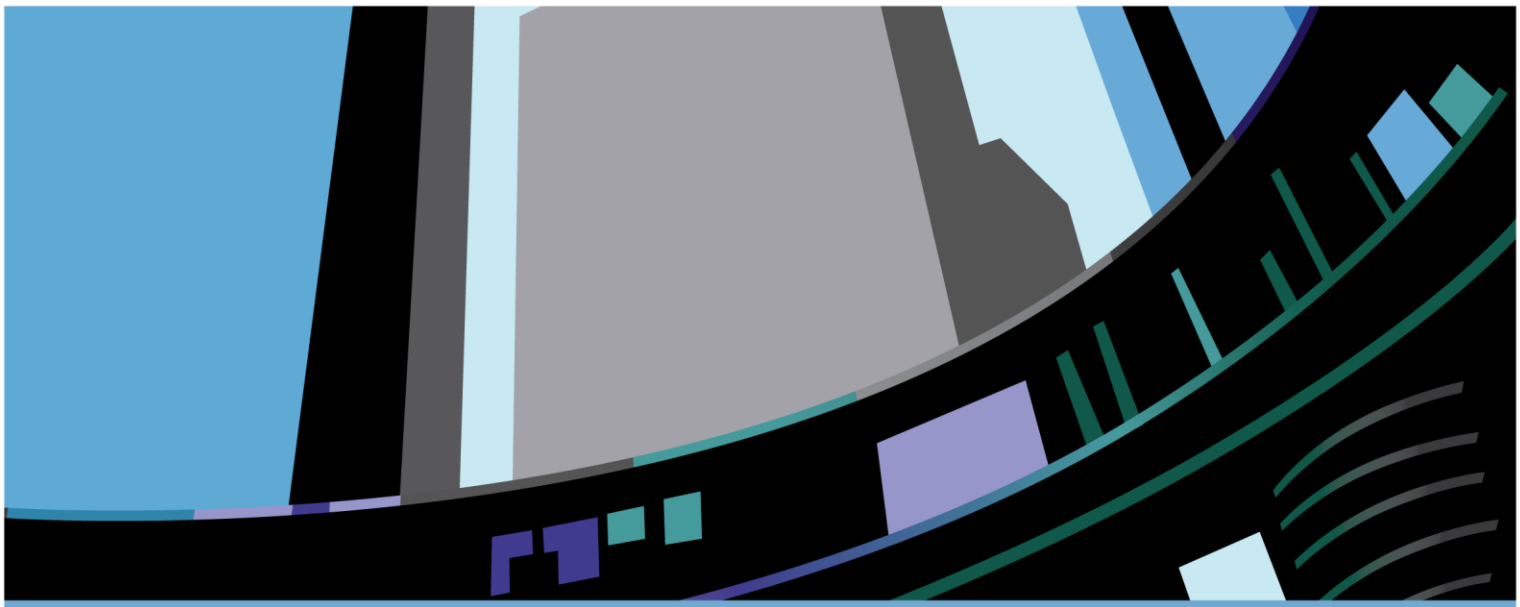

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Report

Phase II Ground Investigation Report

Project: Land off Burn Road,
Prince Royd, Huddersfield,
HD3 3BT

Client: James Dyson, Ruth Bentley and Susan Hill

Reference: B22335-JNP-11-00-RP-G-1001

Date: February 2020

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DOCUMENT CONTROL SHEET

Phase I and II Ground Investigation Report

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FOR AND ON BEHALF OF JNP GROUP

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jnpgroup was instructed by the clients, James Dyson, Ruth Bentley and Susan Hill, to undertake a Phase II Geo-Environmental Investigation and Assessment of a site known as 'Land off Burn Road, Huddersfield' (hereinafter referred to as 'the site'). This report is subject to the limitations presented in Appendix A. This document provides a summary of the findings.

Site Location	Land to the west of Burn Road, Huddersfield. HD2 2DH.
Development Scheme	The site is split into two halves: a northern half and a southern half. These are currently two adjacent fields separated by a steam. **Northern Half**: Residential development proposed to comprise nine new residential detached dwellings with private gardens, new access roads and areas of hardstanding for parking and servicing. **Southern Half:** Residential development proposed to comprise eleven new residential detached dwellings with private gardens, new access roads (shared with the northern half) and areas of hardstanding for parking and servicing.
National Grid Reference	**Northern Half:** 411970 418950 **Southern Half:** 411960 418900
Site Description / Features	The site is located approximately 3.0 km north-west of Huddersfield town centre. Burn Road is situated off Halifax Road, 20 m south of the M62 Junction 24 roundabout. The sites past use has been primarily agricultural and remains undeveloped, with the exceptions of some small farming sheds in the south-east and centre of the northern half. A small substation is also located in the north-east of the southern half. The overall area of the site measures approximately one hectare. The site is covered entirely in soft-standing, including mossy grass with other low-lying vegetation. The edges of the site were more overgrown, and inaccessible during the ground investigation. Trees were situated to the north, south and west of the site (some within the site boundary, as well as alongside the stream). The stream runs from west to east across the length of the site, separating the northern half from the southern half. The stream cuts across the north-eastern corner of the southern half, then leads east and into Grimescar Dike. The watercourse has formed a small valley within the site, causing the levels to decrease towards the south-east in the northern half, and towards the north-east in the southern half. The site was accessed via gates within a sandstone wall which runs along Burn Road, adjacent to the east of the site.

Surrounding Land Use	**Direction**	**Land Use**
	North	Agricultural land with new residential developments beyond
	East	Burn Road, new residential developments beyond
	South	Residential developments and graveyard
	West	Wooded area and a petrol filling station
Geology	The following summary is based on a review of online information obtained from the BGS at http://mapapps2.bgs.ac.uk/geoindex/home.html	
	Lithology	**Description**
	Made Ground:	None recorded in BGS data
	Superficial Deposits:	None recorded in BGS data
	Bedrock Geology: Pennine Lower Coal Measures Formation	Described by the BGS as *'Interbedded grey mudstone, siltstone and pale grey sandstone.'*.
	Geological Faults:	None at the site. Birchencliffe Fault indicated on BGS maps to be located approximately 75 m south of the site's southern boundary. Another smaller fault is indicated approximately 50 m north of the site's northern boundary.

<table>
<tr><td rowspan="3">Ground Investigation</td><td>Scope</td><td colspan="3">Detail</td></tr>
<tr><td>Site work</td><td colspan="3">A site investigation comprising the formation of ten dynamic sample boreholes (WS01 to WS05 in the northern half, and WS06 to WS10 in the southern half) were undertaken on 16th December 2019 with the purpose of assessing the underlying ground conditions. The boreholes were placed in an even spread across the entire site, where land was flat enough to drill. An additional hand excavated pit was formed at the north-west of the northern half because the drilling rig was unable to access this area. The site was too steep to investigate nearer to the river; however as houses and gardens are proposed to be situated away from this then it is not considered to be an issue.

The boreholes were formed using a dynamic sampling rig to depths of 1.00 m to 3.00 m bgl (below ground level). All were terminated on refusal at rockhead. Representative disturbed and environmental soil samples were collected at regular depth intervals.

Prior to excavation, the proposed exploratory holes were scanned by “CAT & Genny” to clear for unrecorded services and all works were undertaken in accordance with BS5930:2015 and BS1075 (2001+A1:2013 +A2:2017).</td></tr>
<tr><td>Laboratory testing</td><td colspan="3">Six environmental soil samples (three topsoil, one Made ground, two natural strata) were tested to determine concentrations of CLEA metals, copper and zinc, PAHs and screened for asbestos. Two of the samples (topsoil) were also tested for total petroleum hydrocarbons (TPHs).

Four recovered soil samples (two topsoil, two natural strata) were tested for chemical suites to determine ground aggressivity (in accordance with BRE Special Digest 1).

Four recovered cohesive soil samples (natural strata) were tested to determine moisture contents and Atterberg Limits (plasticity).

All laboratory geotechnical testing was undertaken in accordance with BS1377:1990

All samples were transferred on the day of collection to i2 Analytical Testing Services in Watford, which is accredited under UKAS and MCerts.</td></tr>
<tr><td rowspan="7">Ground Conditions Encountered</td><td colspan="4">The ground conditions encountered at the site are summarised as follows:</td></tr>
<tr><td colspan="2">Lithological Unit</td><td>Location on-site</td><td>Depth to base (m bgl)</td><td>Description</td></tr>
<tr><td colspan="2">Topsoil</td><td>Both halves of the site</td><td>0.20 – 0.40</td><td>Encountered in all boreholes.

Generally a dark brown or grey/brown clayey loam.</td></tr>
<tr><td rowspan="2">Made Ground</td><td>North</td><td>0.60
Where present</td><td>WS02 only.

Stiff yellow sandy clay and a sandstone cobble.</td></tr>
<tr><td>South</td><td>0.40 – 0.80
Where present</td><td>WS06, WS09, WS10 only.

Brown, sandy clays and sandy, gravelly clays.

Generally situated at higher ground levels.</td></tr>
<tr><td rowspan="2">Pennine Lower Coal Measures
(weathered)</td><td>North</td><td>1.40 – 2.40</td><td>All boreholes.

Soft to stiff / dense, yellow and brown, sandy and gravelly clays, clayey sands and clayey gravelly sands.</td></tr>
<tr><td>South</td><td>0.80 – 1.60</td><td>All boreholes.

Soft to firm / dense brown sandy gravelly clays and clayey sandy gravels.</td></tr>
<tr><td>Pennine Lower Coal Measures
(less weathered to competent)</td><td>North</td><td>Not proven</td><td>Grey / yellow sandstone at the base of WS01.

