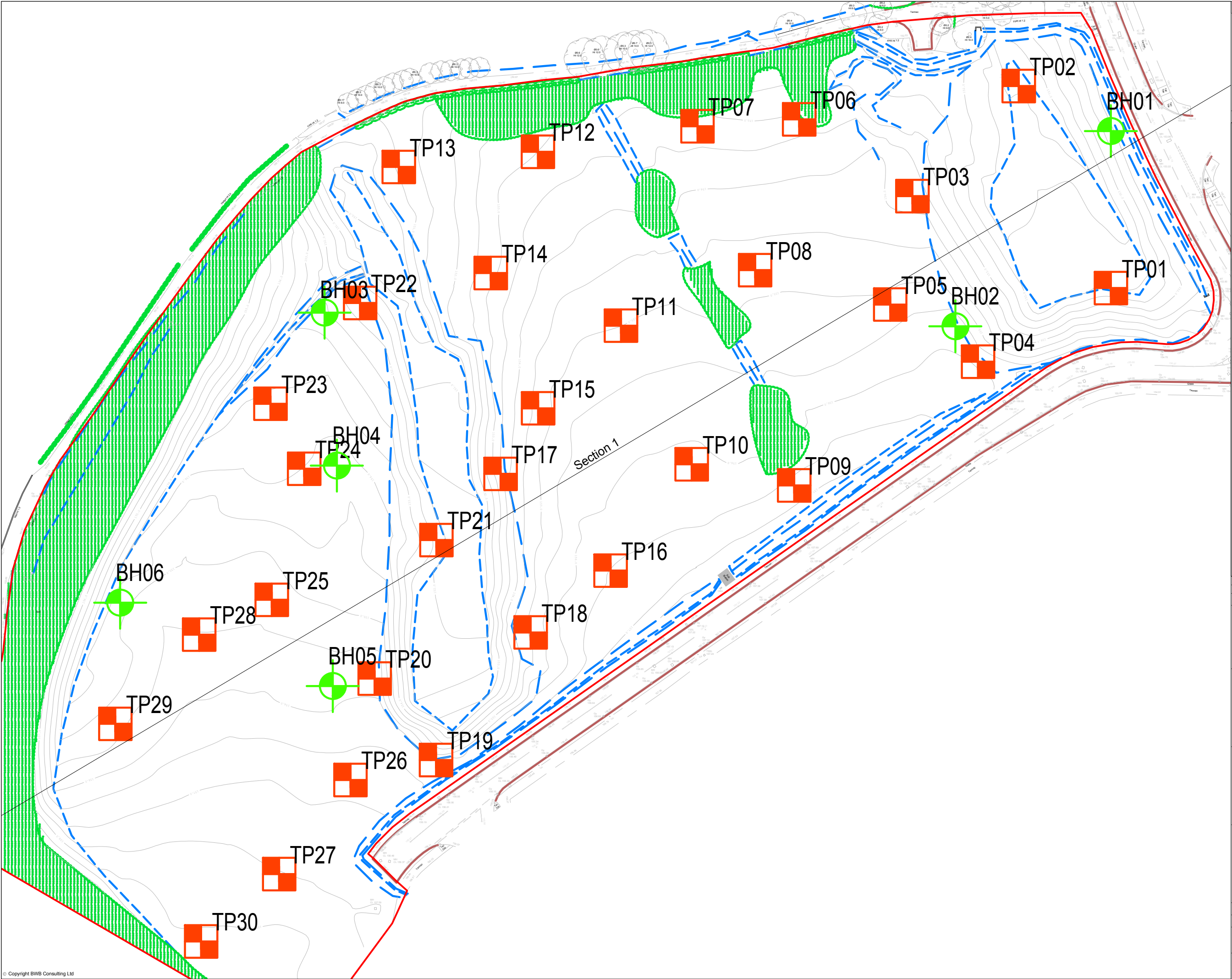
**PLOT J, KINGSWAY
BUSINESS PARK**

Drawing Title

SITE LAYOUT

Drawn:	L. Westoby	Reviewed:	xx		
BWB Ref:	MCS2374	Date:	12/02/18	Scale@A3:	1:1000
Drawing Status					
FINAL					
Project - Originator - Zone - Level - Type - Role - Number				Status	Rev
KBP-BWB-ZJ-XX-DR-YE-0001				P1	V1

DRAWING 2
EXPLORATORY HOLE LOCATION PLAN



- Notes**
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Legend

- Site Boundary
- BH**
Cable Percussion Borehole
- TP**
Trial Pit

V1	12/02/18	FINAL	LJW	XX
Rev	Date	Details of issue / revision	Drw	Rev

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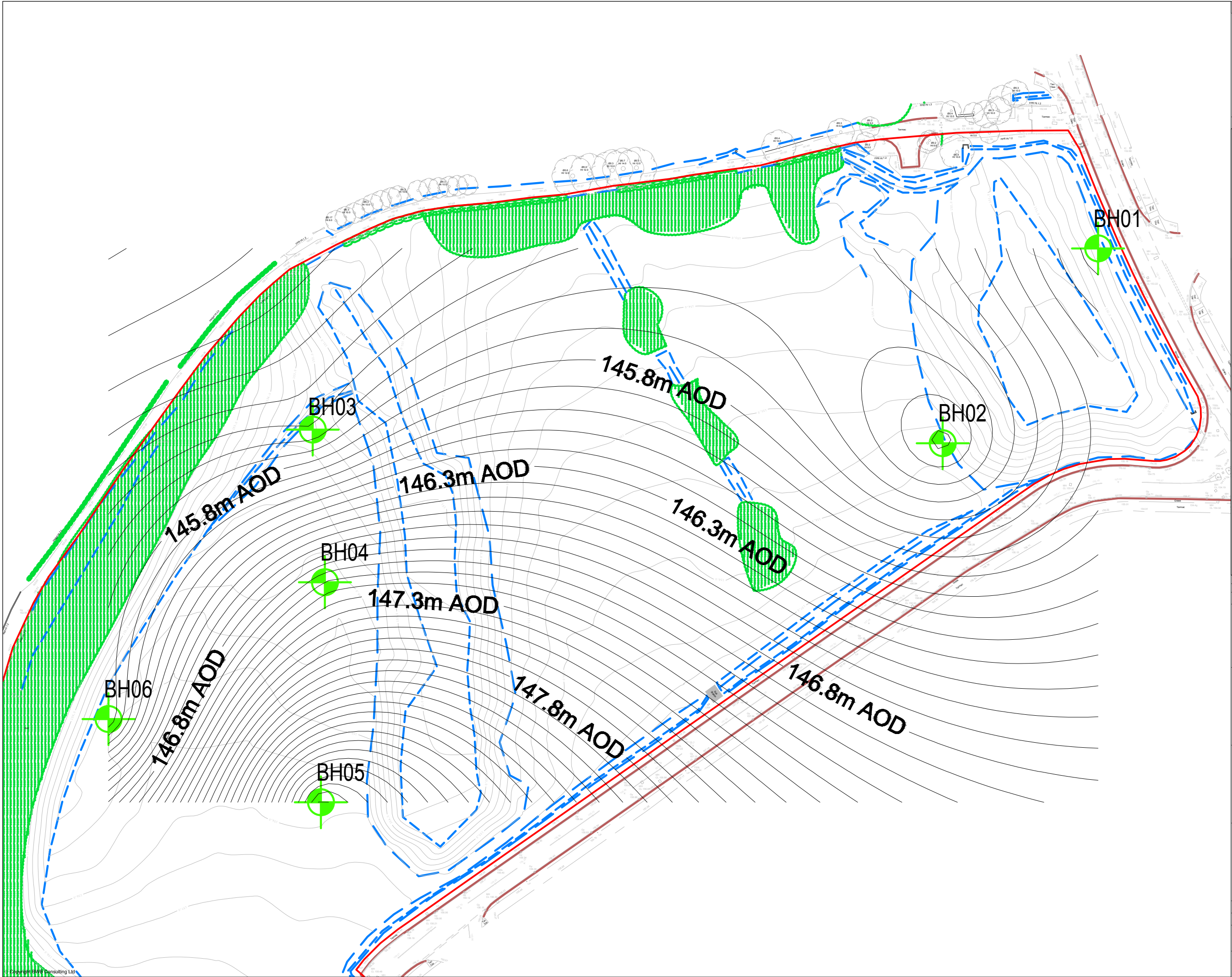
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Project Title
**PLOT J, KINGSWAY
BUSINESS PARK**

Drawing Title
**EXPLORATORY HOLE
LOCATION PLAN**

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BWB Ref:	MCS2374	Date:	12/02/18	Scale@A3:	1:1000
Drawing Status					
FINAL					
Project - Originator - Zone - Level - Type - Role - Number				Status	Rev
KBP-BWB-ZJ-XX-DR-YE-0002				P1	V1

DRAWING 3
DEPTH TO GLACIAL TILL



- Notes**
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 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 4. Any discrepancies noted on site are to be reported to the engineer immediately.

Legend

 Site Boundary

 BH** Cable Percussion Borehole

V1	12/02/18	FINAL	LJW	XX
Rev	Date	Details of issue / revision	Drw	Rev

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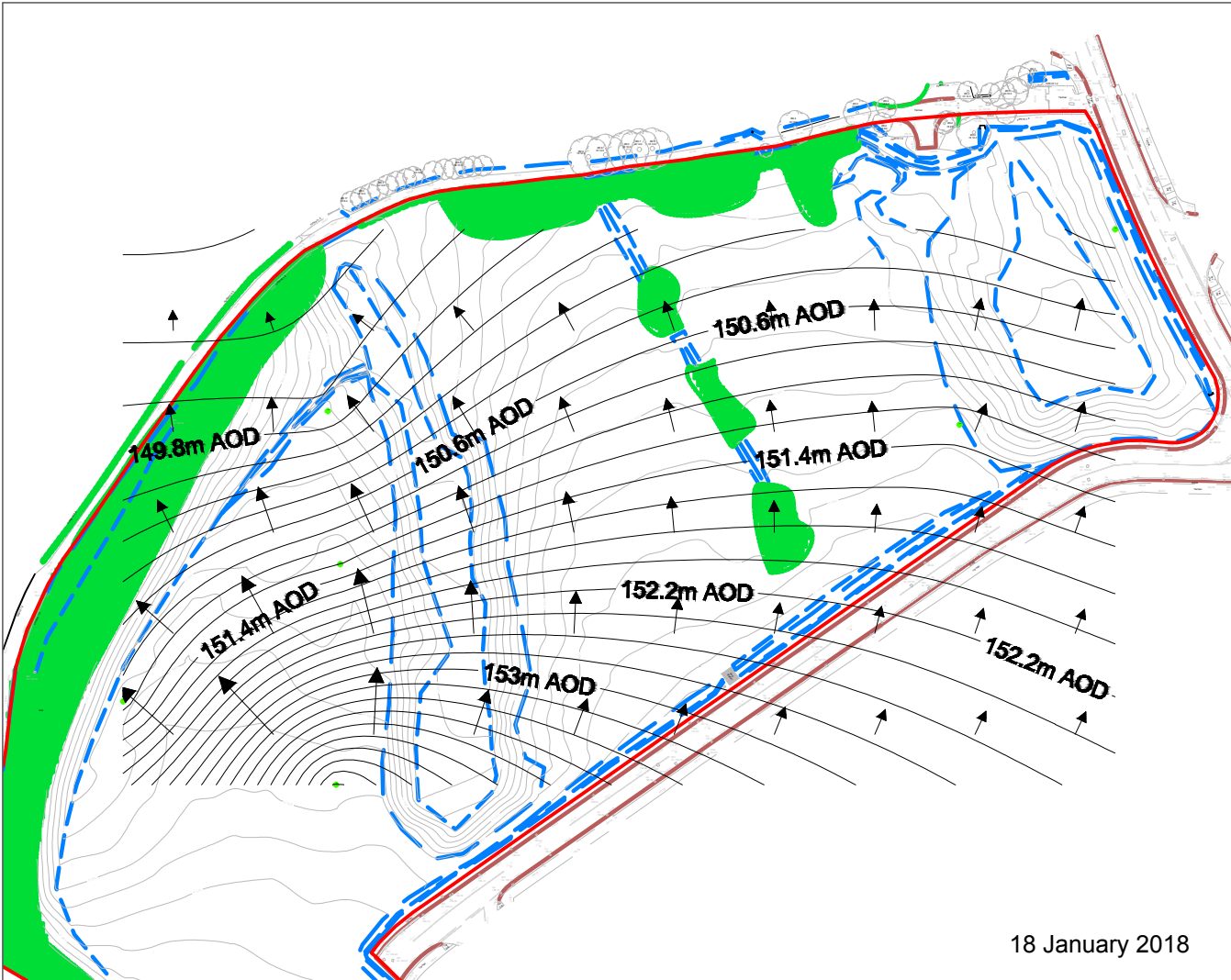
Client
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Project Title
**PLOT J, KINGSWAY
BUSINESS PARK**