Encountered only as refusal, indicating competent rock, in WS02 – WS05.</td></tr>
</table>

		South	Not proven	Weak, laminated, brown, micaceous sandstone Encountered in WS05 – WS10. Increased strength of bedrock indicated by refusal at 1.0 – 3.0 m bgl.
	Interpretation of the ground conditions Groundwater was identified within only the southern half of the site. This may be due to lower levels within the southern half of the site, relative to the north. The groundwater in the southern half appears to deepen towards the watercourse. Monitoring visits indicated the groundwater within the southern half to vary over time (over a period of about one month) by approximately 1.0 m. The boreholes (terminated on refusal) in the northern half indicated the groundwater level to be located within the bedrock to the north of the watercourse. The first layers of natural ground intersected by the boreholes (across the entire site) were interpreted to be the significantly weathered upper layers of the Pennine Lower Coal Measures. These were present as unconsolidated clays, sands and gravels. Weak but consolidated (and laminated) sandstone was recovered from the base of the boreholes from predominantly the southern half of the site. Only 0.10 m of sandstone was recovered from the northern half of the site (WS01) before refusal was encountered. This weak sandstone layer represents the less weathered Pennine Lower Coal Measures, and the top of the bedrock (rockhead). The increase in SPT N values to 50 (refusal) (1.50 – 2.40 m bgl in the northern half, 1.0 – 3.0 m bgl in the southern half) demonstrates the decrease in weathering of the bedrock, to a competent sandstone. Within the southern half of the site, the top of the bedrock may have been weakened due to increased amounts of weathering amplified by a higher water table. Overall, the top of the natural soils and rockhead surfaces can be described as generally following the shape of the topography. Geotechnical parameters derived from in-situ and laboratory testing are included in Table 1 and 2. **Northern Half:** Laboratory tests undertaken on samples of Natural Ground indicated a high plasticity and low volume change potential. **Southern Half:** Laboratory tests undertaken on samples of Natural Ground indicated an intermediate to high plasticity and a medium volume change potential.			
In-situ Evidence of Contamination	No significant contamination was identified during formation of the trial pits by sight or smell, although small amounts of potential coal were identified within the Made Ground in WS06, WS09 (also with potential clinker) and WS10.			
In-situ Substructure	No structures were encountered below the ground surface.			
Groundwater Conditions	**Northern Half:** Groundwater was not encountered within any of the boreholes. **Southern Half:** Groundwater was encountered at approximately 1.0 m bgl in WS06 – WS08 and at approximately 2.0 m bgl in WS09. It was not encountered in WS10.			
Soil Chemistry	Soil chemical testing results are summarised in Tables 3 and 4. From a detailed comparison of the chemical testing results with the published C4SL and S4UL, for a residential with plant uptake scenario, the following summary can be made: • There were exceedances of the following metals: arsenic (WS06 topsoil), beryllium (WS08 topsoil and WS10 Made Ground) within the southern half of the site. • There were also exceedances of the following PAHs: benzo(b)fluoranthene (WS06 topsoil), benzo(a)pyrene (WS06 topsoil) and dibenz(a,h)anthracene (WS06 topsoil) within the southern half of the site.			
Human Health Risk Assessment	The metal and PAH exceedances recorded within the topsoil and Made Ground are considered a risk to Human Health. Exceedances were identified within the topsoil and the Made Ground in the northern and southern sites, without further testing and delineation, the topsoil is not considered fit for purpose and will not be able to be re-used in the development of the new residential housing. Contamination was not identified within any of the natural strata present.			

Groundwater Risk Assessment	As mobile species of hydrocarbons were recorded during the ground investigation, these have potential to leach into deeper levels of the ground and contaminate groundwater, emphasising the need for remediation of contaminated soils.	
Ground Gas Assessment	The ground gas assessment has been undertaken following the guidance in CIRIC C665 2007, BS 8485 2015+A1 2019 and CL:AIRE RB17 2012. The calculated gas screening values are given in Table 5. A CS 2 determination applies across both the northern and southern sites as a result of a combination of moderate flow rates and carbon dioxide, indicating that gas protection measures are required. Based on BS8485 (2015+A1 2019) the following gas protection measures are necessary: • Good performance passive sub-floor ventilation (1.5 points) • Traditional beam and block floor (0 points) • Installation of gas resistant membrane fulfilling all requirements within Table 7 of BS8485 (2015+A1 2019) with verification in accordance with CIRIA (2 points).	
Revised Conceptual Site Model	The Conceptual Site Model has been produced on the basis of the data obtained from the Ground Investigation and is included as Table 6. An overall MEDIUM risk has been concluded from the assessment, due to the presence of metal and PAH contamination within near-surface soils.	
Geotechnical Assessment	**Desiccation**	Following laboratory testing of cohesive soils, two commonly accepted methods for determining the degree of desiccation (as stated in BRE 412 'Desiccation in Clay Soils') are as follows: • Desiccation has occurred when the Moisture Content is less than the Plastic Limit; • Significant desiccation has occurred when the Moisture Content is less than 0.4 x the Liquid Limit. **Northern Half:** When the results of laboratory testing are compared with Method 1, the samples of natural soil from WS01 at 0.70 m bgl and WS04 at 0.50 m bgl are considered to be desiccated. When the results of laboratory testing are compared with Method 2, the soil are not considered as significantly desiccated. **Southern Half:** When the results of laboratory testing are compared with Method 1, the samples of natural soil from WS07 at 0.70 m bgl and WS10 at 0.60 m bgl are considered to be desiccated. When the results of laboratory testing are compared with Method 2, the soil are not considered as significantly desiccated.
	Foundations	**Northern Half:** Natural cohesive material which underwent testing for the moisure content suite indicated a high plasticity and low volume change potential. **Southern Half:** Natural cohesive material tested for the moisure content suite indicated an overall high platicity and low to medium volume change potential. Refusal was encountered at maximum depths of 2.4 m bgl in the northern half, and 3.0 m bgl in the southern half. **Northern Half:** Topsoil/Made Ground were found to be 0.60 m deep and are not considered suitable to found upon. Traditional strip footings 600 mm wide are considered feasible for the proposed development providing the foundations are positioned with the dense sands as a minimum. Footings founded at a depth of at least 1.0 m bgl will provide an allowable bearing capacity of 125 kN/m^2 with a total settlement of less than 25 mm. **Southern Half:** Topsoil/Made Ground were found to be up to 0.80 m deep and are not considered suitable to found upon. The increased variability of ground conditions within the southern half of the site means that the depths of foundations may vary. Bedrock was found to be shallow within lower levels of the site (close to the stream), as indicated by an N value of 50 at 1.00 m in WS10. In these

		areas, shallow strip foundations may be placed directly onto bedrock, which will provide a bearing capacity in excess of 125 kN/m^2 with a total settlement of less than 25 mm. In areas where bedrock is over 1.00 m bgl, the above bearing capacity can be achieved by founding 1.00 bgl into the firm clays or medium dense sands. In comparison, the higher levels of the site (south-west) were found to host softer ground, with deeper bedrock. Groundwater occurs at shallow levels (<1.0 m bgl) in these parts, therefore although strip foundations may be viable, the foundations would require further deepening in order to reach dense sands of the weathered sandstone. It should be noted that the presence of ground water in the sands and gravels would significantly reduce the allowable bearing capacity. At this stage standard strip foundations will be suitable for the majority of the site, however further assessment will be required in the area where soft clays and shallow ground water was required. In all cases, the shallow strip foundations should be keyed wholly into the required clays/sands and sandstone bedrock by at least 150 mm. In order to reduce the risk of differential settlement (cracking where foundations span across both cohesive and granular ground), the founding material should be consistent across each building. Foundation depths should be increased until a consistent material can be founded upon. Alternatively, in the case that foundations span across both cohesive and granular ground, it is recommended that steel reinforcement is incorporated into all foundations, both top and bottom. This would need to be designed by the structural engineer.
	Ground floor slabs	**Northern Half:** A maximum of 0.60 m of topsoil and Made Ground was recorded at the north of the site. In addition, the underlying natural soils are indicated to have low volume change potential, therefore suspended ground floor slabs are recommended with a minimum sub floor void of 50mm. Heave precautions are not required for the side of foundations. **Southern Half:** A maximum of 0.80 m topsoil and Made Ground was recoded at the southern half of the site. The underlying natural soils are also indicated to have up to a medium volume change potential therefore have the potential to heave. Consequently, suspended ground floor slabs should be incorporated within the design, along with a minimum sub floor void of 100 mm below and 25 mm to the side of the foundations. In addition, as analysis indicates the possibility of dessiccation, deepening of foundations should be considered for developments which will be located close to trees. Refer to the recommendations provided in NHBC Chapter 4.2.
	Excavations and groundwater	Groundwater was encountered within four of the southern boreholes therefore groundwater ingress to excavations is anticipated. In addition, as granular components were identified within the boreholes, excavations may undergo partial collapse, with deeper excavations particularly prone to rapid, unpredictable, large scale collapse, especially if there are any groundwater inflows. Should personnel access be required to excavations, industry-standard health and safety measures should be employed in accordance with CDM 2015.
	Slope stability and Retaining walls	Should any steep slopes be incorporated within the structural design, retaining structures may be necessary.
	Road Pavement Design and Frost Susceptibility	**CBR testing has not been undertaken for the site, however plasticity index values have been used to provide estimated CBR values.** In general, CBR values of less than 2.0 % should be assumed for all Made Ground. **Northern Half:** A mean Plasticity Index value of 22 % was recorded in the near-surface soils from the northern half of the site, and indicates an equilibrium subgrade CBR value of 5.0 % (based upon Table 5.1 in Interim Advice Note 73/06 Rev 1 2009), assuming average construction conditions, and high water table. It is recommended that pavement design is based on this value.

		Southern Half: A mean Plasticity Index value of 26 % was recorded in the near-surface soils from the southern half of the site, and indicates an equilibrium subgrade CBR value of 4.0 % (based upon Table 5.1 in Interim Advice Note 73/06 Rev 1 2009), assuming average construction conditions, and high water table. It is recommended that pavement design is based on this value. It is however recommended that the subgrade CBR value is verified immediately before placement of the pavement capping/subbase to confirm the minimum design CBR value. The design CBR value should not be increased on the basis of these tests. Should testing indicate a subgrade CBR less than the design value, then measures should be taken to improve the subgrade before proceeding with pavement construction. Soils with a Plasticity Index greater than 15% would not generally be frost-susceptible (i.e. susceptible to ice lens formation in frosty conditions) (Croney and Jacobs, 1967) therefore the cohesive soils encountered on-site are not indicated to be susceptible to frost.
	Concrete Classification	From the results of the laboratory testing, and in accordance with BRE SD1 (2005) "Concrete in aggressive ground", a Design Sulphate Class of DS1, with an ACEC of AC-3z is indicated to apply for buried concrete.
Conclusions and Recommendations	• The geology across the site includes topsoil with areas of Made Ground (to a maximum depth of 0.6 m bgl in the northern half and 0.80 m bgl in the southern half), weathered Pennine Lower Coal Measures (to 2.4 m bgl in the northern half, 1.6 m bgl in the southern half) and less weathered to competent sandstone of the Pennine Lower Coal Measures (base not proven). • Natural cohesive soils have a high plasticity but low volume change potential in the northern half of the site and an intermediate to high plasticity with a medium volume change potential in the southern half of the site. • Elevated levels of metals and PAHs have been identified within the topsoil / Made Ground in the southern half of the site. Delineation of the contaminated areas is advised, followed by remediation or removal of contaminated soils off-site. • In the northern half of the site, shallow strip foundations lowered to 1.00 m bgl will provide an allowable bearing capacity of 125 kN/m^2 with a total settlement of less than 25 mm. • In the southern half of the site, shallow strip foundations lowered to 1.00 m bgl or less if bedrock is encountered (lower levelled areas), will also provide an allowable bearing capacity of 125 kN/m^2 with a total settlement of less than 25 mm. • Softer areas in the south of the southern half of the site will likely require trench foundations to be deepened due to softer ground where groundwater levels are shallower. Alternatively, piled foundations may be needed if competent ground is too deep for traditional strip foundations.	