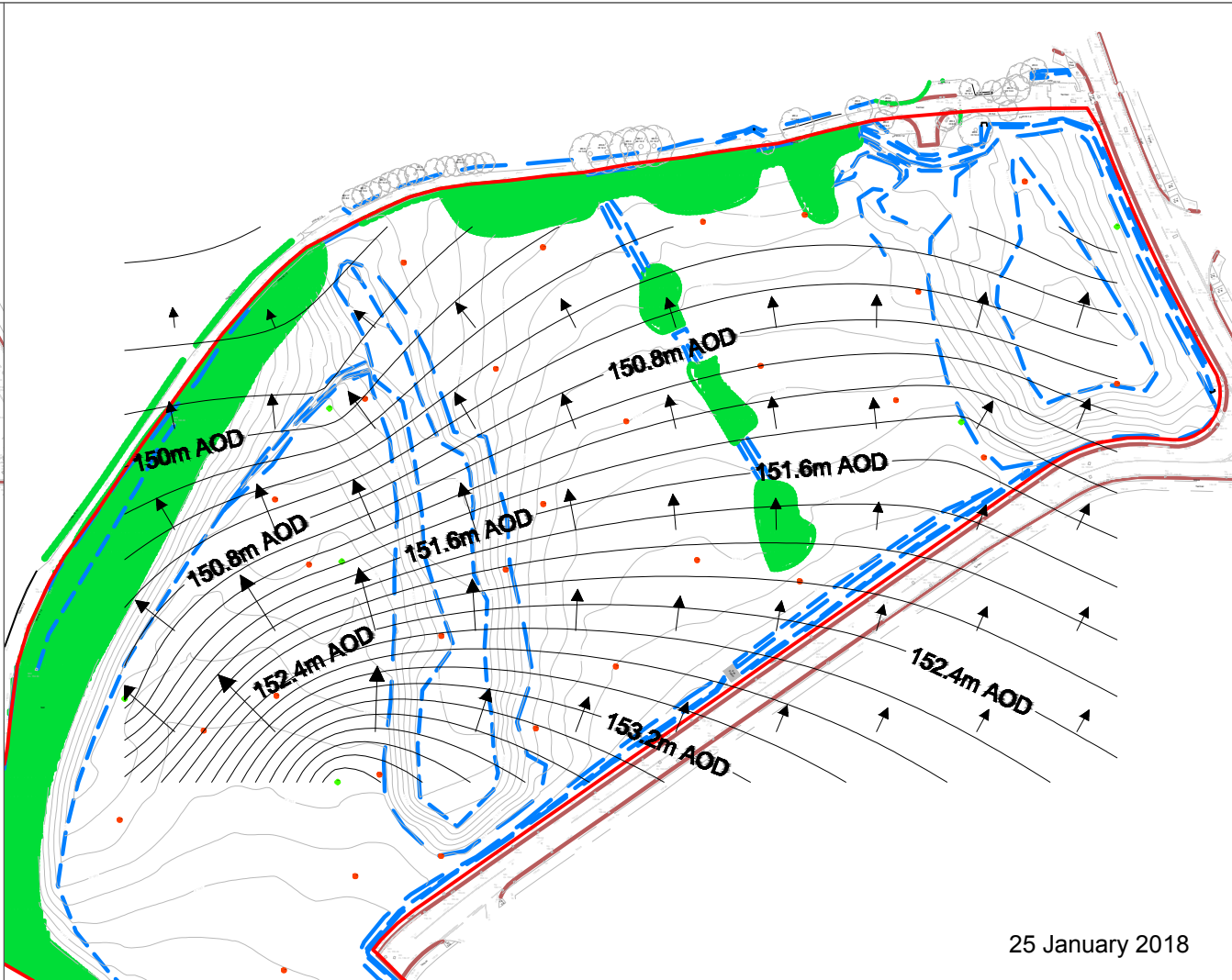
Drawing Title
DEPTH TO GLACIAL TILL

Drawn:	L. Westoby	Reviewed:	xx			
BWB Ref:	MCS2374	Date:	12/02/18	Scale@A3:	1:1000	
Drawing Status						
FINAL						
Project - Originator - Zone - Level - Type - Role - Number					Status	Rev
KBP-BWB-ZJ-XX-DR-YE-0003					P1	V1

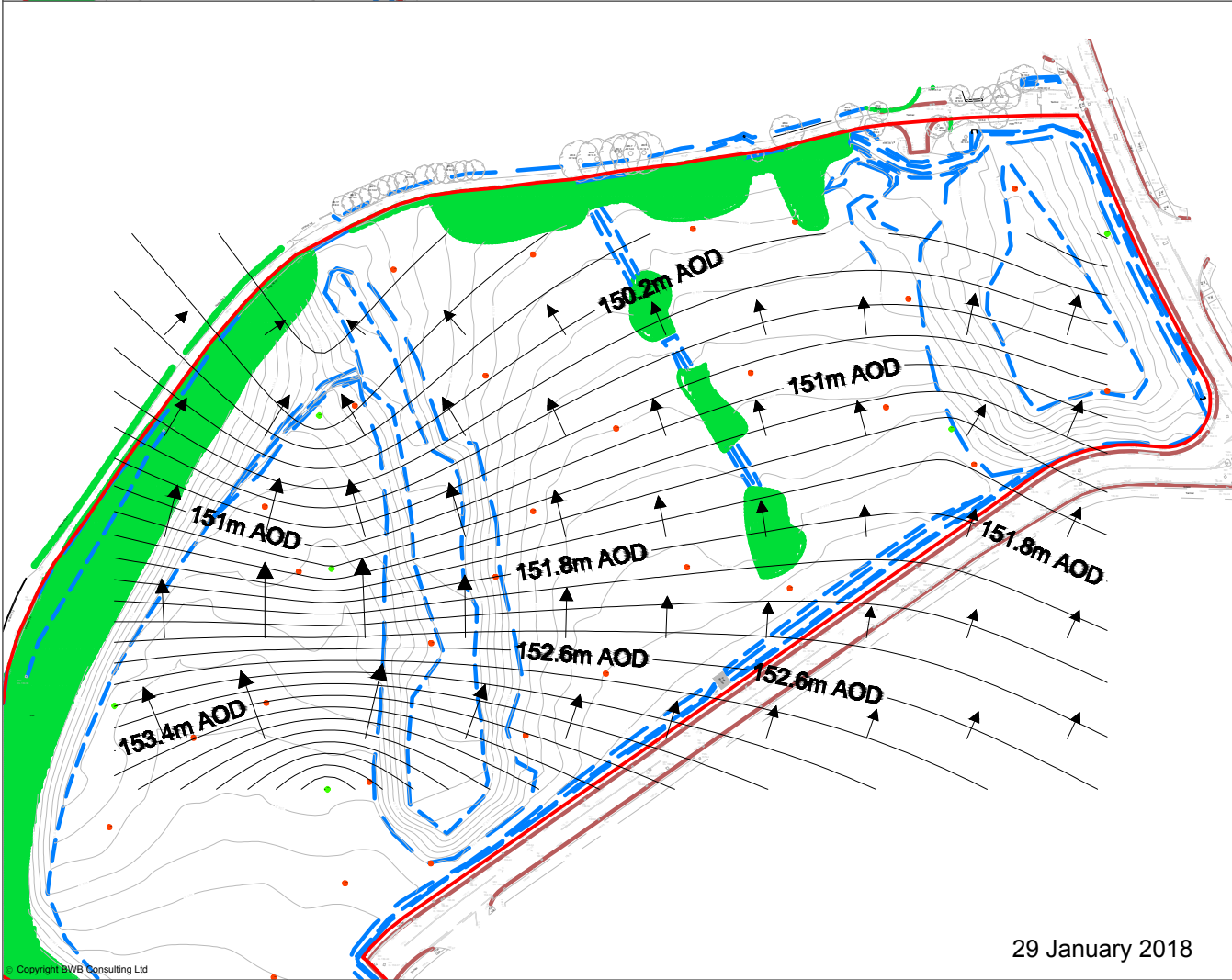
DRAWING 4
GROUNDWATER FLOW PROFILE



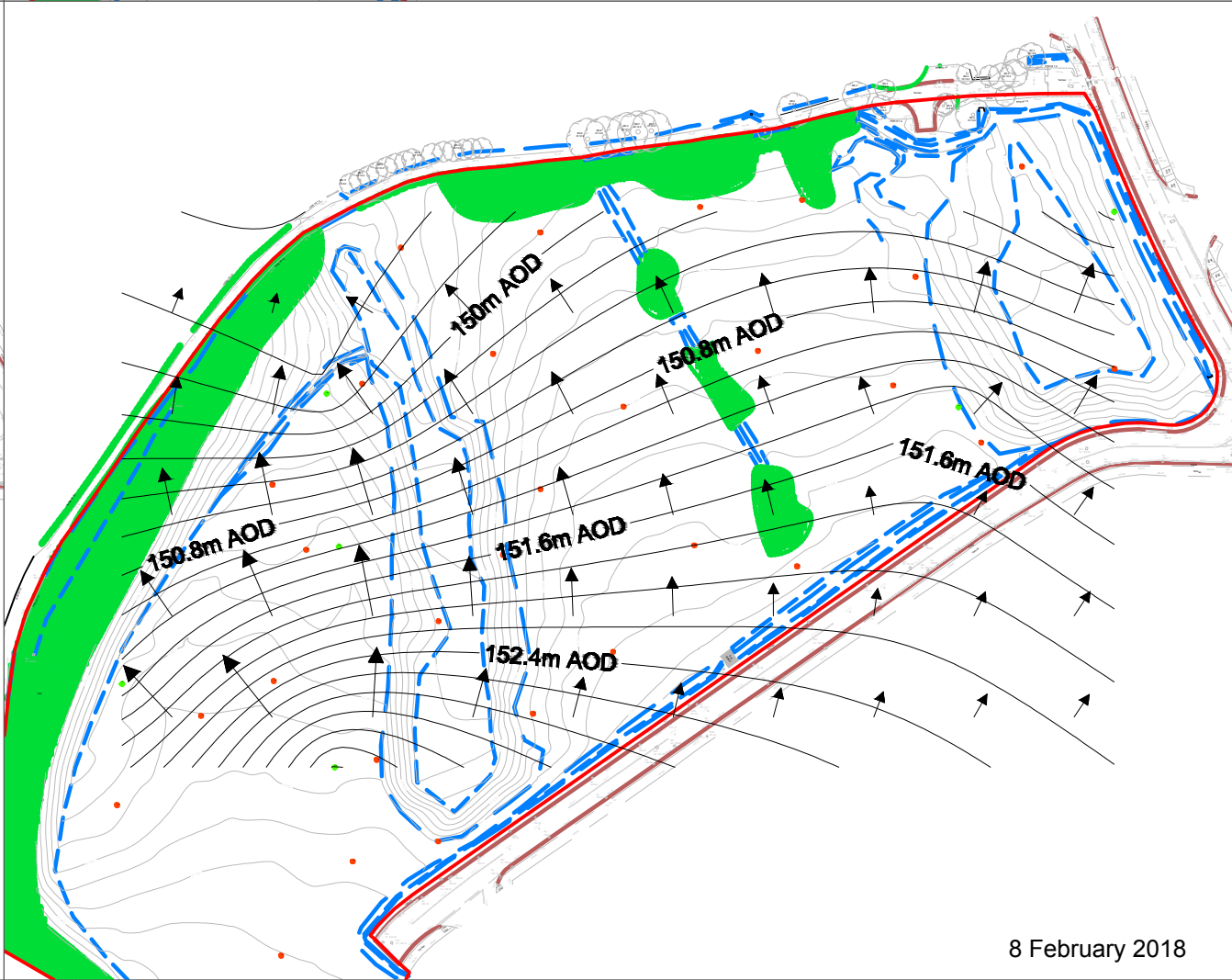
18 January 2018



25 January 2018



29 January 2018



8 February 2018

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Project Title

**PLOT J, KINGSWAY
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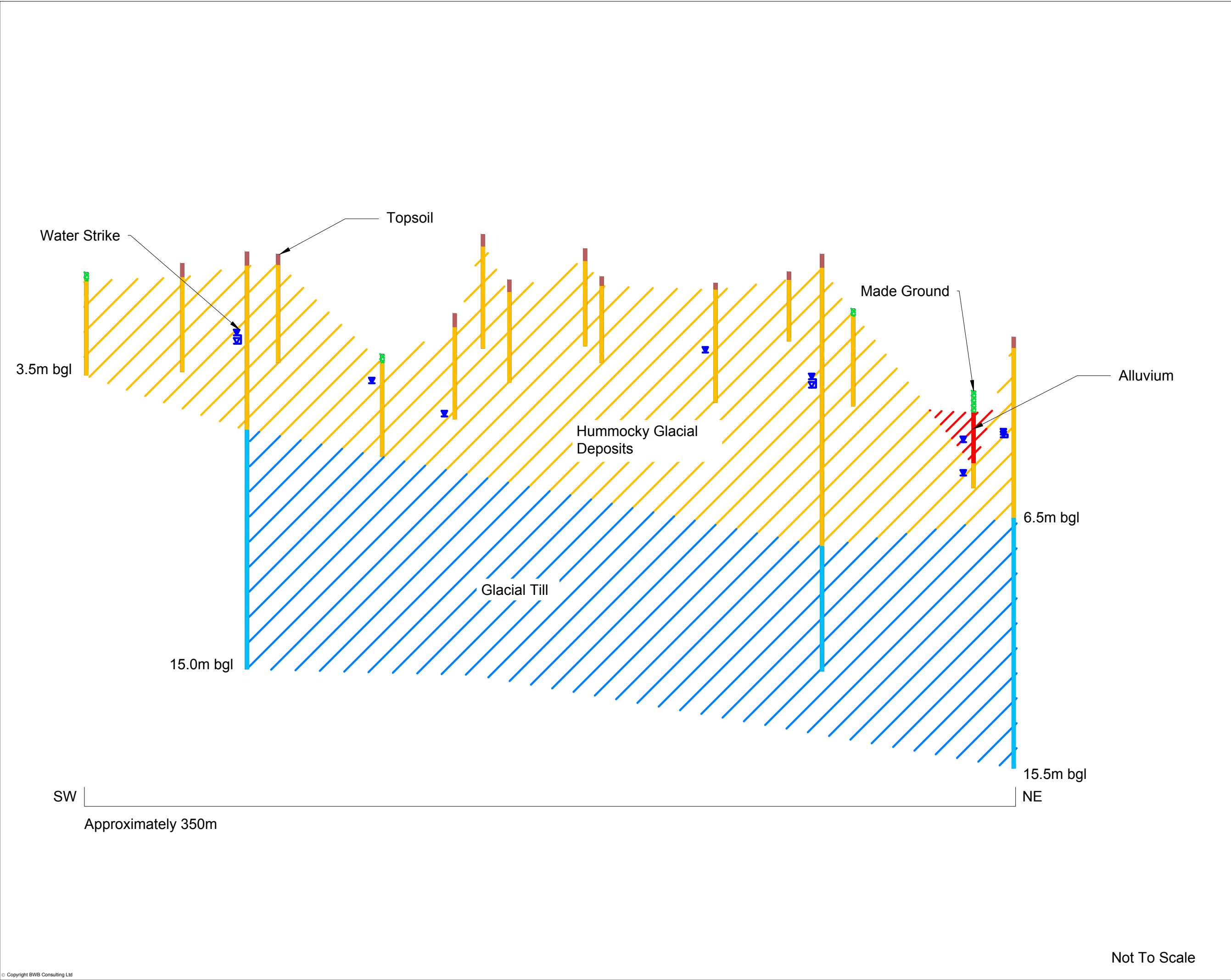
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**GROUNDWATER FLOW
PROFILE**

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Drawing Status					
FINAL					
Project - Originator - Zone - Level - Type - Role - Number					
KBP-BWB-ZJ-XX-DR-YE-0004					
Status	Rev				
P1	V1				

SKETCHES

SKETCH 1
GEOLOGICAL CROSS SECTION



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Drawing Title

CROSS SECTION

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Drawing Status

FINAL

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
KBP-BWB-ZJ-XX-SK-YE-0001	P1	V1

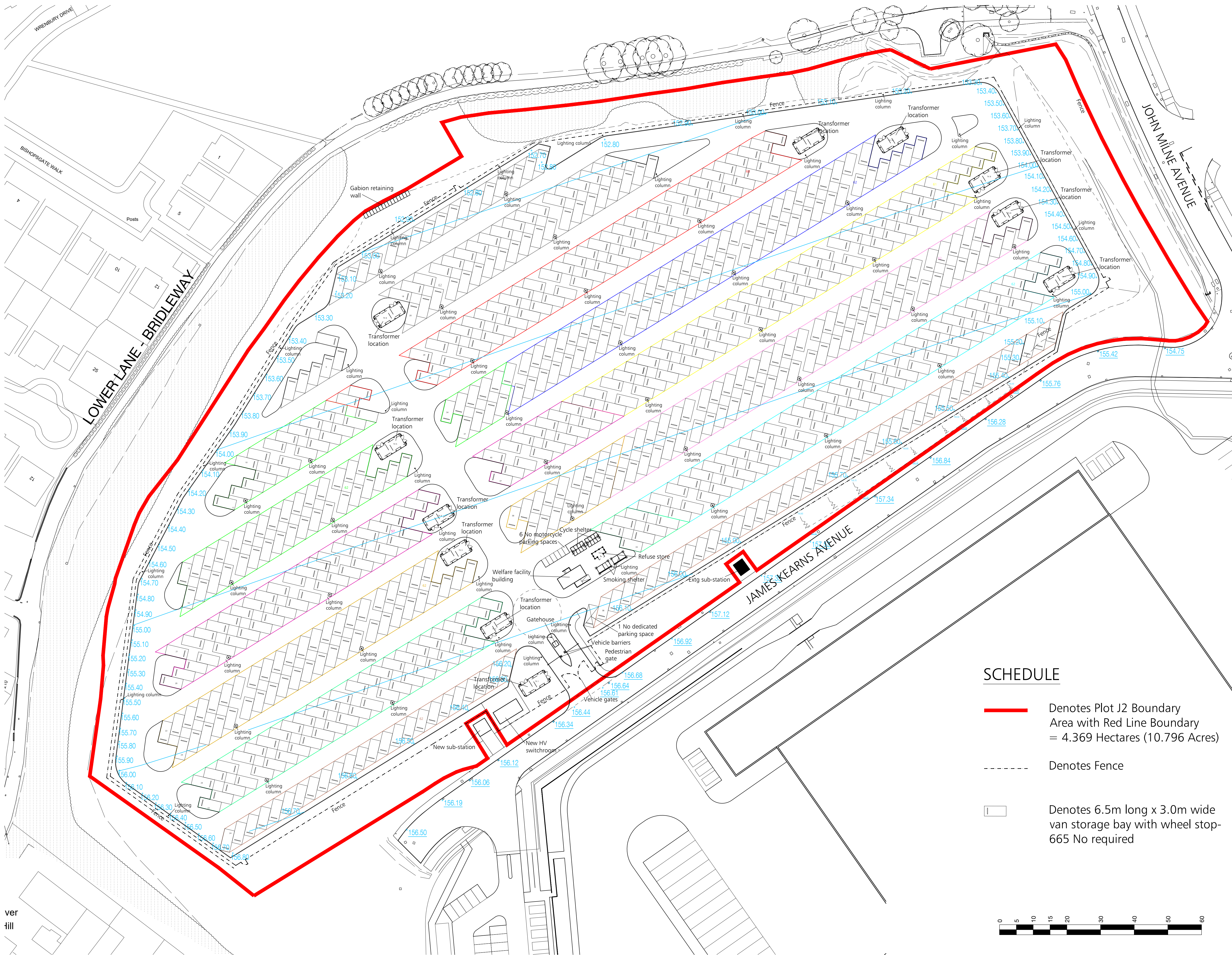
SKETCH 2

PROPOSED DEVELOPMENT AND PRESENT TOPOGRAPHY

APPENDICES

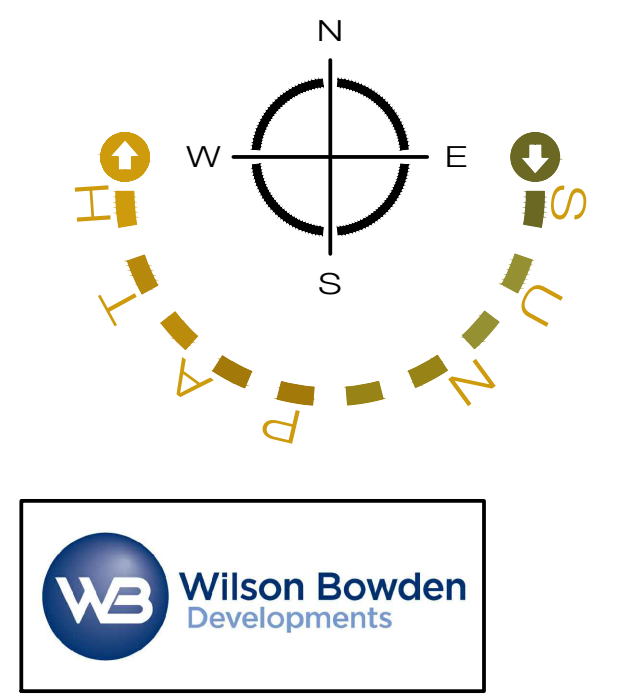
APPENDIX 1

PROPOSED MASTERPLAN



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REVISIONS			
A	26/02/21	B.L.G.	
RED LINE BOUNDARY UPDATED TO REFLECT WBD COMMENTS FOLLOWING MEETING DATED 25/02/21. RED LINE BOUNDARY REVISED TO REMOVE SUB STATIONS ALONG JAMES KEARNS AVENUE FOLLOWING MEETING WITH BWB 26/02/21. PLOT AREA ADDED TO DRAWING CAPTURING THE SAME. SUB STATIONS OMITTED FROM RED LINE BOUNDARY. ONSIE TRANSFORMERS COORDINATED WITH BWB.			
B	05/03/21	CF	
WHEEL STOPS ADDED TO VAN STORAGE			
C	12/03/21	A.G.	B.G.
TURNING CIRCLE AREA INSIDE SITE ENTRANCE ALTERED, KERB LINES TO NW OF SITE ALTERED, GABION RETAINING ADDED TO PORTION OF NORTH BOUNDARY			
D	19/03/21	CF	
FENCE LINE AND VAN STORAGE UPDATED TO CLIENT COMMENTS IN EMAIL FROM DARREN CLARK DATED 08/03/2021 SUBSEQUENT RE-POSITIONING OF CYCLE, SMOKING SHELTER AND REFUSE STORE			
E	26/03/21	A.G.	B.G.
LIGHTING COLUMN LOCATIONS ADDED, LAYOUT ALTERED TO SUIT			
F	01/04/21	AG	B.G.
1 EXTRA LIGHTING COLUMN ADDED, 2 LIGHTING COLUMNS RELOCATED			
G	09/04/21	A.G.	B.G.
LAYOUT OF VAN STORAGE REVISED			
H	13/04/21	A.G.	B.G.
PARKING LAYOUT ALTERED TO SUIT VEHICLE TRACKING			



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PROJECT
**KINGSWAY BUSINESS PARK
PLOT J**

TITLE
PROPOSED SITE PLAN

SCALE
1:500

DATE
09/02/21

DRAWN
TG

REVIEWED

DLA REF
2021-017

NUMBER
102

REVISION
H

STATUS
PLANNING
T:\2021\2021-017\CAD\05-AUTOCAD\DWGS\102

SCHEDULE

-  Denotes Plot J2 Boundary
Area with Red Line Boundary
= 4.369 Hectares (10.796 Acres)
-  Denotes Fence
-  Denotes 6.5m long x 3.0m wide
van storage bay with wheel stop-
665 No required



ver
hill

APPENDIX 2

EXPLORATORY HOLE RECORDS

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park						Ground Level (m AOD): 152.78								
BH01			Project Number: MCS2374						Eastings: 391486.25								
			Client: Wilson Bowden Developments Ltd						Northings: 411534.68								
Hole Type: CP			Rig: Dando 1500			Start & End Date: 08/01/2018 - 09/01/2018			Engineer: LJW			Checker: AD					
Groundwater			Strata						Samples			In-Situ Tests					
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)		
			[0.40]	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with occasional rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Topsoil)				0.40									
			152.38 [2.20]	Loose yellowish brown medium and coarse gravelly SAND. Gravel is angular to subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)					D	1.00	1.45	S	1.00	N=8 (2,2/2,2,2,2)	1.00m (NR)		
				Below 2.00m bgl with pockets of very soft orangish brown clay up to 10mm in size.					D	2.00	2.45	S	2.00	N=8 (2,2/2,2,2,2)	2.00m (NR)		
			150.18 [3.90]	Loose yellowish brown slightly gravelly silty SAND. Gravel is angular fine to coarse mudstone and shale. (Hummocky Glacial Deposits)				2.60	D	3.00	3.45	S	3.00	N=7 (2,2/1,2,2,2)	3.00m (NR)		
									D	4.00	4.45	S	4.00	N=5 (1,1/2,1,1,1)	4.00m (NR)		
									D	5.00	5.45	S	5.00	N=6 (1,2/2,1,1,2)	5.00m (NR)		
			146.28 [9.00]	Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to coarse mudstone, sandstone and shale. (Glacial Till)				6.50	D	6.50	6.95	S	6.50	N=26 (3,4/4,5,7,10)	6.00m (NR)		
				At 7.50m bgl granite cobble.					B	7.50	7.50						
									D	8.00	8.45	C	8.00	N=21 (3,4/4,5,5,7)	8.00m (NR)		
									U (62)	9.50	9.95						
Chiseling			Remarks						Legend								
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination: Target depth achieved.						Sample Type:		Groundwater:		In-Situ Tests				
			Groundwater Remarks: Groundwater encountered at 3.60m bgl, rising to 3.50m bgl after 20 minutes.						B - Bulk C - Core D - Disturbed ES - Environmental Sample U - Undisturbed		Groundwater Strike Resting Groundwater NR = Not Recorded		C - Cone Penetration Test HSV - Hand Shear Vane Test PID - Photo Ionisation Detection Screen S - Standard Penetration Test				
Water Added			Other Remarks: 1. No visual or olfactory evidence of contamination.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS				
From (m bgl)	To (m bgl)	Volume (l)															

BOREHOLE LOG

Scale 1:50

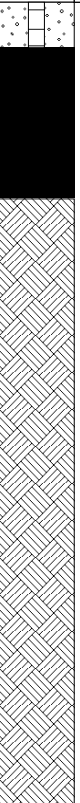
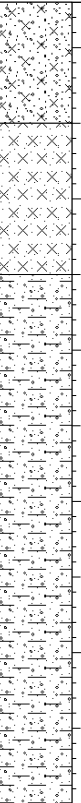
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[illegible]