REFERENCES

1. AGS: 1999 : Electronic transfer of geotechnical and geo-environmental data (3rd edition). Association of Geotechnical and Geo-environmental Specialists.
2. ASTM : 1992 : Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils. Designation D1586-84 (reapproved 1992). American Society for Testing and Materials, West Conshohocken, USA.
3. BRE. 1991 (revised 2003). Special Digest 365: Soakaway Design.
4. BRE. 2005. Special Digest 1 : Concrete in Aggressive Ground. Building Research Establishment.
5. BS 1377. 1990. Methods of Test for soils for civil engineering purposes. British Standards Institution. London.
6. BS 5930. 2015. Code of practice for site investigations. British Standards Institution. London.
7. BS 8485. 2015.+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. British Standards Institution. London.
8. BS 8576. 2013. Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC). British Standards Institution. London.
9. BS 10175. 2001+A1:2013+A2:2017. Investigation of potentially contaminated sites - code of practice. British Standards Institution. London.
10. BS 15175. 2018. Soil quality - characterisation of contaminated soil related to groundwater protection. British Standard Institution. London.
11. BS 18400-104. 2018. Soil quality - sampling. Part 104: Strategies. British Standard Institution. London.
12. BS 18400-202. 2018. Soil quality - sampling. Part 202: Preliminary investigations. British Standard Institution. London.
13. BS 18400-203. 2018. Soil quality - sampling. Part 203: Investigation of potentially contaminated sites. British Standard Institution. London.
14. BS 18400-205. 2018. Soil quality - sampling. Part 205: Guidance on the procedure for investigation of natural, near-natural and cultivated sites. British Standard Institution. London.
15. Burland J B and M C Burbidge. 1985. Settlement of foundations on sand and gravel. Proc. ICE, Part 1, Vol 78.
16. Card G, Wilson S, Mortimore S. 2012. A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17. CL:AIRE. London.
17. CL:AIRE and Chartered Institute of Environmental Health (CIEH). 2008. Guidance on Comparing Soil Contamination Data with a Critical Concentration. CL:AIRE / CIEH. London.
18. CL:AIRE. 2013. SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. CL:AIRE. London.
19. CL:AIRE. 2016. Control of Asbestos Regulations 2012. Interpretation for managing and Working with Asbestos in Soil and Construction and Demolition Materials. Industry Guidance. CL:AIRE. London.
20. CL:AIRE. 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. CL:AIRE. London.
21. Clayton C R I. 1990. SPT energy transmission: theory, measurement and significance. Ground Engineering, December.

22. Chengini A and N A Trenter. 1995. The shear strength and deformation behaviour of a glacial till. Proceedings of International Conference on Advances in site investigation practice. ICE, London.
23. Clayton C R I. 1995. The Standard Penetration Test (SPT) : Methods and use. CIRIA Report 143. Construction Industry Research Information Association, London.
24. Croney D and J C Jacobs. 1967. The frost susceptibility of soils and road materials. RRL Report LR90. Transport Research Laboratory (formerly Road Research Laboratory), Crowthorne
25. CIRIA C665. 2007. Assessing Risks Posed by Hazardous Ground Gases to Buildings. CIRIA, London
26. CIRIA C733. 2014. Asbestos in Soil and Made Ground: A Guide to Understanding and Managing risks. CIRIA. London.
27. DEFRA and EA (2004). Model Procedures for the Management of Land Contamination. CLR11. Environment Agency. Bristol.
28. DEFRA.2014. PB14163. Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment.
29. DEFRA. 2014. SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. DEFRA. London.
30. de Mello V F B : 1971 : The Standard penetration Test. State of the Art Report. 4th Pan American Conference on Soil Mechanics and Foundation Engineering. Puerto Rico. Vol 1.
31. Driscoll R. 1983. The influence of vegetation on swelling and shrinking of clay soils in Britain. Geotechnique 23 (2): 93-105
32. Environment Agency. 2005. The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils. P5-080/TR3.
33. Environment Agency. 2006. Guidance on the design and installation of groundwater quality monitoring points. SC020093.
34. Environment Agency. 2006. Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination.
35. Environment Agency. 2008. Compilation of Date for Priority Organic Pollutants for Derivation of Soil Guideline Values. Science Report SC050021/SR7.
36. Environment Agency. 2009. Human Health Toxicological Assessment of Contaminants in Soil. Science Report SC050021/SR2. Bristol.
37. Environment Agency. 2009. Updated technical background to the CLEA model. Science Report SC050021/SR3. Bristol.
38. Environment Agency. 2009. CLEA Software (Version 1.06) - Science Report SC050021/SR4. Bristol.
39. Environment Agency. 2010. Waste acceptance at landfills – Guidance on waste acceptance procedures and criteria. Bristol.
40. Environment Agency. 2013. Chemical Standards Database - http://evidence.environment-agency.gov.uk/ChemicalStandards/ChemicalsByName.aspx
41. Environment Agency. 2015. Waste Classification: Guidance on the classification and assessment of waste. First Edition. Technical Guidance WM3. Bristol.

42. Environment Agency. 2019. Land Contamination: Risk Management. UK Government Website - https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks.
43. Eurocode 7. 1997. Geotechnical Design - Part 3, Design assisted by field testing. Pre-standard ENV 1997-3. British Standards Institution, London.
44. Gibbs H J and W G Holtz. 1957. Research on determining the density of sands by spoon penetration testing. Proceedings of 4th International Conference on Soil Mechanics and Foundation Engineering, London.
45. HD25/94. 1994. Design Manual for Roads and Bridges Volume 7. The Department of Transport.
46. IAN 73/06. 2009. Design Guidance for Road Pavement Foundations (Draft HD25).
47. Land Quality Management & Chartered Institute of Environmental Health (2015) The LQM/CIEH S4UL for Human Health Risk Assessment - LQM CIEH. Land Quality Press, Nottingham.
48. Nixon I K. 1982. Standard penetration test. State of the art report. Proceedings of the Second European Symposium on Penetration Testing, Amsterdam.
49. Peck R B, W E Hanson and T H Thornburn. 1974. Foundation Engineering, 2nd Edition. Wiley, New York.
50. Rodin S, B O Corbett, D E Sherwood and S Thorburn. 1974. Penetration testing in the UK, State of the art report. Proceedings of Symposium on Engineering Behaviour of Glacial Materials, Birmingham.
51. Skempton A W. 1986. Standard Penetration Test procedures and the effects in sands of overburden pressure, relative density, particle size, ageing and overconsolidation. Geotechnique 36, No 3.
52. Society of Brownfield Risk Assessment. Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater. Version 1. February 2017.
53. Sowers G F. 1979. Introductory Soil Mechanics and Foundations. Macmillan.
54. Stroud M A. 1974. The standard penetration test in insensitive clays and soft rocks. Proceedings of European Symposium on Penetration Testing, Stockholm.
55. Stroud M A and F G Butler. 1975. The standard penetration test and the engineering properties of glacial materials. Proceedings of Symposium on Engineering Behaviour of Glacial Materials, Birmingham.
56. Stroud M A. 1988. The standard penetration test - its application and interpretation on Penetration Testing in the UK, Birmingham. Thomas Telford, London.
57. Terzaghi K and R B Peck. 1967. Soil Mechanics in Engineering Practice, 2nd Edition. John Wiley, London.
58. Tokimatsu K. 1988. Penetration testing for dynamic problems. Proceedings of First International Symposium on Penetration Testing.
59. TPH Criteria Working Group. 1997. Total Petroleum Hydrocarbon Group Series. Volume 3. Selection of Representative TPH Fractions Based on Fate and Transport Considerations.
60. Water Framework Directive UK Technical Advisory Group. 2014. River and Lake Assessment Method Specific Pollutants (metals); Metal Bioavailability Assessment Took (M-BAT). Scotland.
61. Wilson S, Card G and Haines S.2008. Ground Gas Handbook. Dunbeath. Whittles Publishing.

Tables

Table 1 – Summary of Geotechnical Parameters – Northern Half of the site

	Parameter	Number of Tests	Values (Mean)	Classification
Geotechnical Parameters for Natural Ground (Northern Half)	Natural moisture content	2	23, 31 (27)	High plasticity, Low volume change potential
	% passing 425 sieve		71, 92 (82)	
	Liquid Limit %		53, 57 (55)	
	Plastic Limit %		32, 34 (33)	
	Plasticity Index %		19, 25 (22)	
	Modified Plasticity Index %		17, 18 (17.5)	
	SPT N values in weathered PLCM	6	22 – 47 (32)	Medium to high strength
	pH Conditions	3	4.9, 5.1 (5.0)	DS1 AC-3z
	Total Sulphur (%)		0.013, 0.027 (0.020)	
	Total Sulphate (%)		0.041, 0.090 (0.07)	
	Water soluble / dissolved SO^4 (mg/l)		29.3, 48.6 (39.0)	
Geotechnical Parameters for Made Ground (Northern Half)	pH Conditions	1	4.7	DS1 AC-3z
	Total Sulphur (%)		0.041	
	Total Sulphate (%)		0.097	
	Water soluble / dissolved SO^4 (mg/l)		19.7	

Table 2 – Summary of Geotechnical Parameters – Southern Half of the site

	Parameter	Number of Tests	Values (Mean)	Classification
Geotechnical Parameters for Natural Ground (Southern Half)	Natural moisture content	2	25, 29 (27)	Intermediate to high plasticity (high overall), Low to medium volume change potential (Medium overall)
	% passing 425 sieve		65, 74 (70)	
	Liquid Limit %		49, 65 (57)	
	Plastic Limit %		29, 33 (31)	
	Plasticity Index %		20, 32 (26)	
	Modified Plasticity Index %		13, 24 (18)	
	SPT N values in weathered PLCM	5	8 – 39 (23)	Low to medium strength
	SPT N values in weak sandstone (PLCM)	3	14 – 42 (32)	Medium to high strength
Geotechnical Parameters for Topsoil (Southern Half)	pH Conditions	1	5.4	DS1 AC-3z
	Total Sulphur (%)		0.073	
	Total Sulphate (%)		0.163	
	Water soluble / dissolved SO^4 (mg/l)		38.3	

Table 3 – Summary of Results of Soil Chemical Testing – Northern Half of the site (Natural Ground)

Determinant	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL: Residential with plant uptake Value (mg/kg)	Number of tests per determinant	Number/location of exceedances
Arsenic	23	37	3	0
Beryllium	**2**	1.7		**1 (WS01)**
Boron	2	290		0
Cadmium	0.5	11		0
Chromium (total)	60	910		0
Copper	37	2400		0
Lead	200	200**		0
Nickel	< 0.3	180		0

Selenium	45	250		0
Vanadium	< 1.0	410		0
Zinc	270	3700		0
Soil organic matter class		**1.0%**		
Benzene	< 1.0	0.087		0
Toluene	< 1.0	130	1	0
Ethylbenzene	< 1.0	47		0
Naphthalene	< 0.05	2.3		0
Acenaphthylene	< 0.05	170		0
Acenaphthene	< 0.05	210		0
Fluorene	< 0.05	170		0
Phenanthrene	< 0.05	95		0
Anthracene	< 0.05	2400		0
Fluoranthene	< 0.05	280		0
Pyrene	< 0.05	620	3	0
Benzo(a)anthracene	< 0.05	7.2		0
Chrysene	< 0.05	15		0
Benzo(b)fluoranthene	< 0.05	2.6		0
Benzo(k)fluoranthene	< 0.05	77		0
Benzo(a)pyrene	< 0.05	2.2		0
Indeno(1,2,3-c,d)pyrene	< 0.05	27		0
Dibenzo(a,h)anthracene	< 0.05	0.24		0
Benzo(g,h,i)perylene	< 0.05	320		0
TPH Aliphatic $C_5 – C_6$	< 0.001	42		0
TPH Aliphatic $C_6 – C_8$	< 0.001	100		0
TPH Aliphatic $C_8 – C_{10}$	< 0.001	27		0
TPH Aliphatic $C_{10} – C_{12}$	< 1.0	130		0
TPH Aliphatic $C_{12} – C_{16}$	< 2.0	1100		0
TPH Aliphatic $C_{16} – C_{35}$	< 8.0	65000		0
TPH Aromatic $C_5 – C_7$	< 0.001	70	1	0
TPH Aromatic $C_7 – C_8$	< 0.001	130		0
TPH Aromatic $C_8 – C_{10}$	< 0.001	34		0
TPH Aromatic $C_{10} – C_{12}$	< 1.0	74		0
TPH Aromatic $C_{12} – C_{16}$	< 2.0	140		0
TPH Aromatic $C_{16} – C_{21}$	< 10	260		0
TPH Aromatic $C_{21} – C_{35}$	< 10	1100		0
Asbestos	Not detected	If present	3	0

** provisional C4SL

Table 4 – Summary of Results of Soil Chemical Testing – Southern Half of the site (Topsoil and Made Ground)

Determinant	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL: Residential with plant uptake Value (mg/kg)	Number of tests per determinant	Number/location of exceedances
Arsenic	**39**	37		**1 (WS06)**
Beryllium	**2.9**	1.7		**2** (WS08, WS10)
Boron	1	290		0
Cadmium	2.7	11		0
Chromium (total)	35	910	3	0
Copper	190	2400		0
Lead	270	200**		**1 (WS06)**
Nickel	31	180		0
Selenium	< 1.0	250		0
Vanadium	72	410		0
Zinc	300	3700		0
Soil organic matter class		**1.0%**		
Benzene	< 1.0	0.087		0
Toluene	< 1.0	130	1	0
Ethylbenzene	< 1.0	47		0
Naphthalene	0.33	2.3		0
Acenaphthylene	0.26	170		0
Acenaphthene	0.43	210	3	0
Fluorene	0.34	170		0
Phenanthrene	4.1	95		0
Anthracene	0.61	2400		0

Fluoranthene	7.2	280		0
Pyrene	6.7	620		0
Benzo(a)anthracene	4.2	7.2		0
Chrysene	3.5	15		0
Benzo(b)fluoranthene	**3.4**	2.6		**1 (WS06)**
Benzo(k)fluoranthene	1.9	77		0
Benzo(a)pyrene	**2.7**	2.2		**1 (WS06)**
Indeno(1,2,3-c,d)pyrene	1.9	27		0
Dibenzo(a,h)anthracene	**0.64**	0.24		**1 (WS06)**
Benzo(g,h,i)perylene	2.0	320		0
TPH Aliphatic $C_5 – C_6$	< 0.001	42		0
TPH Aliphatic $C_6 – C_8$	< 0.001	100		0
TPH Aliphatic $C_8 – C_{10}$	< 0.001	27		0
TPH Aliphatic $C_{10} – C_{12}$	< 1.0	130		0
TPH Aliphatic $C_{12} – C_{16}$	< 2.0	1100		0
TPH Aliphatic $C_{16} – C_{35}$	21	65000		0
TPH Aromatic $C_5 – C_7$	< 0.001	70	1	0
TPH Aromatic $C_7 – C_8$	< 0.001	130		0
TPH Aromatic $C_8 – C_{10}$	< 0.001	34		0
TPH Aromatic $C_{10} – C_{12}$	4.7	74		0
TPH Aromatic $C_{12} – C_{16}$	14	140		0
TPH Aromatic $C_{16} – C_{21}$	60	260		0
TPH Aromatic $C_{21} – C_{35}$	100	1100		0
Asbestos	Not detected	If present	3	0

Table 5 – Gas Conditions

Location	Maximum CH4 Concent (% v/v)	Maximum CO2 Concen (% v/v)	Maximum Flow Rate (l/hr)	Maximum Gas Screenin (l/hr)	Characteristic Situatic R149)
WS01	<0.1	0.8	8.53	0.068	**2**
WS05	<0.1	0.9	8.86	0.080	
WS06	<0.1	0.7	11.04	0.077	

Table 6 – Environmental Conceptual Site Model considering the results of the Ground Investigation

Issue	Risk		Justification
LAND	MEDIUM		Chemical tests have indicated that there are elevated levels of metals and PAHs on-site.
GROUNDWATER	MEDIUM		Groundwater was encountered within the southern half of the site. Metal and PAH contamination was identified within near surface soils which has the potential to leach into groundwater.
SURFACE WATER	MEDIUM		There is a watercourse which leads through the centre of the site. Metal and PAH contamination was identified within near surface soils which has the potential to contaminate surface waters. Development of the area may require the stream to be redirected.

Figures/Drawings

Figure 1

Conceptual Site Model

john newton & partners
jnpgroup
Consulting Engineers

Project:

Land off Burn Road, Huddersfield

Project No:

B22335

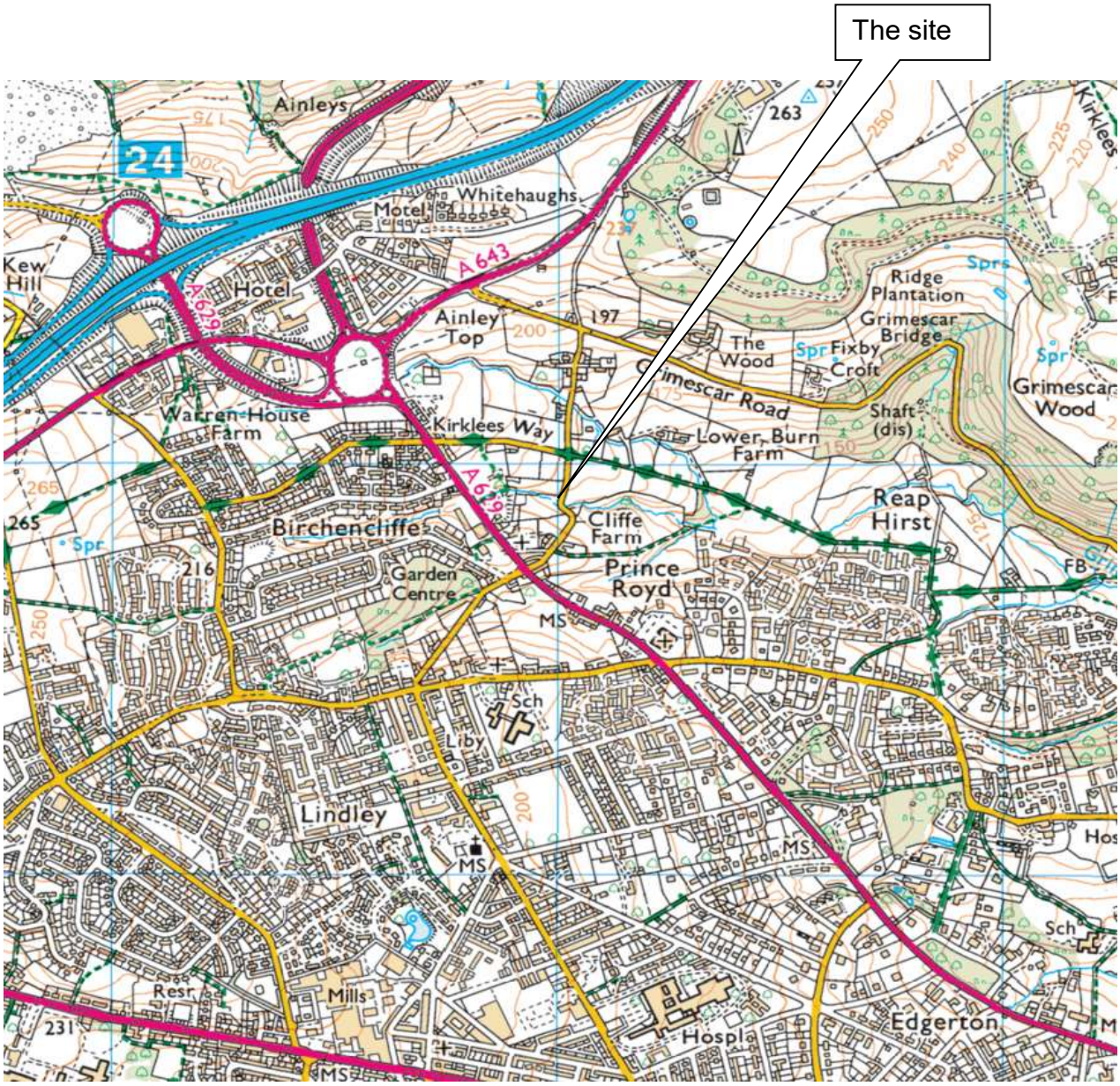

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Figure 2

SPT / Depth Relationship

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Project:
Land off Burn Road, Huddersfield