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park							Ground Level (m AOD): 155.76						
BH02			Project Number: MCS2374							Eastings: 391441.36						
			Client: Wilson Bowden Developments Ltd							Northings: 411478.39						
Hole Type: CP			Rig: Dando 1500			Start & End Date: 09/01/2018 - 10/01/2018				Engineer: LJW		Checker: AD				
Groundwater			Strata							Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)	
			[0.50]	Grass over very soft dark brownish grey slightly gravelly sandy CLAY with occasional rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Topsoil)				0.50	D	0.40						
			155.26 [3.20]	Medium dense orangish brown slightly gravelly medium and coarse SAND. Gravel is subangular fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)					D	1.00	1.45	S	1.00	N=14 (2,3/3,3,4,4)		
				Between 2.50m - 3.70m bgl, clayey bands.					D	2.00	2.45	S	2.00	N=14 (1,3/4,3,4,3)	2.00m (NR)	
									D	3.00	3.45	S	3.00	N=9 (1,1/2,2,2,3)		
			152.06 [1.10]	Medium dense dark orangish brown slightly silty slightly gravelly fine and medium SAND. Gravel is subangular fine to medium siltstone. (Hummocky Glacial Deposits)				3.70	D	4.00	4.45	S	4.00	N=17 (2,3/4,4,4,5)		
			150.96 [3.00]	Loose orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)				4.80	D	5.00	5.45	S	5.00	N=6 (1,2/1,2,1,2)		
				Below 6.50m bgl, sand is medium dense.					D	6.50	6.95	S	6.50	N=14 (2,3/3,3,4,4)		
			147.96 [0.70]	Soft dark orangish brown slightly sandy SILT. Sand is fine. (Hummocky Glacial Deposits)				7.80	D	8.00	8.45	S	8.00	N=6 (1,1/1,1,2,2)		
			147.26 [2.00]	Medium dense orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine sandstone and quartz. (Hummocky Glacial Deposits)				8.50	D	9.50	9.95	S	9.50	N=14 (2,2/3,3,4,4)		
Chiseling			Remarks							Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:							Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.							B - Bulk		 Groundwater		C - Cone Penetration Test		
			Groundwater Remarks:							C - Core		 Strike		HSV - Hand Shear Vane Test		
			Groundwater encountered at 4.80m bgl, rising to 4.50m bgl after 20 minutes.							D - Disturbed		 Resting		PID - Photo Ionisation Detection Screen		
			Other Remarks:							ES - Environmental		Groundwater		S - Standard Penetration Test		
			1. No visual or olfactory evidence of contamination.							U - Undisturbed		NR = Not Recorded				
Water Added										BWB Consulting Ltd		Web:				
From (m bgl)	To (m bgl)	Volume (l)								Waterfront House		bwbconsulting.com				
										Station Street		P: 0115 9241100				
										Nottingham		E: nottingham				
										NG2 3DQ		@bwbconsulting.com				

BOREHOLE LOG

LOCATION ID		Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 155.76						
BH02		Project Number: MCS2374					Eastings: 391441.36						
		Client: Wilson Bowden Developments Ltd					Northings: 411478.39						
Hole Type: CP		Rig: Dando 1500			Start & End Date: 09/01/2018 - 10/01/2018			Engineer: LJW		Checker: AD			
Groundwater			Strata					Samples			In-Situ Tests		
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			145.26 [1.00]	Medium dense orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine sandstone and quartz. (Hummocky Glacial Deposits)		10.50	D	10.50					
				Firm greyish brown slightly sandy SILT. Sand is fine and medium. (Glacial Till)			B	11.00	11.20				
			144.26 [3.50]	Very stiff greyish brown slightly gravelly sandy CLAY. Gravel is subangular fine and medium granite, mudstone and siltstone. (Glacial Till)		11.50	D	11.50	11.95	S	11.50	N=46 (12,7/8,11,13,14)	
							U	13.00	13.35				
							D	13.40					
							D	14.50	14.95	S	14.50	N=51 (7,8/11,12,13,15)	
			140.76	Hole Terminated at 15.00m bgl.		15.00							
Chiselling			Remarks					Legend					
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:					Sample Type:		Groundwater:		In-Situ Tests	
			Target depth achieved.					B - Bulk		Groundwater		C - Cone Penetration Test	
			Groundwater Remarks:					C - Core		Strike		HSV - Hand Shear Vane Test	
			Groundwater encountered at 4.80m bgl, rising to 4.50m bgl after 20 minutes.					D - Disturbed		Resting		PID - Photo Ionisation Detection Screen	
								ES - Environmental Sample		Groundwater NR = Not Recorded		S - Standard Penetration Test	
								U - Undisturbed					
Water Added			Other Remarks:					BWB Consulting Ltd		Web:			
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.					Waterfront House Station Street Nottingham NG2 3DQ		bwbcconsulting.com P: 0115 9241100 E: nottingham@bwbcconsulting.com			

BOREHOLE LOG

Scale 1:50

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LOCATION ID			Project Name: Plot J, Kingsway Business Park						Ground Level (m AOD): 152.71								
BH03			Project Number: MCS2374						Easting: 391259.31								
			Client: Wilson Bowden Developments Ltd						Northings: 411482.30								
Hole Type: CP			Rig: Dando 1500			Start & End Date: 10/01/2018 - 11/01/2018			Engineer: LJW			Checker: AD					
Groundwater			Strata						Samples			In-Situ Tests					
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)		
			[0.50]	Grass over soft dark grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is subangular and subrounded fine to coarse sandstone and quartz.					D	0.20							
			152.21 [1.50]	(Topsoil)				0.50	D	0.50							
				Loose reddish brown gravelly very silty SAND with occasional black mottling, rare wood fragments up to 10mm in size and rare rootlets. Gravel is subangular and subrounded fine to coarse flint, sandstone and quartz. (Hummocky Glacial Deposits)					D	1.00	1.45	S	1.00	N=6 (1,0/1,1,2,2)			
			150.71 [2.10]	Firm orangish brown slightly gravelly sandy SILT with occasional black speckling. Gravel is subangular and subrounded fine and medium flint, sandstone and quartz. (Hummocky Glacial Deposits)				2.00	D	2.00	2.45	S	2.00	N=10 (1,1/2,2,3,3)			
				Below 3.00m bgl, becoming greyish brown and soft.					D	3.00	3.45	S	3.00	N=7 (1,0/1,2,2,2)			
			148.61 [3.10]	Medium dense light orangish brown slightly silty fine and medium SAND. (Hummocky Glacial Deposits)				4.10	B D	4.00 4.00	4.45 4.45	S	4.00	N=17 (2,3/3,4,5,5)			
				Below 5.00m bgl, sand is fine to coarse.					D	5.00	5.45	S	5.00	N=23 (3,4/5,6,6,6)			
				Below 6.50m bgl, fine to coarse sand.					D	6.50	6.95	S	6.50	N=19 (2,3/4,5,5,5)			
			145.51 [7.80]	Stiff greyish brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine to coarse granite sandstone and siltstone. (Glacial Till)				7.20	U D D	8.00 8.50 9.50	8.45	S	9.50	N=20 (2,3/4,5,5,6)			
Chiseling			Remarks						Legend								
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:						Sample Type:		Groundwater:		In-Situ Tests				
			Target depth achieved.						B - Bulk C - Core D - Disturbed ES - Environmental Sample U - Undisturbed		Groundwater: Strike Resting Groundwater NR = Not Recorded		C - Cone Penetration Test HSV - Hand Shear Vane Test PID - Photo Ionisation Detection Screen S - Standard Penetration Test				
Water Added			Groundwater Remarks:						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ						Web: bwbconsulting.com P: 0115 9241100 E: nottingham @bwbconsulting.com		
From (m bgl)	To (m bgl)	Volume (l)	Other Remarks:												BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDING		
			1. No visual or olfactory evidence of contamination.														

BOREHOLE LOG

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BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park						Ground Level (m AOD): 154.31								
BH04			Project Number: MCS2374						Eastings: 391262.85								
			Client: Wilson Bowden Developments Ltd						Northings: 411438.20								
Hole Type: CP			Rig: Dando 1500			Start & End Date: 09/01/2018 - 10/01/2018			Engineer: LJW			Checker: AD					
Groundwater			Strata						Samples			In-Situ Tests					
Strike	Strike Details	Well	Level (m AOD) & Thickness (m)	Description			Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)		
			[0.80]	Soft dark brownish grey slightly gravelly sandy SILT with occasional rootlets. Gravel is subangular and subrounded fine and medium flint quartz. (Topsoil)					D	0.30							
			153.51 [3.00]	Medium dense reddish brown silty gravelly SAND with rare black mottling. Gravel is subangular and subrounded fine to coarse flint, granite, siltstone and quartz. (Hummocky Glacial Deposits)				0.80	B D	1.00 1.00	1.45 1.45	S	1.00	N=20 (8,12/7,5,4,4)			
									U	2.00	2.45						
									D	2.50							
				Below 3.00m bgl, loose sand.					D	3.00	3.45	S	3.00	N=4 (1,0/0,1,1,2)			
			150.51 [3.40]	Loose reddish brown slightly gravelly silty fine and medium SAND with rare black speckling. Gravel is subangular and subrounded fine to coarse quartz. (Hummocky Glacial Deposits)				3.80	D	4.00	4.45	S	4.00	N=7 (1,0/1,2,2,2)			
				Below 5.00m bgl, medium dense sand.					D	5.00	5.45	S	5.00	N=14 (1,2/2,3,4,5)			
				Below 5.50m bgl, gravel is fine to medium granite, shale and quartz.													
				Below 6.50m bgl, fine to coarse sand and gravel is subrounded fine to coarse.					D	6.50	6.95	S	6.50	N=18 (2,3/3,4,5,6)			
			147.11 [7.80]	Stiff dark reddish brown slightly gravelly sandy CLAY. Gravel is subangular fine to coarse granite, mudstone and siltstone. (Glacial Till)				7.20	U	8.00	8.45						
									D	8.50							
				Below 9.50m bgl, very stiff.					D	9.50	9.95	S	9.50	N=32 (2,3/5,9,10,8)			
Chiseling			Remarks						Legend								
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:						Sample Type:		Groundwater:		In-Situ Tests				
			Target depth achieved.						B - Bulk		 Groundwater		C - Cone Penetration Test				
			Groundwater Remarks:						C - Core		 Strike		HSV - Hand Shear Vane Test				
			No groundwater encountered.						D - Disturbed		 Resting		PID - Photo Ionisation Detection Screen				
Water Added			Other Remarks:						ES - Environmental Sample		Groundwater NR = Not Recorded		S - Standard Penetration Test				
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.						U - Undisturbed								
			2. Groundwater obscured by drilling, groundwater encountered on second day at 2.80m bgl.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com						

BOREHOLE LOG

Scale 1:50

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[illegible]

BOREHOLE LOG

LOCATION ID			Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 155.84						
BH05			Project Number: MCS2374					Eastings: 391261.67						
			Client: Wilson Bowden Developments Ltd					Northings: 411374.64						
Hole Type: CP			Rig: Dando 1500		Start & End Date: 08/01/2018			Engineer: LJW		Checker: AD				
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & (Thickness (m))	Description		Legend	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.50]	Grass over dark brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz.				D	0.20	0.20				
			155.34 [2.80]	(Topsoil)			0.50	D	0.50	0.50				
				Loose orangish brown gravelly very silty SAND. Gravel is angular to subrounded fine to coarse sandstone and quartzite. (Hummocky Glacial Deposits)				D	1.00	1.45	S	1.00	N=6 (1,0/1,1,2,2)	0.00m (NR)
								D	2.00	2.45	S	2.00	N=7 (1,1/2,1,2,2)	2.00m (NR)
								D	3.00	3.45	S	3.00	N=8 (1,0/2,2,2,2)	3.00m (NR)
			152.54 [2.10]	Soft brown sandy CLAY (Hummocky Glacial Deposits)			3.30							
				Below 4.00m bgl, firm.				D	4.00	4.45	S	4.00	N=10 (1,1/2,2,3,3)	4.00m (2.70m bgl)
								D	5.00	5.45	S	5.00	N=15 (2,2/3,4,4,4)	5.00m (3.30m bgl)
			150.44 [1.00]	Firm brown slightly gravelly very sandy SILT with rare roots. Gravel is angular and subangular fine and medium mudstone and shale. (Hummocky Glacial Deposits)			5.40	B	5.50	6.00				
			149.44 [8.60]	Firm dark brown slightly sandy slightly gravelly CLAY with occasional pockets of sandy clay up to 15mm in size. Gravel is angular to subrounded fine to coarse mudstone and shale. (Glacial Till)			6.40	U (40)	6.50	6.95				
								D	7.00	7.00				
				Below 8.00m bgl, stiff.				D	8.00	8.45	S	8.00	N=16 (2,3/3,4,4,5)	8.00m (NR)
								U (65)	9.50	9.95				
Chiseling			Remarks					Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:					Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.					B - Bulk		Groundwater Strike		C - Cone Penetration Test		
			Groundwater Remarks:					C - Core		Resting		HSV - Hand Shear Vane Test		
			Groundwater encountered at 3.30m bgl, rising to 2.70m bgl after 20 minutes.					D - Disturbed		Groundwater NR = Not Recorded		PID - Photo Ionisation Detection Screen		
Water Added			Other Remarks:					ES - Environmental Sample				S - Standard Penetration Test		
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.					U - Undisturbed						
								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS		