Project No:
B22335

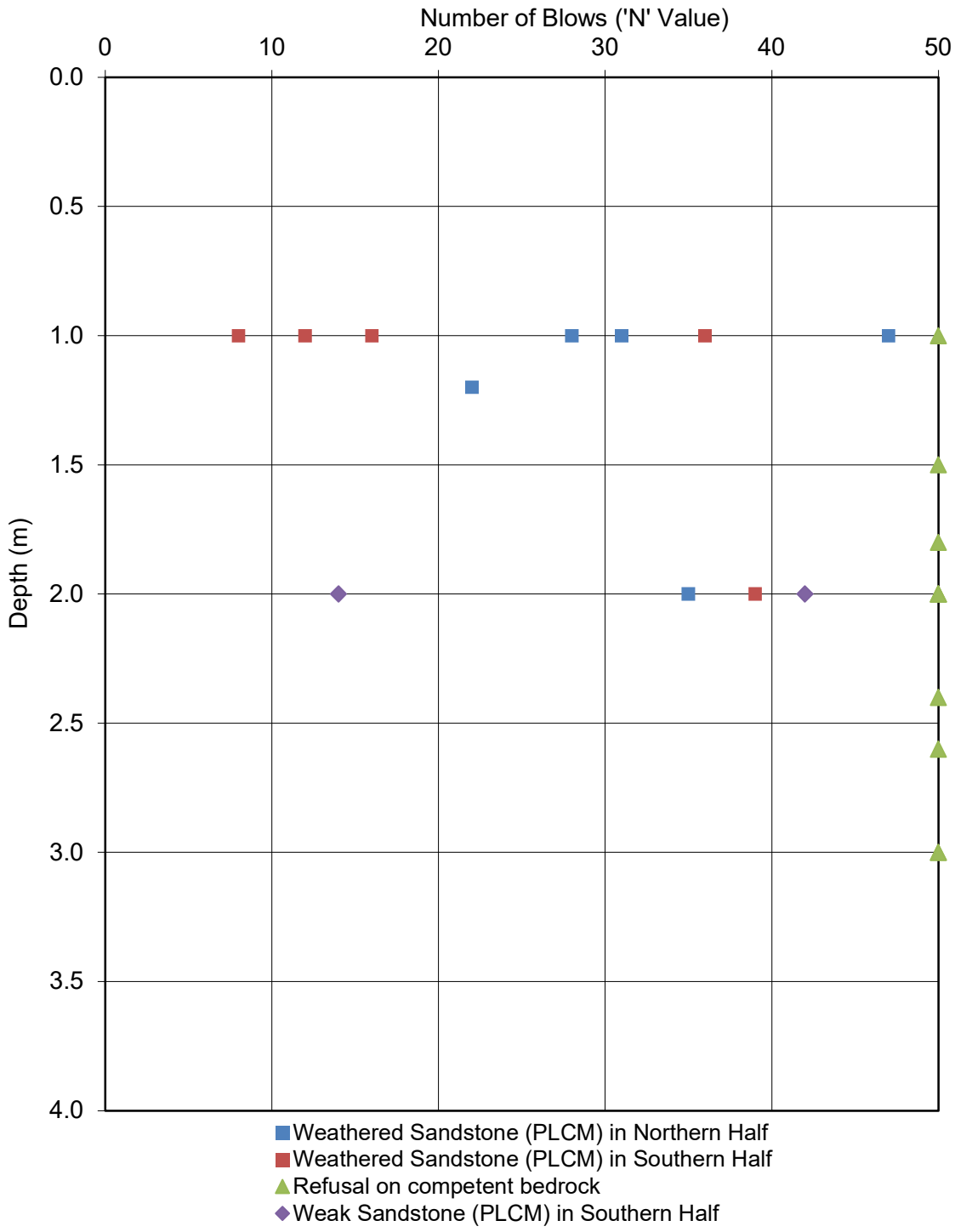

Figure 3

Plasticity Index Chart

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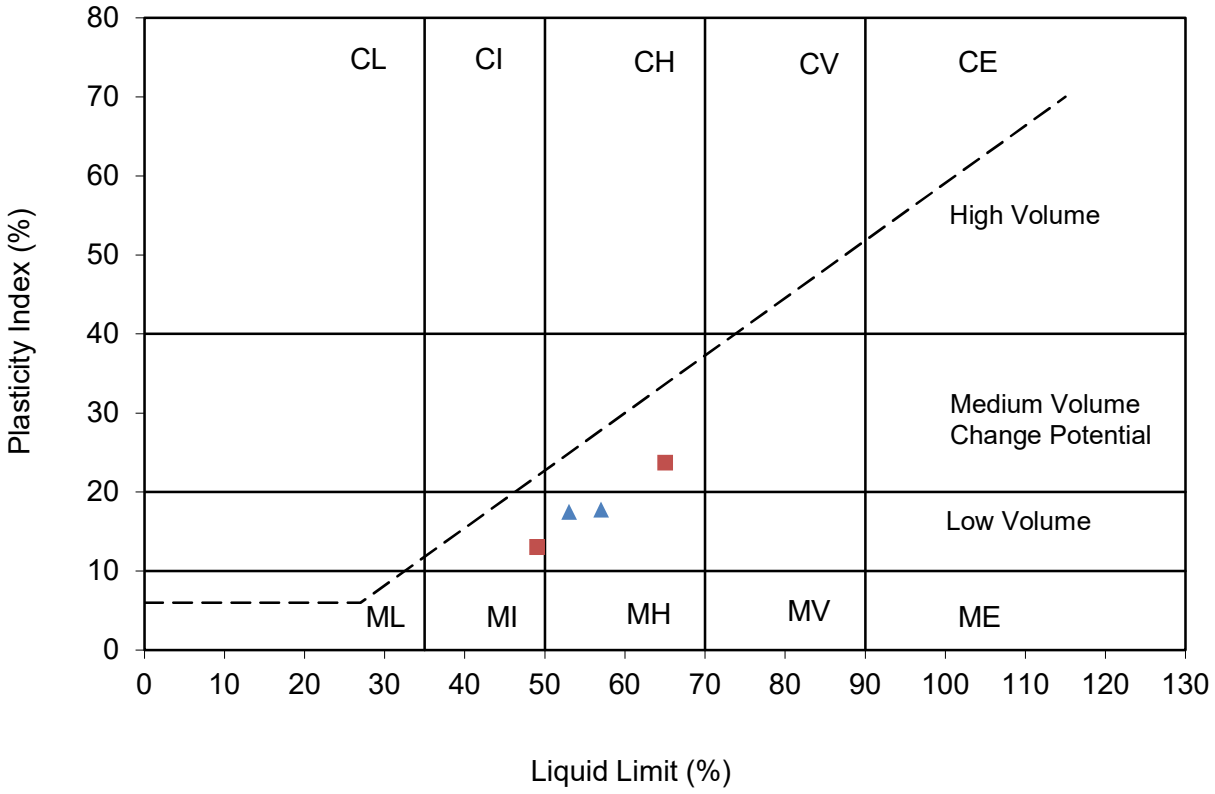
Consulting Engineers

Project:
Land off Burn Road, Huddersfield

Project No:
B22335

Key:
C Clay M Silt

L Low plasticity
I Intermediate plasticity
H High plasticity
V Very high plasticity
E Extremely high plasticity