BOREHOLE LOG

LOCATION ID		Project Name: Plot J, Kingsway Business Park					Ground Level (m AOD): 155.84							
BH05		Project Number: MCS2374					Eastings: 391261.67							
		Client: Wilson Bowden Developments Ltd					Northings: 411374.64							
Hole Type: CP		Rig: Dando 1500			Start & End Date: 08/01/2018			Engineer: LJW		Checker: AD				
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & Thickness (m)	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)	
				Firm dark brown slightly sandy slightly gravelly CLAY with occasional pockets of sandy clay up to 15mm in size. Gravel is angular to subrounded fine to coarse mudstone and shale. (Glacial Till)			D	10.00	10.00					
							D	11.00	11.45	S	11.00	N=22 (2,4/4,5,6,7)	9.00m (NR)	
							U (90)	12.50	12.95					
							D	13.00	13.00					
							D	14.50	14.95	S	14.50	N=31 (2,1/5,7,9,10)	9.00m (NR)	
			140.84	Hole Terminated at 15.00m bgl.										
Chiseling			Remarks					Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:					Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.					B - Bulk		Groundwater		C - Cone Penetration Test		
			Groundwater Remarks:					C - Core		Strike		HSV - Hand Shear Vane Test		
			Groundwater encountered at 3.30m bgl, rising to 2.70m bgl after 20 minutes.					D - Disturbed		Resting		PID - Photo Ionisation Detection Screen		
			Other Remarks:					ES - Environmental Sample		Groundwater		NR = Not Recorded		
			1. No visual or olfactory evidence of contamination.					U - Undisturbed		Recorded		S - Standard Penetration Test		
Water Added								BWB Consulting Ltd		Web:				
From (m bgl)	To (m bgl)	Volume (l)						Waterfront House		bwiconsulting.com				
								Station Street		P: 0115 9241100				
								Nottingham		E: nottingham				
								NG2 3DQ		@bwiconsulting.com				

BOREHOLE LOG

LOCATION ID		Project Name: Plot J, Kingsway Business Park				Ground Level (m AOD): 155.00							
BH06		Project Number: MCS2374				Eastings: 391200.32							
		Client: Wilson Bowden Developments Ltd				Northings: 411398.68							
Hole Type: CP		Rig: Dando 1500		Start & End Date: 11/01/2018 - 12/01/2018		Engineer: TY		Checker: AD					
Groundwater			Strata				Samples		In-Situ Tests				
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.70]	Grass over dark brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz. (Topsoil)			D	0.20					
			154.29 [2.30]	Loose orangish brown slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse granite and quartz. (Hummocky Glacial Deposits)		0.70	D	0.70					
							D	1.00	1.45	S	1.00	N=7 (1,0/1,2,2,2)	
							D	2.00	2.45	S	2.00	N=6 (1,1/1,1,2,2)	
				Below 2.00m bgl, gravel includes sandstone.									
			152.00 [3.20]	Loose yellowish brown slightly silty slightly gravelly SAND. Gravel is angular to subangular fine to medium granite and shale. (Hummocky Glacial Deposits)		3.00	D	3.00	3.45	S	3.00	N=7 (1,1/2,2,1,2)	
							B	4.00	4.45	S	4.00	N=14 (2,2/3,3,4,4)	
				Below 4.00m bgl, medium dense sand, gravel includes sandstone.			D	4.00	4.45				
							B	5.00	5.45	S	5.00	N=12 (1,2/2,3,3,4)	
				Between 5.70m - 6.20m bgl, Band of stiff brown sandy clay.									
			148.79 [3.10]	Medium dense brown slightly silty slightly gravelly SAND. Gravel is angular to subangular fine to coarse granite and sandstone. (Hummocky Glacial Deposits)		6.20	D	6.50	6.95	S	6.50	N=23 (2,3/4,6,6,7)	
				Below 8.00m bgl, gravel is fine to medium.			D	8.00	8.45	S	8.00	N=27 (3,4/5,6,8,8)	
			145.70 [5.70]	Stiff dark grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium mudstone.		9.30	D	9.50	9.95	S	9.50	N=23 (2,3/4,6,6,7)	
Chiseling			Remarks				Legend						
From (m bgl)	To (m bgl)	Time (hh:mm)	Reason for Termination:				Sample Type:		Groundwater:		In-Situ Tests		
			Target depth achieved.				B - Bulk		Groundwater Strike		C - Cone Penetration Test		
			Groundwater Remarks:				C - Core		Resting		HSV - Hand Shear Vane Test		
			No groundwater encountered.				D - Disturbed		Groundwater NR = Not Recorded		PID - Photo Ionisation Detection Screen		
Water Added			Other Remarks:				ES - Environmental Sample				S - Standard Penetration Test		
From (m bgl)	To (m bgl)	Volume (l)	1. No visual or olfactory evidence of contamination.				U - Undisturbed						
			2. Groundwater obscured by drilling, groundwater recorded on second day at 4.00m bgl.				BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com P: 0115 9241100 E: nottingham@bwbconsulting.com				

BOREHOLE LOG

Scale 1:50

Sheet 2 of 2

LOCATION ID		Project Name: Plot J, Kingsway Business Park							Ground Level (m AOD): 155.00					
BH06		Project Number: MCS2374							Eastings: 391200.32					
		Client: Wilson Bowden Developments Ltd							Northings: 411398.68					
Hole Type: CP		Rig: Dando 1500			Start & End Date: 11/01/2018 - 12/01/2018				Engineer: TY		Checker: AD			
Groundwater			Strata					Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & Thickness (m)	Description	Legend	Depth (m bgl)	Type (U/blows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)	
				(Glacial Till)										
							B	11.00	11.45					
				Below 11.50m bgl, gravel is fine to coarse and includes granite and coal.			D	11.50	11.95	S	11.50	N=25 (2,3/5,6,7,7)		
							D	12.50	12.95	S	12.50	N=28 (2,4/6,6,7,9)		
				Below 14.00m bgl, very stiff.			D	14.50	14.95	S	14.50	N=41 (3,5/7,9,12,13)		
			140.00	Hole Terminated at 15.00m bgl.		15.00								
			Remarks					Legend						
Chiseling			Reason for Termination: Target depth achieved. Groundwater Remarks: No groundwater encountered. Other Remarks: 1. No visual or olfactory evidence of contamination. 2. Groundwater obscured by drilling, groundwater recorded on second day at 4.00m bgl.					Sample Type:		Groundwater:		In-Situ Tests		
From (m bgl) To (m bgl) Time (hh:mm)								B - Bulk C - Core D - Disturbed ES - Environmental Sample U - Undisturbed		Groundwater Strike Resting Groundwater NR = Not Recorded		C - Cone Penetration Test HSV - Hand Shear Vane Test PID - Photo Ionisation Detection Screen S - Standard Penetration Test		
Water Added								BWb Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbcconsulting.com P: 0115 9241100 E: nottingham@bwbcconsulting.com				
From (m bgl) To (m bgl) Volume (l)														

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP01

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:09/01/2018

Ground Level (m AOD):151.92

Eastings & Northings:391486E 411489N

2.35

0.65

Pit Dimensions (m)

Degrees

Stability: Unstable

Engineer: LJW

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickness

Description

Legend

Depth (m bgl)

151.67

0.25m

Grass over very soft dark brownish grey slightly gravelly sandy CLAY with abundant rootlets and slight organic odour. Gravel is subangular and subrounded fine to coarse quartz. (Topsoil)

1.10m

150.57

2.35m

Soft brownish grey sandy CLAY with rare plant remains. Sand is fine and medium. (Alluvium)

Brownish grey silty gravelly SAND with rare black mottling, rare wood fragments up to 50mm in size and organic odour. Gravel is subangular and subrounded fine to coarse quartz. (Alluvium)

Below 3.00 bgl slightly gravelly very silty.

3.4m bgl

148.22

Hole Terminated at 3.70m bgl.

0.25

1.35

3.70

Type

From (m)

To (m)

Type

Depth (m)

Result

D

ES

0.75

0.85

0.80

0.80

0.80

(17)kPa

(20)kPa

(26)kPa

B

ES

1.75

1.85

B

3.40

3.50

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Slow inflow noted at 3.40m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP02		Project Name: Plot J, Kingsway Business Park			2.65 0.70 Pit Dimensions (m) Degrees								
Project Number: MCS2374													
Client: Wilson Bowden Developments Ltd													
Plant: CAT 320 F													
Hole Type: TP		Start & End Date: 10/01/2018			Stability: Unstable								
Ground Level (m AOD): 150.85		Eastings & Northings: 391460E 411548N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
				0.50m	Grass over very soft dark grey slightly sandy slightly gravelly CLAY with abundant rootlets. Gravel is subrounded fine to coarse quartz.		0.50	ES	0.55	0.65			
			150.35	0.30m	(Made Ground)		0.80						
			150.05	0.35m	Greenish grey mottled orangish brown slightly gravelly very silty SAND with rare material fragments up to 5mm in thickness. Gravel is subrounded fine to coarse quartz.		1.15						
			149.70		(Made Ground)								
				1.45m	Very soft brown slightly sandy slightly gravelly CLAY with abundant wood fragments up to 300m in size. Gravel is subrounded fine to coarse quartz.			B	1.70	1.80			
	1.85m bgl				(Alluvium)			ES	1.70	1.80			
			148.25		Light bluish grey very sandy GRAVEL with a low subrounded sandstone cobble content and abundant wood fragments up to 0.50m in length. Gravel is subangular and subrounded fine to coarse sandstone and quartz.		2.60						
	3.05m bgl			0.90m	(Alluvium)			B	3.10	3.20			
			147.35		Below 1.85m bgl, becoming slightly gravelly silty.		3.50						
					Orangish brown silty fine and medium SAND.								
					(Hummocky Glacial Deposits)								
					Hole Terminated at 3.50m bgl.								
Remarks													
Reason for Termination: Trial pit unstable.								Samples: B - Bulk D - Disturbed ES - Environmental Sample					
Groundwater Notes: Seepage noted at 1.85m bgl.								Groundwater Strikes: Groundwater Strike Resting Groundwater Level					
Other Remarks: 1. No visual or olfactory evidence of contamination.								In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test					
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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP03

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:09/01/2018

Eastings & Northings:391429E 411516N

2.50

0.65Pit Dimensions (m)

Degrees

Stability: Unstable

Engineer: LJW

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickness

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

153.55

0.25m

Grass over brownish grey clayey gravelly SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse brick and quartzite. (Made Ground)

0.25

ES

0.10

0.20

1.20m

Orangish brown gravelly medium and coarse SAND with occasional roots. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

1.45

BES

1.00

1.10

152.35

0.75m

Reddish brown clayey gravelly SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

2.20

151.60

1.30m

Light orange gravelly medium and coarse sand with a low subangular sandstone cobble content. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)

3.50

B

3.00

3.10

150.30

Hole Terminated at 3.50m bgl.

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
No groundwater encountered

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP04	Project Name: Plot J, Kingsway Business Park		2.20 0.75Pit Dimensions (m) Degrees										
	Project Number: MCS2374												
	Client: Wilson Bowden Developments Ltd												
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 09/01/2018		Stability: Unstable								
Ground Level (m AOD): 155.84		Eastings & Northings: 391448E 411468N		Engineer: TYChecker: AD									
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			155.44	0.40m	Grass over soft dark grey slightly gravelly sandy CLAY with a low subrounded mudstone and quartz cobble content, abundant rootlets and occasional metal up to 60mm. Gravel is subangular and subrounded fine and medium quartz. (Made Ground)		0.40	ES	0.50	0.60			
				3.10m	Yellowish brown slightly gravelly fine to coarse SAND. Gravel is subangular and subrounded fine to coarse mudstone and quartz. (Hummocky Glacial Deposits)			B ES	1.40 1.40	1.50 1.50			
			152.34		Below 2.20m bgl, pockets of orange clay up to 70mm and gravel includes slate.								
					Hole Terminated at 3.50m bgl.		3.50						
Remarks						Legend							
Reason for Termination: Target depth achieved.						Samples: B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strikes: Groundwater Strike Resting Groundwater Level		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes: No groundwater encountered													
Other Remarks: 1. No visual or olfactory evidence of contamination.						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP05		Project Name: Plot J, Kingsway Business Park			2.65 1.40Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 09/01/2018			Stability: Unstable							
Ground Level (m AOD): 155.13		Eastings & Northings: 391423E 411485N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			154.83	0.30m	Dark brownish grey clayey gravelly SAND with abundant rootlets. Gravel is subrounded fine to coarse quartz. (Topsoil)		0.30	ES	0.20	0.30			
				2.20m	Orangish brown gravelly medium and coarse SAND with a low subangular and subrounded granite and sandstone cobble content. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)			B	1.70	1.80			
			152.63		Hole Terminated at 2.50m bgl.		2.50						
Remarks						Legend							
Reason for Termination:						Samples:		Groundwater Strikes:		In-Situ Tests:			
Trial pit unstable.						B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strike Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes:													
No groundwater encountered													
Other Remarks:						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			
1. No visual or olfactory evidence of contamination.													

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park				3.00 0.90 Pit Dimensions (m) Degrees							
TP06		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 09/01/2018									
Hole Type: TP						Stability: Unstable							
Ground Level (m AOD): 153.13		Eastings & Northings: 391396E 411538N				Engineer: LJW		Checker: AD					
Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
▼ 1.7m bgl			152.82	0.30m	Grass over dark grey slightly gravelly clayey SAND with abundant rootlets. Gravel is subangular and subrounded fine to coarse shale and quartz.		0.30	ES	0.15	0.25			
				0.90m	(Topsoil)			B ES	1.50	1.60			
			151.93		Reddish brown silty very gravelly SAND. Gravel is subangular and subrounded fine to coarse mudstone and quartz.								
				1.30m	(Hummocky Glacial Deposits)								
		150.62		Reddish brown very sandy GRAVEL with a low subrounded granite and quartzite cobble content. Sand is medium and coarse. Gravel is subrounded fine to coarse siltstone and quartz.		1.20							
					(Hummocky Glacial Deposits)		2.50						
					Hole Terminated at 2.50m bgl.								
Remarks								Legend					
Reason for Termination:								Samples:		Groundwater Strikes:		In-Situ Tests:	
Trial pit unstable.								B - Bulk D - Disturbed ES - Environmental Sample		▼ Groundwater Strike ▼ Resting ▼ Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test	
Groundwater Notes:								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS	
Seepage noted at 1.70m bgl.													
Other Remarks:													
1. No visual or olfactory evidence of contamination.													

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP07

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:09/01/2018

Ground Level (m AOD):153.14

Eastings & Northings:391367E 411536N

Stability:Unstable

Engineer:TY

Checker:AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

2.3m bgl

Grass over soft slightly gravelly sandy CLAY with abundant rootlets. Gravel is subangular and subrounded fine to coarse granite and quartz. (Topsoil)

Reddish brown gravelly very silty SAND with rare rootlets and a low subangular granite cobble content. Gravel is angular to subrounded fine to coarse granite and quartz. (Hummocky Glacial Deposits)

Below 1.00m bgl, silty

Reddish brown sandy GRAVEL with a low subangular to subrounded granite cobble content. Gravel is angular to rounded fine to coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)

Hole Terminated at 2.60m bgl.

0.55m

1.05m

1.60m

2.60m

B

ES

B

1.00

1.00

1.90

1.10

1.10

2.00

Type

From (m)

To (m)

Type

Depth (m)

Result

Remarks

Reason for Termination:
Trial pit unstable.

Groundwater Notes:
Seepage noted at 2.30m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental
Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear
Vane Test
PID - Photo Ionisation
Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP08

Project Name: Plot J, Kingsway Business Park

Project Number: MCS2374

Client: Wilson Bowden Developments Ltd

Hole Type: TP

Plant: CAT 320 F

Start & End Date: 09/01/2018

3.60

0.80

Pit Dimensions (m)

Degrees

Stability: Unstable

Ground Level (m AOD): 154.72

Eastings & Northings: 391384E 411495N

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

2.5m bgl

154.47

0.25m

Grass over gravelly clayey SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse mudstone and quartz. (Topsoil)

0.25

154.17

0.30m

0.55

153.32

0.85m

Dark orangish brown slightly gravelly clayey SAND with occasional rootlets. Gravel is subangular and subrounded fine to coarse mudstone and quartz. (Hummocky Glacial Deposits)

1.40

151.42

1.90m

Reddish brown mottled grey slightly gravelly sandy SILT with rare rootlets. Gravel is angular and subangular fine to medium shale. (Hummocky Glacial Deposits)

3.30

150.42

1.00m

Reddish brown very gravelly SAND. Gravel is subangular to rounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

4.30

150.42

Orangish brown slightly gravelly sandy SILT. Gravel is subangular to subrounded fine to medium mudstone. (Hummocky Glacial Deposits)

Hole Terminated at 4.30m bgl.

Remarks

Reason for Termination: Target depth achieved.

Groundwater Notes: Very slow inflow noted at 2.50m bgl.

Other Remarks: 1. No visual or olfactory evidence of contamination.

Samples: B - Bulk D - Disturbed ES - Environmental Sample

Groundwater Strikes: Groundwater Strike Resting Groundwater Level

In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID: TP09	Project Name: Plot J, Kingsway Business Park		3.00 0.70 Pit Dimensions (m) Degrees	
	Project Number: MCS2374			
	Client: Wilson Bowden Developments Ltd			
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 10/01/2018	Stability: Unstable
Ground Level (m AOD): 156.31		Eastings & Northings: 391395E 411433N	Engineer: LJW	Checker: AD

[illegible]

Remarks		Legend		
Reason for Termination: Trial pit collapsed back to 2.10m bgl.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: No groundwater encountered				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP10

Project Name: Plot J, Kingsway Business Park

Project Number: MCS2374

Client: Wilson Bowden Developments Ltd

Hole Type: TP

Plant: CAT 320 F

Start & End Date: 10/01/2018

2.75

0.70

Pit Dimensions (m)

Degrees

Stability: Unstable

Ground Level (m AOD): 155.96

Eastings & Northings: 391365E 411439N

Engineer: LJW

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

155.51

0.45m

Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subangular and subrounded fine to coarse granite, sandstone and quartz. (Topsoil)

0.45

ES

0.15

0.25

155.31

0.20m

0.65

B

0.90

1.00

154.56

0.75m

Dark orangish brown slightly silty slightly gravelly SAND. Gravel is subangular and subrounded fine to coarse granite, sandstone and quartz. (Hummocky Glacial Deposits)

1.40

ES

0.90

1.00

2.10m

Light reddish brown silty gravelly SAND with rare rootlets and occasional yellowish brown mottling. Gravel is angular to subrounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)

B

2.15

2.25

152.46

Light orangish brown gravelly medium and coarse SAND. Gravel is angular to subrounded fine to coarse granite mudstone, shale and quartz. (Hummocky Glacial Deposits)

3.50

Hole Terminated at 3.50m bgl.

Remarks

Reason for Termination:

Trial pit collapsed back to 2.20m bgl.

Groundwater Notes:

No groundwater encountered

Other Remarks:

1. No visual or olfactory evidence of contamination.

Samples:

Groundwater Strikes:

In-Situ Tests:

B - Bulk

D - Disturbed

ES - Environmental Sample

Groundwater Strike

Resting

Groundwater Level

HSV - Hand Shear

Vane Test

PID - Photo Ionisation

Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP11		Project Name: Plot J, Kingsway Business Park			3.20 0.70 Pit Dimensions (m) Degrees		
		Project Number: MCS2374					
		Client: Wilson Bowden Developments Ltd					
Hole Type: TP		Plant: CAT 320 F		Start & End Date: 10/01/2018			
Ground Level (m AOD): 154.96		Eastings & Northings: 391345E 411479N			Stability: Unstable		
					Engineer: LJW		
					Checker: AD		

Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			154.61	0.35m	Grass over dark brownish grey slightly gravelly silty SAND with abundant rootlets. Gravel is subangular and subrounded fine to coarse granite. (Topsoil)		0.35						
			154.16	0.45m			0.80						
			153.76	0.40m	Dark orangish brown slightly gravelly silty SAND with rare rootlets. Gravel is subangular and subrounded fine to coarse granite. (Hummocky Glacial Deposits)		1.20	D	1.00	1.10			
			153.36	0.40m			1.60	ES	1.00	1.10			
					Light reddish brown slightly gravelly silty SAND. Gravel is angular to subrounded fine to coarse flint, granite and sandstone. (Hummocky Glacial Deposits)			B	1.30	1.40			
				1.20m			2.80						
			152.16		Light reddish brown slightly silty very sandy GRAVEL with a low subangular granite cobble content. Gravel is subangular and subrounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)		3.10						
			151.86	0.30m					2.45	2.55			
					Light reddish brown slightly gravelly silty SAND with rare black mottling, Gravel is subangular and subrounded fine to coarse granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)								
					Lightly yellowish brown silty SAND. (Hummocky Glacial Deposits)								
					Hole Terminated at 3.10m bgl.								

Remarks		Legend	
Reason for Termination: Trial pit unstable.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	
Groundwater Notes: No groundwater encountered		Groundwater Strikes: Groundwater Strike Resting Groundwater Level	
Other Remarks: 1. No visual or olfactory evidence of contamination.		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test	
		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	
		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	
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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP12

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:10/01/2018

Eastings & Northings:391321E 411529N

3.10

0.90

Pit Dimensions (m)

Degrees

Stability: Unstable

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

▼

1.3m bgl

152.62

0.40m

Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse granite, shale, and quartz. (Topsoil)

0.40

ES

0.30

0.40

152.37

0.25m

0.65

B

0.80

0.90

151.72

0.65m

Orangish brown slightly gravelly sandy SILT with occasional rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Hummocky Glacial Deposits)

1.30

D

1.40

1.50

150.97

0.75m

Reddish brown slightly silty sandy GRAVEL with a medium subrounded granite cobble content. Gravel is angular to subrounded granite and mudstone. (Hummocky Glacial Deposits)

2.05

ES

1.40

1.50

150.22

0.75m

Reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

2.80

148.92

1.30m

Orangish brown gravelly SAND. Gravel is angular to rounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

4.10

D

3.10

3.20

Soft dark grey slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)

ES

3.10

3.20

Below 3.50m bgl, low subangular to subrounded granite cobble content.

Hole Terminated at 4.10m bgl.

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Slow inflow noted at 1.30m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:

TP13

Hole Type: TP

Project Name:

Plot J, Kingsway Business Park

Project Number:

MCS2374

Client:

Wilson Bowden Developments Ltd

Plant:

CAT 320 F

Start & End Date:

10/01/2018

3.15

0.85

Pit Dimensions (m)

Degrees

Stability: Unstable

Ground Level (m AOD):

151.16

Eastings & Northings:

391281E 411524N

Engineer:

TY

Checker:

AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

▼

1.35m bgl

150.81

0.35m

Grass over dark greyish brown slightly gravelly very silty SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse shale and quartz. (Topsoil)

0.35

150.26

0.55m

Orangish brown slightly gravelly very silty SAND with occasional rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Hummocky Glacial Deposits)

0.90

149.81

0.45m

Below 0.50m bgl, slightly silty.

1.35

149.01

0.80m

Reddish brown sandy GRAVEL with a low subangular and subrounded granite cobble content. Gravel is angular to rounded fine to coarse granite, mudstone, and shale. (Hummocky Glacial Deposits)

2.15

147.56

1.45m

Soft greyish brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to coarse granite and shale. (Hummocky Glacial Deposits)

3.60

Hole Terminated at 3.60m bgl.

ES

0.10

0.20

B

1.00

1.10

D

1.50

1.60

ES

1.50

1.60

B

2.40

2.50

Remarks

Reason for Termination:

Trial pit unstable.

Groundwater Notes:

Slow inflow noted at 1.35m bgl.

Other Remarks:

1. No visual or olfactory evidence of contamination.

Samples:

Groundwater Strikes:

In-Situ Tests:

B - Bulk

D - Disturbed

ES - Environmental Sample

Groundwater Strike

Resting

Groundwater Level

HSV - Hand Shear

Vane Test

PID - Photo Ionisation

Detector Test

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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

Sheet 1 of 1

LOCATION ID: TP14	Project Name: Plot J, Kingsway Business Park		2.95 0.95 Pit Dimensions (m) Degrees		
	Project Number: MCS2374				
	Client: Wilson Bowden Developments Ltd				
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 10/01/2018	Stability: Unstable	
Ground Level (m AOD): 152.97		Eastings & Northings: 391307E 411494N	Engineer: TY	Checker: AD	

[illegible]

Remarks		Legend		
Reason for Termination: Trial pit unstable.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: Fast inflow noted at 1.85m bgl.				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP15		Project Name: Plot J, Kingsway Business Park			3.00 0.80 Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 12/01/2018			Stability: Unstable							
Ground Level (m AOD): 154.84		Eastings & Northings: 391321E 411455N			Engineer: TY		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			154.39	0.45m	Dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subangular to rounded fine to coarse granite and sandstone. (Topsoil)		0.45	ES	0.10	0.20			
					Orangish brown slightly silty gravelly SAND with a low subangular and subrounded granite cobble content with rare rootlets. Gravel is subangular to rounded granite, mudstone and quartz. (Hummocky Glacial Deposits)			B	1.10	1.20			
				3.25m	Below 1.20m bgl, becoming silty.								
					Below 2.90m bgl, very silty, gravel is granite, mudstone and shale.			D	3.00	3.10			
					Below 3.30m bgl, silty gravelly SAND.			B	3.50	3.60			
			151.14		Hole Terminated at 3.70m bgl.		3.70						
Remarks						Legend							
Reason for Termination:						Samples:		Groundwater Strikes:		In-Situ Tests:			
Target depth achieved.						B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strike Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test			
Groundwater Notes:													
No groundwater encountered													
Other Remarks:						BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham @bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS			
1. No visual or olfactory evidence of contamination.													