▲ Natural sands / clays in the northern half of the site

■ Natural sands / clays in the southern half of the site

– – – A Line

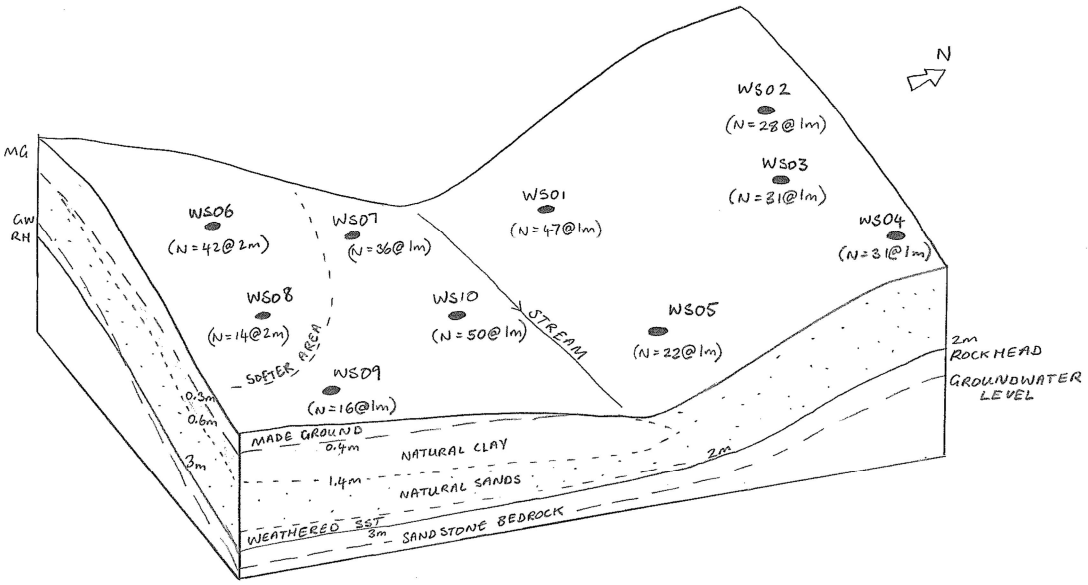
Figure 4

Conceptual Site Model

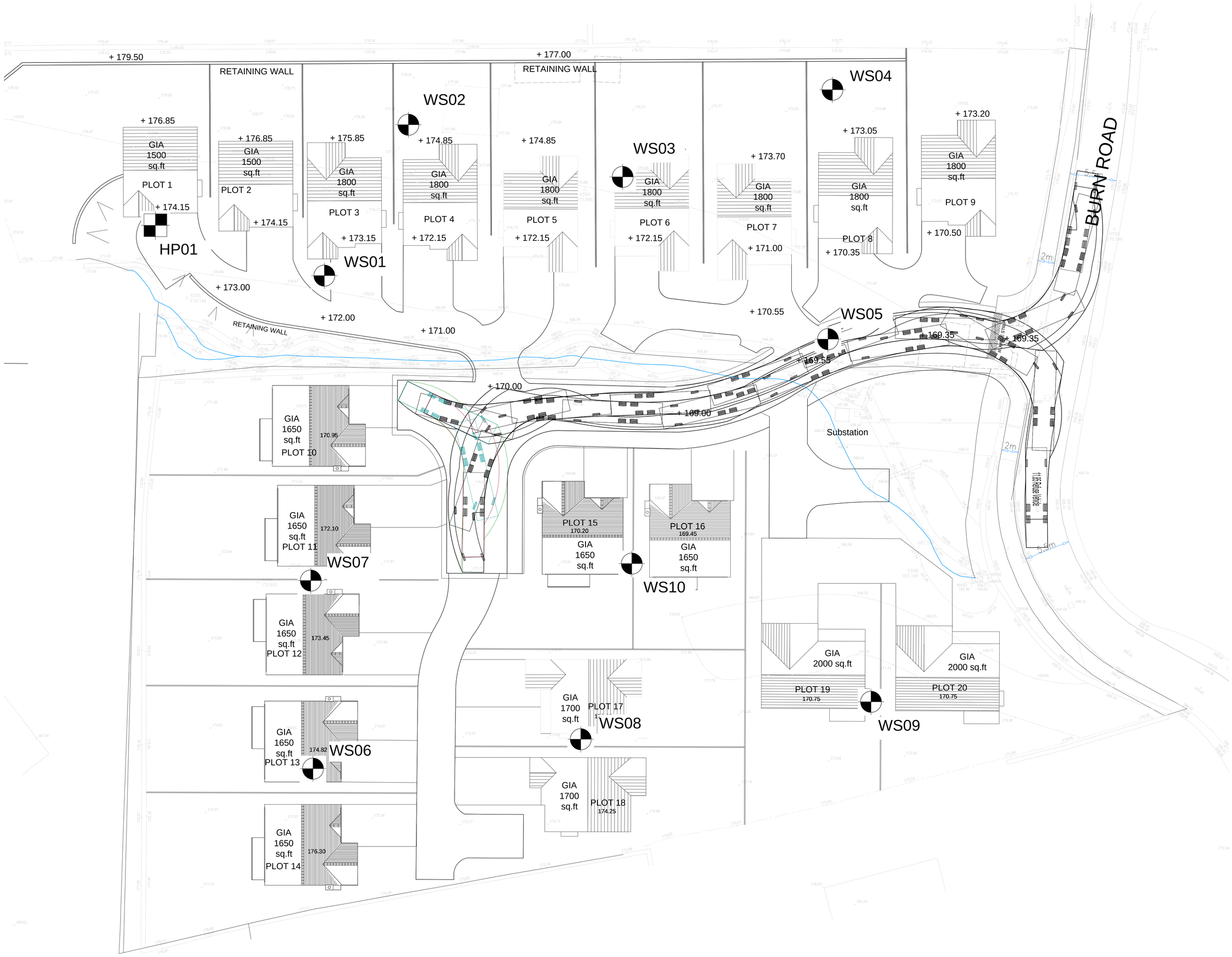
john newton & partners jnpgroup Consulting Engineers

Project:
Land off Burn Road, Huddersfield

Project No:
B22335



QD049 Issue A



Only figured dimensions should be used.

Scaled dimensions should be checked with the Architect.

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PLANNING

Rev B:
Site amended to show one access from public hig
Internal arrangement amended. JF 2

Rev A:
Turning heads amended following highways cons
guidance. JF 1

Revision:

acumen
designers & architect

acumenarchitects.co.uk 01484 546
Headrow House, Old Leeds Road, Huddersfield, HD1 1

CLIENT:
MR J. DYSON

JOB TITLE:
RESIDENTIAL DEVELOPMENT
LAND OFF BURN ROAD
BIRCHENCLIFFE
HUDDERSFIELD

DRAWING TITLE:
PROPOSED SITE PLAN

DRAWN:	SH	DATE:	MAY 201
CHECKED:	JC	SCALE:	1:200 @
DRAWING NUMBER:			2529 - 03

Appendix A

Limitations

1 INTRODUCTION

1.1.1 This report is confidential and has been prepared solely for the benefit of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from jnpgroup; a charge may be levied against such approval. jnpgroup accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, and: this document to any third party with whom and agreement has not been executed.

1.1.2 Any comments given within this report are based on the understanding that the proposed works to be undertaken will be as described in the introduction and the information referred to and provided by others and will be assumed to be correct and will not have been checked by jnpgroup and jnpgroup will not accept any liability or responsibility for any inaccuracy in such information.

1.1.3 Any deviation from the recommendations or conclusions contained in this report should be referred to jnpgroup in writing for comment and jnpgroup reserve the right to reconsider their recommendations and conclusions contained within. jnpgroup will not accept any liability or responsibility for any changes or deviations from the recommendations noted in this report without prior consultation and our full approval.

1.1.4 The details contained within this report reflect the site conditions prevailing at the time of investigation. jnpgroup warrants the accuracy of this report up to and including that date. Additional information, improved practice or changes in legislation may necessitate this report having to be reviewed in whole or in part after that date. If necessary, this report should be referred back to jnpgroup for re-assessment and, if necessary, re-appraisal.

1.1.5 This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report. Whilst this report and the opinion made herein are correct to the best of jnpgroups's belief, jnpgroup cannot guarantee the accuracy or completeness of any information provided by third parties.

1.1.6 The report represents the finding and opinions of experience geotechnical and geo-environmental engineers. jnpgroup does not provide legal advice and the advice of lawyers may also be required.

1.1.7 It should be noted that the following were not included as part of the agreed scope of works with the client: detailed ecological surveys and assessment;

1.1.8 jnpgroup has provided advice and made recommendations based on the findings of the work undertaken, however this is subject to the approval / acceptance by the relevant Regulatory Authorities.

1.2 Objectives

1.2.1 The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, jnpgroup reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

1.3 Phase II Intrusive Investigations

1.3.1 The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made.

1.3.2 Where intrusive investigations have been undertaken, they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature sampling, no investigation technique is capable of identifying all conditions present in all areas. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered. The risk assessment and opinions provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

1.3.3 The objectives of the investigation have been linked to establishing the risks associated with potential human targets, building materials, the environment (including adjacent land), and to surface and ground water. The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to areas unoccupied by the building(s) on the site and by buried services.

1.3.4 Gas and groundwater levels may vary from those reported due to seasonal, or other effects.

Appendix B

Exploratory Hole Records

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Borehole Log

Borehole No.
WS01
Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411948.00 - 418943.00	Hole Type WLS
Location: HD3 3BT		Level: 173.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By CDW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30 - 0.50	ES		0.40	172.60		Grass over dark brown clayey loam containing rootlets. TOPSOIL
		0.70 - 0.90	D		0.80	172.20		Soft turning firm yellow slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular and of sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		1.00		N=47 (0,3/8,12,17,10)	1.40	171.60		Firm turning very stiff grey / yellow gravelly CLAY. Gravel is medium to coarse and angular of sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		1.50		N=50 (10,11/50 for 295mm)	1.50	171.50		Grey / yellow SANDSTONE. PENNINE LOWER COAL MEASURES End of borehole at 1.50 m

1
2
3
4

Remarks
Refusal upon sandstone bedrock encountered at 1.5 m bgl.

AGS

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Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411954.00 - 418956.00	Hole Type WLS
Location: HD3 3BT		Level: 176.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By CDW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30 - 0.50	ES		0.40	175.60		Grass over grey / brown clayey loam. TOPSOIL
					0.50	175.50		Stiff yellow sandy CLAY. MADE GROUND
					0.60	175.40		Grey sandstone cobble. MADE GROUND
		0.70 - 0.90	ES					Very stiff friable slightly sandy CLAY. WEATHERED PENNINE LOWER COAL MEASURES
		0.80 - 1.00	D					
		1.00		N=28 (2,3/6,7,8,7)				
					1.40	174.60		Orange / brown slightly clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
					1.80	174.20		Stiff yellow / brown sandy CLAY. WEATHERED PENNINE LOWER COAL MEASURES
		2.00		N=35 (3,6/9,6,8,12)				
		2.40		50 (25 for 115mm/50 for 265mm)	2.40	173.60		End of borehole at 2.40 m

1 2 3 4

Remarks

Refusal upon sandstone bedrock encountered at 2.4 m bgl.

AGS

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Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411980.00 - 418944.00	Hole Type WLS
Location: HD3 3BT		Level: 174.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By CDW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	173.60		Grass over grey / brown clayey loam. TOPSOIL
		0.50 - 0.70	ES					Dense yellow clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
		0.70 - 0.90	ES					
		0.90 - 1.10	D					
		1.00		N=31 (4,6/8,8,7,8)				
					1.10	172.90		Dense grey / brown slightly clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
		2.00		50 (7,8/50 for 235mm)	2.00	172.00		End of borehole at 2.00 m

Remarks

Refusal upon sandstone bedrock encountered at 2.0 m bgl.

AGS

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Borehole Log

Borehole No. **WS04**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 412002.00 - 418951.00	Hole Type WLS
Location: HD3 3BT		Level: 174.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By CDW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	173.80		Grass over dark brown clayey loam. TOPSOIL
		0.50 - 0.70	D		0.50	173.50		Yellow very clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
		0.80 - 1.00	ES					Dense yellow / brown clayey gravelly SAND. WEATHERED PENNINE LOWER COAL MEASURES
		1.00		N=31 (5,4/5,6,10,10)				
		2.00		50 (25 for 105mm/50 for 275mm)	2.00	172.00		End of borehole at 2.00 m

Remarks

Refusal upon sandstone bedrock encountered at 2.0 m bgl.