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP16		Project Name: Plot J, Kingsway Business Park			3.20 0.75 Pit Dimensions (m) Degrees														
Project Number: MCS2374																			
Client: Wilson Bowden Developments Ltd																			
Plant: CAT 320 F		Start & End Date: 12/01/2018																	
Hole Type: TP					Stability: Unstable														
Ground Level (m AOD): 156.47		Eastings & Northings: 391342E 411408N			Engineer: TY		Checker: AD												
Groundwater		Strata				Samples		In-Situ Tests											
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result						
			156.02	0.45m	Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subrounded and subangular granite and quartz.		0.45	ES	0.20	0.30									
			155.67	0.35m	(Topsoil)		0.80	ES	0.50	0.60									
			154.97	0.70m	Orangish brown slightly gravelly very silty SAND. Gravel is subrounded and subangular granite and quartz. (Hummocky Glacial Deposits)		1.50	B	1.20	1.30									
			154.27	0.70m	Reddish brown slightly silty very gravelly SAND with a low subangular and subrounded granite cobble content. Gravel is subangular to rounded granite, mudstone and shale. (Hummocky Glacial Deposits)		2.20	B	2.30	2.40									
			152.47	1.80m	Reddish brown slightly silty very sandy GRAVEL with a low subangular and subrounded granite cobble content. Gravel is subangular to rounded granite, mudstone and shale. (Hummocky Glacial Deposits)		4.00	D	4.00	4.10		4.05	(104)kPa						
			152.37	0.10m	Yellowish brown gravelly SAND with a low subangular to subrounded granite cobble content. Gravel is angular to subrounded coal, granite, mudstone and sandstone. (Hummocky Glacial Deposits)		4.10					4.05	(121)kPa						
					Below 3.10m bgl, sightly gravelly silty SAND with cobble absent.								(94)kPa						
					Firm reddish brown slightly gravelly sandy CLAY. Gravel is angular to rounded coal and mudstone. (Hummocky Glacial Deposits)														
					Hole Terminated at 4.10m bgl.														
Remarks														Legend					
Reason for Termination:														Samples:		Groundwater Strikes:		In-Situ Tests:	
Target depth achieved.														B - Bulk		Groundwater Strike		HSV - Hand Shear	
Groundwater Notes:														D - Disturbed		Resting		Vane Test	
No groundwater encountered														ES - Environmental Sample		Groundwater Level		PID - Photo Ionisation Detector Test	
Other Remarks:														BWB Consulting Ltd		Web:		BWB	
1. No visual or olfactory evidence of contamination.														Waterfront House		bwbconsulting.com		CONSULTANCY ENVIRONMENT	
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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP17

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:12/01/2018

Ground Level (m AOD):153.63

Eastings & Northings:391310E 411436N

Engineer: TY

Checker: AD

2.95

0.80

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

▼

3.7m bgl

153.13

0.50m

Grass over soft dark greyish brown slightly gravelly sandy SILT with abundant rootlets. Gravel is subangular and subrounded granite and quartz. (Topsoil)

0.50

ES

0.60

0.70

1.95m

Orangish brown slightly silty gravelly SAND with a low subangular and subrounded granite content. Gravel is angular to subrounded fine to coarse granite, sandstone and quartz. (Hummocky Glacial Deposits)

Below 1.05m bgl, light brown mottled grey with pockets of soft clay up to 40mm.

Below 1.70m bgl, slightly gravelly silty.

2.45

B

1.20

1.30

151.18

1.05m

Brown slightly gravelly very silty SAND. Gravel is angular to subrounded fine to coarse coal, granite, mudstone, sandstone and quartz.

2.45

B ES

2.50

2.60

150.13

0.30m

(Hummocky Glacial Deposits)

3.50

D

3.70

3.80

149.83

Soft reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded fine to medium flint and granite. (Hummocky Glacial Deposits)

3.80

Hole Terminated at 3.80m bgl.

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Very slow inflow noted at 3.70m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike
Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park				3.10 0.90 Pit Dimensions (m) Degrees							
TP18		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 11/01/2018									
Hole Type: TP						Stability: Unstable							
Ground Level (m AOD): 155.10		Eastings & Northings: 391319E 411390N				Engineer: TY		Checker: AD					
Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is subangular and subrounded granite, shale and quartz. (Topsoil)		0.55	ES	0.10	0.20			
			154.55	0.55m	Orangish brown slightly silty gravelly SAND with a low subrounded granite content. Gravel is subangular to subrounded granite and shale. (Hummocky Glacial Deposits)			B	0.80	0.90			
					Below 0.75m bgl, patches of mottled black.			ES	0.80	0.90			
				2.15m	Below 1.40m bgl, orangish brown and slightly gravelly.								
					Below 1.70m bgl, silty.								
			152.40		Soft greyish brown slightly gravelly sandy CLAY. Gravel is angular and subangular mudstone and shale. (Hummocky Glacial Deposits)		2.70	D	2.80	2.90			
				1.00m	Below 3.40m bgl, firm dark grey and gravel including mudstone and sandstone.			D	3.40	3.50		3.50	(104)kPa
			151.40		Hole Terminated at 3.70m bgl.		3.70					3.50	(121)kPa
												3.50	(122)kPa
Remarks													
Reason for Termination:								Samples:					
Target depth achieved.								Groundwater Strikes:					
Groundwater Notes:								In-Situ Tests:					
No groundwater encountered								B - Bulk					
Other Remarks:								D - Disturbed					
1. No visual or olfactory evidence of contamination.								ES - Environmental					
								Sample					
								Groundwater Level					
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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park						3.20					
TP19		Project Number: MCS2374						0.85 Pit Dimensions (m) Degrees					
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 11/01/2018									
Hole Type: TP								Stability: Unstable					
Ground Level (m AOD): 155.89		Easting & Northings: 391291E 411353N						Engineer: TY		Checker: AD			
Groundwater		Strata						Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
	2.5m bgl			0.65m	Dark greyish brown slightly silty sightly gravelly SAND with a low subrounded granite cobble content and abundant rootlets. Gravel is subangular and subrounded granite and quartz.			ES	0.40	0.50			
			155.24	0.20m	(Topsoil)			0.65					
			155.04		Orangish brown slightly silty slightly gravelly SAND. Gravel is subangular to rounded granite and quartz.			0.85	B	0.90	1.00		
				0.65m	(Hummocky Glacial Deposits)								
			154.39		Orangish brown slightly silty sandy GRAVEL with a low subangular and subrounded granite content. Gravel is angular to rounded granite, sandstone and quartz.			1.50					
				0.60m	(Hummocky Glacial Deposits)								
			153.79		Below 1.10m bgl, silty			2.10	D	2.30	2.40		
				0.50m	Orangish brown gravelly very silty SAND. Gravel is angular to subrounded granite, sandstone, shale and quartz.			2.60	B	2.70	2.80		
				1.45m	(Hummocky Glacial Deposits)								
					Stiff reddish brown slightly gravelly sandy SILT. Gravel is angular and subangular granite and shale.								
		(Hummocky Glacial Deposits)											
		Yellowish brown slightly gravelly SAND. Gravel is subangular and surrounded fine to coarse sandstone and shale.											
		(Hummocky Glacial Deposits)											
					Hole Terminated at 4.05m bgl.								
Remarks							Legend						
Reason for Termination:							Samples:		Groundwater Strikes:		In-Situ Tests:		
Target depth achieved.							B - Bulk D - Disturbed ES - Environmental Sample		 Groundwater Strike  Resting Groundwater Level		HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test		
Groundwater Notes:													
Other Remarks:													
1. No visual or olfactory evidence of contamination.							BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100				

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP20

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:11/01/2018

Ground Level (m AOD):155.76

Eastings & Northings:391274E 411377N

Stability:Unstable

Engineer: TY

Checker: AD

Groundwater

Strata

Samples

In-Situ Tests

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

Type

From (m)

To (m)

Type

Depth (m)

Result

155.36

0.40m

Grass over dark greyish brown slightly silty slightly gravelly SAND with abundant rootlets. Gravel is subrounded fine to medium quartz. (Topsoil)

0.40

ES

0.50

0.60

154.71

0.65m

Reddish brown mottled grey slightly silty gravelly SAND. Gravel is subangular and subrounded granite and quartz. (Hummocky Glacial Deposits)

1.05

D

1.20

1.30

1.65m

Reddish brown slightly sandy very clayey GRAVEL with a low subrounded granite cobble content. Gravel is subangular to subrounded fine to coarse coal and granite. (Hummocky Glacial Deposits)

153.06

0.70m

Soft orangish brown slightly gravelly sandy SILT. Gravel is angular to rounded fine to coarse granite and shale. (Hummocky Glacial Deposits)

2.70

D

2.80

2.90

152.36

0.50m

Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine coarse granite, mudstone, shale and quartz. (Hummocky Glacial Deposits)

3.40

D

3.60

3.70

151.86

Hole Terminated at 3.90m bgl.

3.90

Remarks

Legend

Reason for Termination:

Groundwater Notes:

Other Remarks:

Samples:

Groundwater Strikes:

In-Situ Tests:

Reason for Termination:

Groundwater Notes:

Other Remarks:

Samples:

Groundwater Strikes:

In-Situ Tests:

Reason for Termination:

Groundwater Notes:

Other Remarks:

Samples:

Groundwater Strikes:

In-Situ Tests:

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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

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LOCATION ID: TP21	Project Name: Plot J, Kingsway Business Park		3.05 1.30 Pit Dimensions (m) Degrees	
	Project Number: MCS2374			
	Client: Wilson Bowden Developments Ltd			
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 11/01/2018	Stability: Unstable
Ground Level (m AOD): 152.17		Eastings & Northings: 391292E 411417N	Engineer: LJW	Checker: AD

[illegible]

Remarks		Legend		
Reason for Termination: Target depth achieved.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: Seepage noted at 1.05m bgl.				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:TP22

Hole Type: TP

Project Name:Plot J, Kingsway Business Park

Project Number:MCS2374

Client:Wilson Bowden Developments Ltd

Plant:CAT 320 F

Start & End Date:11/01/2018

Ground Level (m AOD):151.75

Eastings & Northings:391270E 411485N

Engineer:LJW

Checker:AD

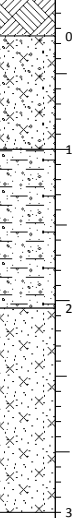
3.15

0.70

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			151.50	0.25m	Soft brownish grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is subrounded fine to coarse quartz. (Topsoil)		0.25	B	0.65	0.75		1.50	(150)kPa
			0.75m	Orangish brown slightly gravelly silty SAND with rare rootlets and a moderate subangular granite cobble content. Gravel is subangular and subrounded fine to coarse granite and sandstone. (Hummocky Glacial Deposits)	D		0.65	0.75					
			150.75		ES		0.65	0.75					
			1.05m		D		1.40	1.50					
			149.70		Stiff dark reddish brown slightly gravelly sandy CLAY with a low subrounded granite cobble content and rare pockets of medium and coarse grey sand. Gravel is subangular and subrounded fine to coarse granite, siltstone and shale. (Hummocky Glacial Deposits)		B	2.35	2.45				
1.35m	Light orangish brown silty SAND. (Hummocky Glacial Deposits)												
		148.35	Hole Terminated at 3.40m bgl.										

Remarks

Reason for Termination:
Target depth achieved.

Groundwater Notes:
Seepage noted at 1.00m bgl.

Other Remarks:
1. No visual or olfactory evidence of contamination.

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
 Groundwater Strike
 Resting
 Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

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LOCATION ID: TP23	Project Name: Plot J, Kingsway Business Park		3.00 0.85 Pit Dimensions (m) Degrees	
	Project Number: MCS2374			
	Client: Wilson Bowden Developments Ltd			
	Hole Type: TP	Plant: CAT 320 F	Start & End Date: 11/01/2018	Stability: Unstable
Ground Level (m AOD): 153.47		Eastings & Northings: 391244E 411456N	Engineer: TY	Checker: AD

[illegible]

Remarks		Legend		
Reason for Termination: Target depth achieved.		Samples: B - Bulk D - Disturbed ES - Environmental Sample	Groundwater Strikes:  Groundwater Strike  Resting  Groundwater Level	In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test
Groundwater Notes: Seepage noted at 0.80m bgl.				
Other Remarks: 1. No visual or olfactory evidence of contamination.		BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ	Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100	 CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID: TP24

Hole Type: TP

Project Name: Plot J, Kingsway Business Park

Project Number: MCS2374

Client: Wilson Bowden Developments Ltd

Plant: CAT 320 F

Start & End Date: 11/01/2018

Ground Level (m AOD): 154.00

Eastings & Northings: 391253E 411437N

Engineer: LJW

Checker: AD

3.20

0.70

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

3.85m bgl

153.50

0.50m

Grass over very soft dark brownish grey slightly gravelly sandy CLAY with abundant rootlets. Gravel is angular to subrounded fine to coarse flint, granite and sandstone. (Topsoil)

0.50

153.10

0.40m

Yellowish brown silty sandy GRAVEL with rare rootlets and a low subrounded granite cobble content. Gravel is angular to subrounded fine to coarse flint, granite, sandstone and quartz. (Hummocky Glacial Deposits)

0.90

151.85

1.25m

Reddish brown silty very sandy GRAVEL with rare plant material. Gravel is subangular and subrounded fine to coarse granite, mudstone, sandstone and quartz. (Hummocky Glacial Deposits)

2.15

151.70

0.15m

Light orangish brown slightly silty gravelly SAND with occasional black mottling. Gravel is subangular fine to coarse granite and sandstone. (Hummocky Glacial Deposits)

2.30

150.50

1.20m

Soft reddish brown sandy SILT. Sand is fine and medium. (Hummocky Glacial Deposits)

3.50

150.10

0.40m

Firm brown slightly sandy slightly gravelly CLAY with a low subrounded granite cobble content. Gravel is angular to subrounded fine to coarse granite, mudstone and shale. (Hummocky Glacial Deposits)

3.90

Hole Terminated at 3.90m bgl.

Type

From (m)

To (m)

Type

Depth (m)

Result

ES

0.20

0.30

B

0.60

0.70

B

1.80

1.90

B

2.20

2.30

D

2.50

2.60

2.80

(29)kPa

2.80

(30)kPa

2.80

(36)kPa

D

3.60

3.70

ES

3.60

3.70

3.60

(58)kPa

3.60

(60)kPa

3.60

(67)kPa

Remarks

Reason for Termination: Target depth achieved.

Groundwater Notes: Medium inflow noted at 3.85m bgl.

Other Remarks: 1. No visual or olfactory evidence of contamination.

Samples: B - Bulk D - Disturbed ES - Environmental Sample

Groundwater Strikes: Groundwater Strike Resting Groundwater Level

In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP25		Project Name: Plot J, Kingsway Business Park			2.90 1.00 Pit Dimensions (m) Degrees																	
		Project Number: MCS2374																				
		Client: Wilson Bowden Developments Ltd																				
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 11/01/2018			Stability: Unstable																
Ground Level (m AOD): 155.35		Eastings & Northings: 391244E 411400N			Engineer: TY		Checker: AD															
Groundwater		Strata				Samples			In-Situ Tests													
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result									
					Grass over dark grey brown slightly gravelly silty SAND with a low subangular and subrounded granite cobble content and abundant rootlets. Gravel is angular to subrounded granite, shale and quartz.		0.50															
			154.85	0.50m																		
				0.35m			0.85	D	0.85	0.95		0.90	(28)kPa									
			154.50		(Topsoil)			ES	0.85	0.95		0.90	(38)kPa									
				0.35m	Reddish brown mottled grey slightly gravelly sandy SILT. Gravel is subangular and subrounded granite and quartz. (Hummocky Glacial Deposits)		1.20	B	1.40	1.50		0.90	(40)kPa									
			154.15																			
				0.85m	Reddish brown silty sandy GRAVEL. Gravel is subangular and subrounded granite, shale and quartz. (Hummocky Glacial Deposits)																	
			153.30				2.05															
				1.20m	Reddish brown slightly gravelly very silty SAND. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)			D	2.40	2.50		2.45	(14)kPa									
					Soft reddish brown slightly gravelly sandy SILT. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)			ES	2.40	2.50		2.45	(22)kPa									
					Below 2.80m bgl, very sandy.							2.45	(24)kPa									
			152.10				3.25															
				0.35m	Yellowish brown slightly gravelly SAND. Gravel is subangular and rounded granite and sandstone. (Hummocky Glacial Deposits)			B	3.50	3.60												
			151.75				3.60															
					Hole Terminated at 3.60m bgl.																	
Remarks														Legend								
Reason for Termination:														Samples:			Groundwater Strikes:			In-Situ Tests:		
Target depth achieved.														B - Bulk			Groundwater Strike			HSV - Hand Shear		
Groundwater Notes:														D - Disturbed			Resting			Vane Test		
No groundwater encountered														ES - Environmental Sample			Groundwater Level			PID - Photo Ionisation Detector Test		
Other Remarks:														BWB Consulting Ltd			Web:			BWB		
1. No visual or olfactory evidence of contamination.														Waterfront House			bwbconsulting.com			CONSULTANCY ENVIRONMENT		
														Station Street			E: nottingham			INFRASTRUCTURE BUILDINGS		
														Nottingham			@bwbconsulting.com					
														NG2 3DQ			P: 0115 9241100					

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP26		Project Name: Plot J, Kingsway Business Park			3.05 0.75Pit Dimensions (m) Degrees																	
		Project Number: MCS2374																				
		Client: Wilson Bowden Developments Ltd																				
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 11/01/2018					Stability: Unstable														
Ground Level (m AOD): 156.76		Eastings & Northings: 391267E 411348N			Engineer: TY		Checker: AD															
Groundwater		Strata					Samples		In-Situ Tests													
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result									
			156.21	0.55m	Grass over dark greyish brown slightly gravelly silty SAND with abundant rootlets. Gravel is angular to subrounded fine to coarse granite, shale and quartz. (Topsoil)		0.55	ES	0.10	0.20												
			155.31	0.90m	Orangish brown slightly silty sandy GRAVEL. Gravel is subangular and subrounded granite, sandstone, shale and quartz. (Hummocky Glacial Deposits)		1.45	B ES	0.90 0.90	1.00 1.00												
			153.86	1.45m	Reddish brown slightly gravelly very silty SAND. Gravel is angular to subrounded granite, mudstone and shale. (Hummocky Glacial Deposits)		2.90	B D	1.85 1.85	1.95 1.95												
			153.01	0.85m	Reddish brown slightly gravelly sandy SILT. Gravel is angular and subangular granite, mudstone and shale. (Hummocky Glacial Deposits)		3.75	D	3.40	3.50		3.40 3.40 3.40	(17)kPa (22)kPa (24)kPa									
					Hole Terminated at 3.75m bgl.																	
Remarks														Legend								
Reason for Termination: Target depth achieved.														Samples: B - Bulk D - Disturbed ES - Environmental Sample			Groundwater Strikes: Groundwater Strike Resting Groundwater Level			In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test		
Groundwater Notes: No groundwater encountered																						
Other Remarks: 1. No visual or olfactory evidence of contamination.														BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ			Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100			BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS		

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP27		Project Name: Plot J, Kingsway Business Park			2.30 0.65Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 08/01/2018			Stability: Unstable							
Ground Level (m AOD): 157.50		Eastings & Northings: 391246E 411320N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples			In-Situ Tests				
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
				1.10m	Grass over dark grey very clayey SAND with rare glass fragments up to 30mm and organic odour. (Topsoil)			B ES	0.45 0.45	0.55 0.55			
			156.40	0.55m	Firm orangish brown mottled grey slightly gravelly sandy CLAY. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits)		1.10	B	1.20	1.30		1.20 1.20 1.20	(108)kPa (88)kPa (99)kPa
			155.85	2.00m	Orangish brown mottled grey silty gravelly SAND with a low subrounded quartz cobble content. Gravel is subrounded fine to coarse quartz. (Hummocky Glacial Deposits) Below 1.85m bgl, slightly gravelly very silty.		1.65	B ES	1.75 1.75	1.85 1.85			
								B	3.20	3.30			
	3.65m bgl		153.85		Hole Terminated at 3.65m bgl.		3.65						
Remarks								Legend					
Reason for Termination: Target depth achieved.								Samples: B - Bulk D - Disturbed ES - Environmental Sample		Groundwater Strikes: Groundwater Strike Resting Groundwater Level		In-Situ Tests: HSV - Hand Shear Vane Test PID - Photo Ionisation Detector Test	
Groundwater Notes: Slow inflow noted at 3.65m bgl.													
Other Remarks: 1. No visual or olfactory evidence of contamination.								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS	

TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID: TP28		Project Name: Plot J, Kingsway Business Park			2.30 0.65Pit Dimensions (m) Degrees								
		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
Hole Type: TP		Plant: CAT 320 F	Start & End Date: 08/01/2018			Stability: Unstable							
Ground Level (m AOD): 155.43		Eastings & Northings: 391223E 411389N			Engineer: LJW		Checker: AD						
Groundwater		Strata				Samples		In-Situ Tests					
Strike	Strike Details	Backfill	Level (m AOD)	Thickn ess	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Grass over very soft dark grey slightly gravelly sandy CLAY with abundant rootlets and organic odour. Gravel is subangular fine to coarse sandstone.			D	0.20	0.30			
			154.93	0.50m	(Topsoil)		0.50	B	0.60	0.70			
			154.43	0.50m	Light grey mottled orange silty gravelly SAND. Gravel is subrounded fine to coarse quartz.		1.00						
				0.60m	(Hummocky Glacial Deposits)								
			153.83		Reddish brown sandy very silty GRAVEL. Gravel is subrounded fine to coarse quartz.		1.60						
					(Hummocky Glacial Deposits)			D	2.00	2.10			
					Reddish brown slightly gravelly very silty SAND.			ES	2.00	2.10			
					(Hummocky Glacial Deposits)								
				2.10m									
			151.73				3.70	B	3.40	3.50			
			151.53	0.20m	Light orangish brown slightly gravelly medium and coarse SAND. Gravel is angular and subangular fine to coarse black stained sandstone		3.90	B	3.70	3.90			
					(Hummocky Glacial Deposits)								
					Hole Terminated at 3.90m bgl.								
Remarks													
Reason for Termination:								Legend					
Target depth achieved.								Samples:		Groundwater Strikes:		In-Situ Tests:	
Groundwater Notes:								B - Bulk		Groundwater Strike		HSV - Hand Shear	
No groundwater encountered								D - Disturbed		Resting		Vane Test	
Other Remarks:								ES - Environmental Sample		Groundwater Level		PID - Photo Ionisation Detector Test	
1. No visual or olfactory evidence of contamination.								BWB Consulting Ltd Waterfront House Station Street Nottingham NG2 3DQ		Web: bwbconsulting.com E: nottingham@bwbconsulting.com P: 0115 9241100		BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS	

TRIAL PIT LOG

Scale: 1:50

Sheet 1 of 1

LOCATION ID: TP29

Hole Type: TP

Project Name: Plot J, Kingsway Business Park

Project Number: MCS2374

Client: Wilson Bowden Developments Ltd

Plant: CAT 320 F

Start & End Date: 08/01/2018

Ground Level (m AOD): 155.11

Eastings & Northings: 391199E 411364N

Engineer: LJW

Checker: AD

2.15

0.65

Pit Dimensions (m)

Degrees

Stability: Unstable

Groundwater

Strike

Strike Details

Backfill

Level (m AOD)

Thickn ess

Description

Legend

Depth (m bgl)

154.81

0.30m

Very soft dark grey slightly sandy slightly gravelly CLAY with abundant rootlets and slight organic odour. Gravel is subangular and subrounded fine and medium sandstone, tile and quartz. (Made Ground)

0.30

154.26

0.55m

Light yellowish grey slightly gravelly silty SAND. Gravel is subangular and subrounded fine to coarse sandstone and siltstone. (Hummocky Glacial Deposits)

0.85

2.85m

Reddish brown slightly gravelly very silty fine and medium SAND. Gravel is subrounded fine to coarse flint and quartzite. (Hummocky Glacial Deposits)

151.41

Hole Terminated at 3.70m bgl.

3.70

Type

From (m)

To (m)

Type

Depth (m)

Result

ES

0.10

0.20

B

0.50

0.60

ES

0.50

0.60

B

1.80

1.90

Remarks

Reason for Termination: Target depth achieved.

Groundwater Notes: No groundwater encountered

Other Remarks: 1. No visual or olfactory evidence of contamination.

Samples:

Groundwater Strikes:

In-Situ Tests:

B - Bulk

D - Disturbed

ES - Environmental Sample

Groundwater Strike

Resting

Groundwater Level

HSV - Hand Shear

Vane Test

PID - Photo Ionisation

Detector Test

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TRIAL PIT LOG

Scale: 1:50Sheet 1 of 1

LOCATION ID:		Project Name: Plot J, Kingsway Business Park				2.25 0.65 Pit Dimensions (m) Degrees							
TP30		Project Number: MCS2374											
		Client: Wilson Bowden Developments Ltd											
		Plant: CAT 320 F		Start & End Date: 08/01/2018									
Hole Type: TP						Stability: Unstable							
Ground Level (m AOD): 158.09		Eastings & Northings: 391224E 411301N				Engineer: LJW		Checker: AD					
Groundwater		Strata					Samples			In-Situ Tests			
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Soft greyish brown slightly gravelly sandy CLAY with a low angular brick cobble content and organic odour. Gravel is angular to subrounded fine to coarse brick and quartz. (Made Ground)			ES	0.35	0.45			
			156.69	0.70m	Orangish brown mottled grey slightly gravelly SAND. Gravel is angular to subrounded fine to coarse siltstone and quartz. (Hummocky Glacial Deposits)		1.40	B	1.70	1.80			
			155.99	0.80m	Orangish brown gravelly very silty SAND. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)		2.10	ES	1.70	1.80			
			155.19	0.60m	Orangish brown with rare green mottling silty sandy GRAVEL. Gravel is subangular and subrounded fine to coarse sandstone and quartz. (Hummocky Glacial Deposits)		2.90	B	2.80	2.90			
			154.59		Hole Terminated at 3.50m bgl.		3.50						
Remarks													
Reason for Termination:								Samples:					
Target depth achieved.								Groundwater Strikes:					
Groundwater Notes:								In-Situ Tests:					
Medium inflow noted at 3.00m bgl.								B - Bulk					
Other Remarks:								D - Disturbed					
1. No visual or olfactory evidence of contamination.								ES - Environmental					
								Sample					
								Groundwater Level					
								BWB Consulting Ltd					
								Waterfront House					
								Station Street					
								Nottingham					
								NG2 3DQ					
								Web:					
								bwbconsulting.com					
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								INFRASTRUCTURE BUILDINGS					

APPENDIX 3

DRILLERS' LOGS

DAILY REPORT

[illegible]

QUANTITIES:		Boring . 6.50 m	Bulks	Jars S	U100	GPT/SPT S
				Reason	Hrs.	Drillers Signature

Key: W = Water Sample. SPT CPT = Insitu Penetration Test. S = Spoon. C = Cone.
U100 = Undisturbed. J = Small Disturbed (jar) Sample. B = Bulk Disturbed Sample.