AGS

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Borehole Log

Borehole No. **WS05**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 412005.00 - 418927.00	Hole Type WLS
Location: HD3 3BT		Level: 170.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By CDW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	169.70		Grass over grey / brown clayey loam. TOPSOIL
		0.50 - 0.70	ES					Medium dense brown clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
					1.00	169.00		
		1.20		N=22 (2,3/6,4,5,7)				Dense brown clayey SAND. WEATHERED PENNINE LOWER COAL MEASURES
		1.50 - 1.70	D					
		2.00		50 (25 for 125mm/50 for 265mm)	2.00	168.00		End of borehole at 2.00 m

1 2 3 4

Remarks
Refusal upon sandstone bedrock encountered at 2.0 m bgl.

AGS

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Borehole Log

Borehole No. **WS06**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411931.00 - 418889.00	Hole Type WLS
Location: HD3 3BT		Level: 174.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By SKL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10 - 0.30	ES					Moss over dark brown clayey loam containing rootlets. TOPSOIL
					0.40	173.60		Soft brown fine sandy clay with rootlets at shallower depths. Contains occasional fine black gravel (potential coal) and sub-angular gravel of fine grained sandstone. MADE GROUND
		0.80 - 1.00	D		0.80	173.20		Soft brown sandy gravelly CLAY. Sand is coarse and gravel is fine to medium and of laminated sandstone. WEATHERED PENNINE LOWER COAL MEASURES
	▼	1.00		N=8 (2,2/2,2,2,2)	1.00	173.00		Wet loose brown clayey sandy GRAVEL. Gravel is fine to medium, angular and of sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		1.30 - 1.50	D					
					1.60	172.40		Wet very weak brown weathered micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES
		1.80 - 2.00	D					
		2.00		N=42 (3,3/6,8,13,15)				
		2.60		50 (25 for 70mm/50 for 60mm)	2.60	171.40		End of borehole at 2.60 m

1 2 3 4

Remarks
Refusal upon sandstone bedrock encountered at 2.6 m bgl.

AGS

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Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411933.00 - 418906.00	Hole Type WLS
Location: HD3 3BT		Level: 172.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By SKL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 0.40	ES					Grass over dark brown clayey loam containing rootlets. TOPSOIL
					0.30	171.70		
		0.50 - 0.70	ES					Soft brown fine sandy CLAY with rootlets. Contains occasional sub-angular gravel of fine grained sandstone. Gravel content increases with depth. WEATHERED PENNINE LOWER COAL MEASURES
		0.70 - 0.90	D					
					0.90	171.10		Brown micaceous SANDSTONE. PENNINE LOWER COAL MEASURES
	▼	1.00		N=36 (2,3/4,6,12,14)	1.00	171.00		Very wet stiff brown sandy very gravelly CLAY. WEATHERED PENNINE LOWER COAL MEASURES
		1.20 - 1.50	D					
					1.30	170.70		Very wet brown clayey sandy GRAVEL. Gravel is fine to medium, angular and of micaceous sandstone. WEATHERED PENNINE LOWER COAL MEASURES
					1.60	170.40		Brown weathered micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES
		1.80		50 (25,/50 for 285mm)	1.80	170.20		End of borehole at 1.80 m

1 2 3 4

Remarks

Refusal upon sandstone bedrock encountered at 1.8 m bgl.

AGS

john newton & partners jnpgroup Consulting Engineers

Borehole Log

Borehole No. **WS08**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411964.00 - 418895.00	Hole Type WLS
Location: HD3 3BT		Level: 173.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By SKL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 - 0.40	ES		0.30	172.70		Grass over dark brown clayey loam containing rootlets and occasional plastic. TOPSOIL
		0.50 - 0.70	D		0.60	172.40		Damp soft brown fine sandy CLAY with rootlets. Contains occasional sub-angular gravel of fine grained sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		0.90 - 1.10	D					Brown mottled grey weathered clayey micaceous sandy GRAVEL. WEATHERED PENNINE LOWER COAL MEASURES
	▼	1.00		N=12 (3,2/3,3,3,3)	1.00	172.00		Wet medium dense brown clayey sandy GRAVEL. Gravel is fine to medium, angular and of sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		1.70 - 1.90	D		1.80	171.20		Brown very weak weathered micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES
		2.00		N=14 (3,4/3,3,3,5)				
		3.00		50 (25 for 105mm/50 for 255mm)	3.00	170.00		End of borehole at 3.00 m

1 2 3 4

Remarks
Refusal upon sandstone bedrock encountered at 3.0 m bgl.

AGS

john newton & partners jnpgroup Consulting Engineers

Borehole Log

Borehole No. **WS09** Sheet 1 of 1

Project Name:	Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411988.00 - 418897.00	Hole Type WLS
Location:	HD3 3BT		Level: 172.00	Scale 1:20
Client:	C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By SKL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.30	ES					Grass over dark brown clayey loam containing rootlets. TOPSOIL	
					0.20	171.80		Brown clayey gravelly sand contining fine black and fine metallic gravel. MADE GROUND	
					0.40	171.60		Firm brown sandy very gravelly CLAY. Gravel is fine to medium and of sandstone. Gravel content increases with depth, along with sandstone lithorelics. WEATHERED PENNINE LOWER COAL MEASURES	
		0.60 - 0.80	D						
		1.00		N=16 (2,3/3,5,4,4)					1
		1.40 - 1.70	D		1.40	170.60		Brown weathered micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES	
	▼	2.00		N=39 (4,9/10,10,9,10)	2.00	170.00		Wet dense brown clayey sandy GRAVEL. Gravel is fine to medium, angular and of sandstone. WEATHERED PENNINE LOWER COAL MEASURES	2
					2.60	169.40		Brown weathered micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES	
		3.00		N=50 (7,8/50 for 255mm)	3.00	169.00		End of borehole at 3.00 m	3
									4

Remarks
Refusal upon sandstone bedrock encountered at 3.0 m bgl.

AGS

john newton & partners jnpgroup Consulting Engineers

Borehole Log

Borehole No. **WS10**

Sheet 1 of 1

Project Name: Land off Burn Road, Huddersfield	Project No. B22335	Co-ords: 411967.00 - 418914.00	Hole Type WLS
Location: HD3 3BT		Level: 170.00	Scale 1:20
Client: C/O Acumen Architects		Dates: 16/12/2019 - 16/12/2019	Logged By SKL

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30 - 0.50	ES		0.25	169.75		Grass over dark brown clayey loam containing rootlets. TOPSOIL
		0.60 - 0.80	D		0.50	169.50		Brown sandy very gravelly clay with rootlets at shallower depths. Contains occasional fine black gravel (potential coal) and sub-angular gravel of fine grained sandstone. MADE GROUND
		0.80 - 1.00	D		0.80	169.20		Brown sandy very gravelly CLAY. Gravel is fine to medium and of sandstone. WEATHERED PENNINE LOWER COAL MEASURES
		1.00		50 (2,8/50 for 265mm)	1.00	169.00		Brown weathered clayey micaceous SANDSTONE. Sandstone is thinly laminated. PENNINE LOWER COAL MEASURES
								End of borehole at 1.00 m

1 2 3 4

Remarks

Refusal upon sandstone bedrock encountered at 1.0 m bgl.

AGS

Appendix C

Geotechnical Test Results

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

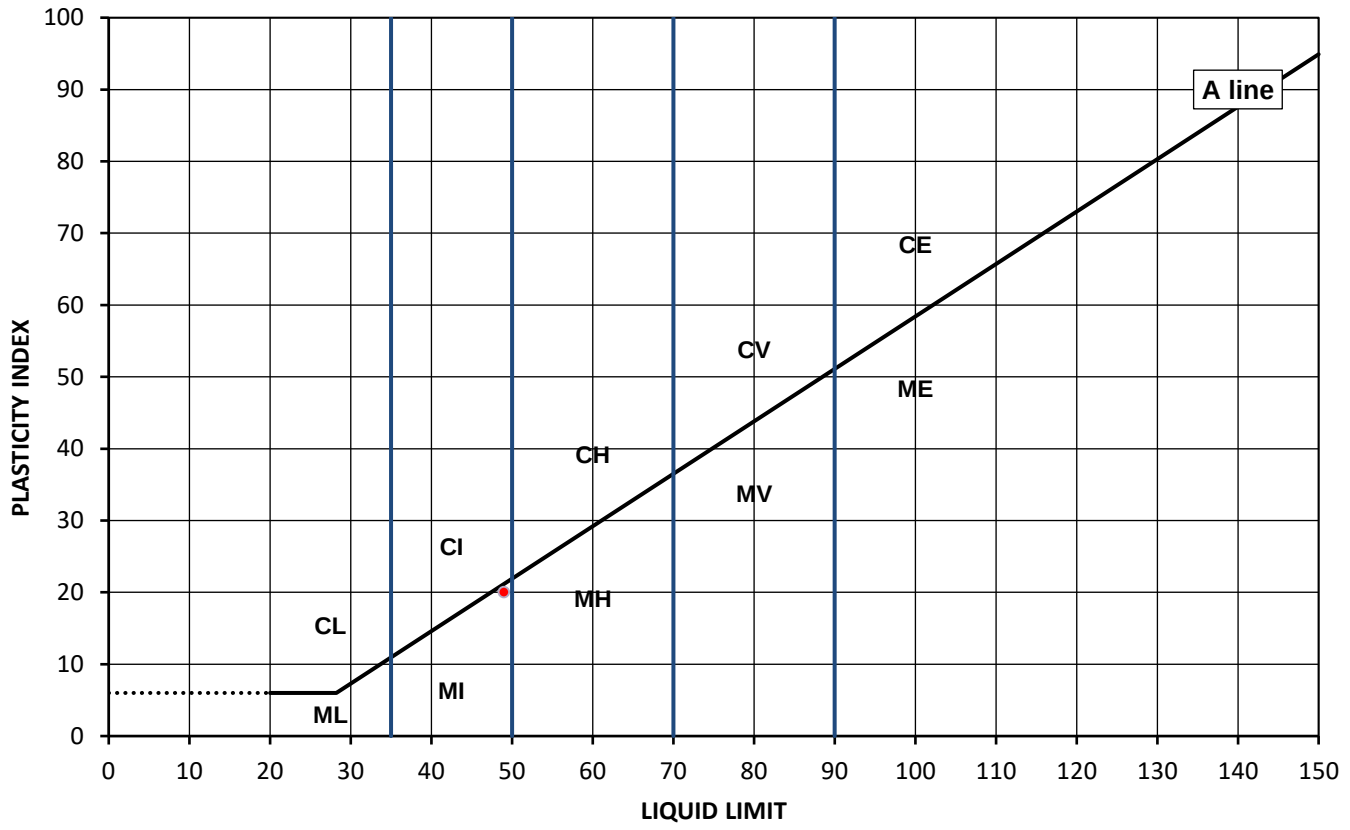
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	JNP Midlands LLP	Client Reference:	B22335
Client Address:	3rd Floor, Marlborough House, 48 Holly Walk, Leamington Spa, CV32 4XP	Job Number:	20-79334
		Date Sampled:	16/12/2019
		Date Received:	17/12/2019
Contact:	Charley Wainwright	Date Tested:	31/12/2019
Site Name:	Burn Road	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1403401	Depth Top [m]:	0.70
Hole No.:	WS07	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly slightly sandy CLAY with shales		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
25	49	29	20	65



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager

Signed: Darren Berrill
Geotechnical General Manager

Date Reported: 09/01/2020

for and on behalf of i2 Analytical Ltd **GF 232.5**

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

"Any assessment of compliance with specifications based the analytical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request."

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

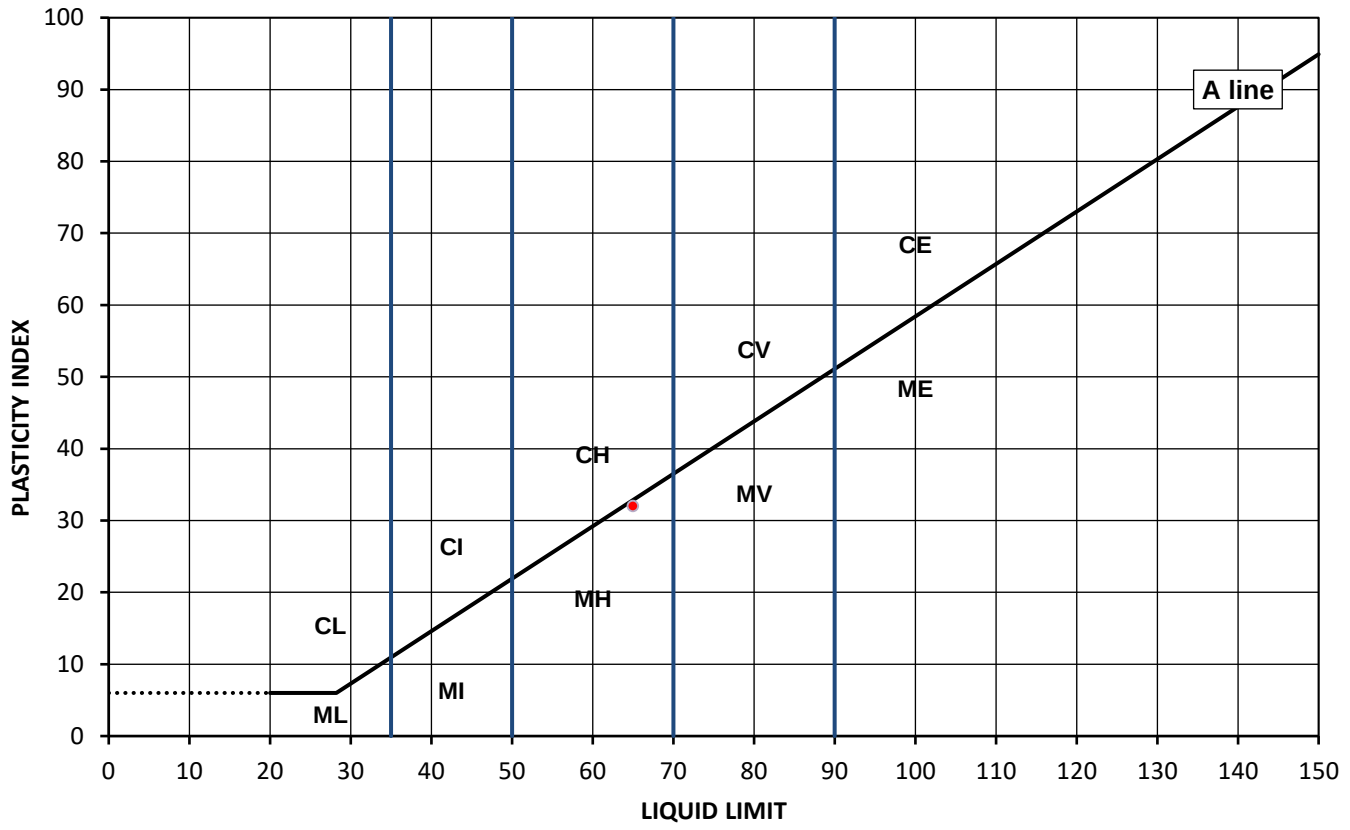
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	JNP Midlands LLP	Client Reference:	B22335
Client Address:	3rd Floor, Marlborough House, 48 Holly Walk, Leamington Spa, CV32 4XP	Job Number:	20-79334
		Date Sampled:	16/12/2019
		Date Received:	17/12/2019
Contact:	Charley Wainwright	Date Tested:	31/12/2019
Site Name:	Burn Road	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1403402	Depth Top [m]:	0.60
Hole No.:	WS10	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Orangish brown slightly gravelly CLAY with shales		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	65	33	32	74



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager

Signed: Darren Berrill
Geotechnical General Manager

Date Reported: 09/01/2020

for and on behalf of i2 Analytical Ltd **GF 232.5**

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TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

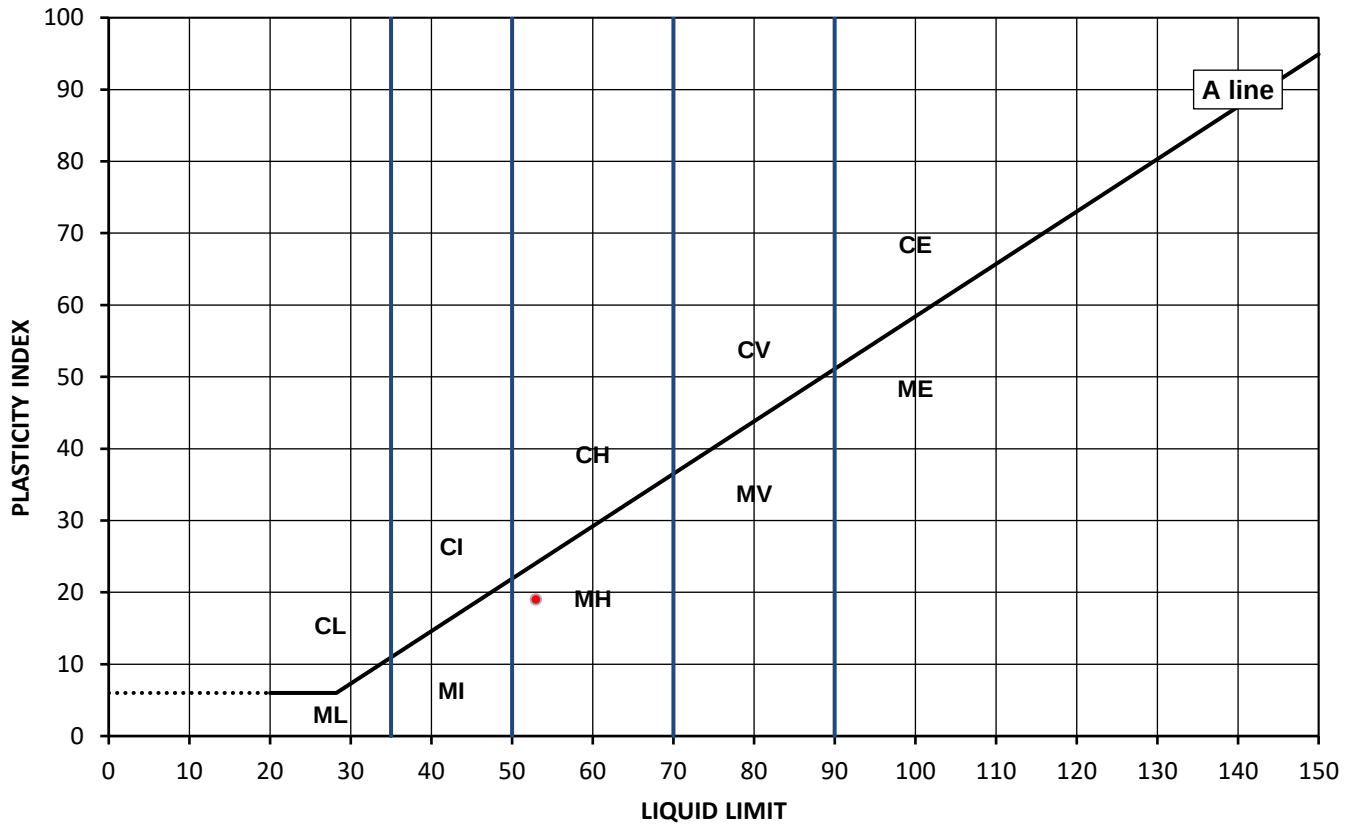
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	JNP Midlands LLP	Client Reference:	B22335
Client Address:	3rd Floor, Marlborough House, 48 Holly Walk, Leamington Spa, CV32 4XP	Job Number:	20-79334
		Date Sampled:	16/12/2019
		Date Received:	17/12/2019
Contact:	Charley Wainwright	Date Tested:	31/12/2019
Site Name:	Burn Road	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1403403	Depth Top [m]:	0.70
Hole No.:	WS01	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly slightly sandy CLAY with shales		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
31	53	34	19	92



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager

Signed: Darren Berrill
Geotechnical General Manager

Date Reported: 09/01/2020

for and on behalf of i2 Analytical Ltd **GF 232.5**

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TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

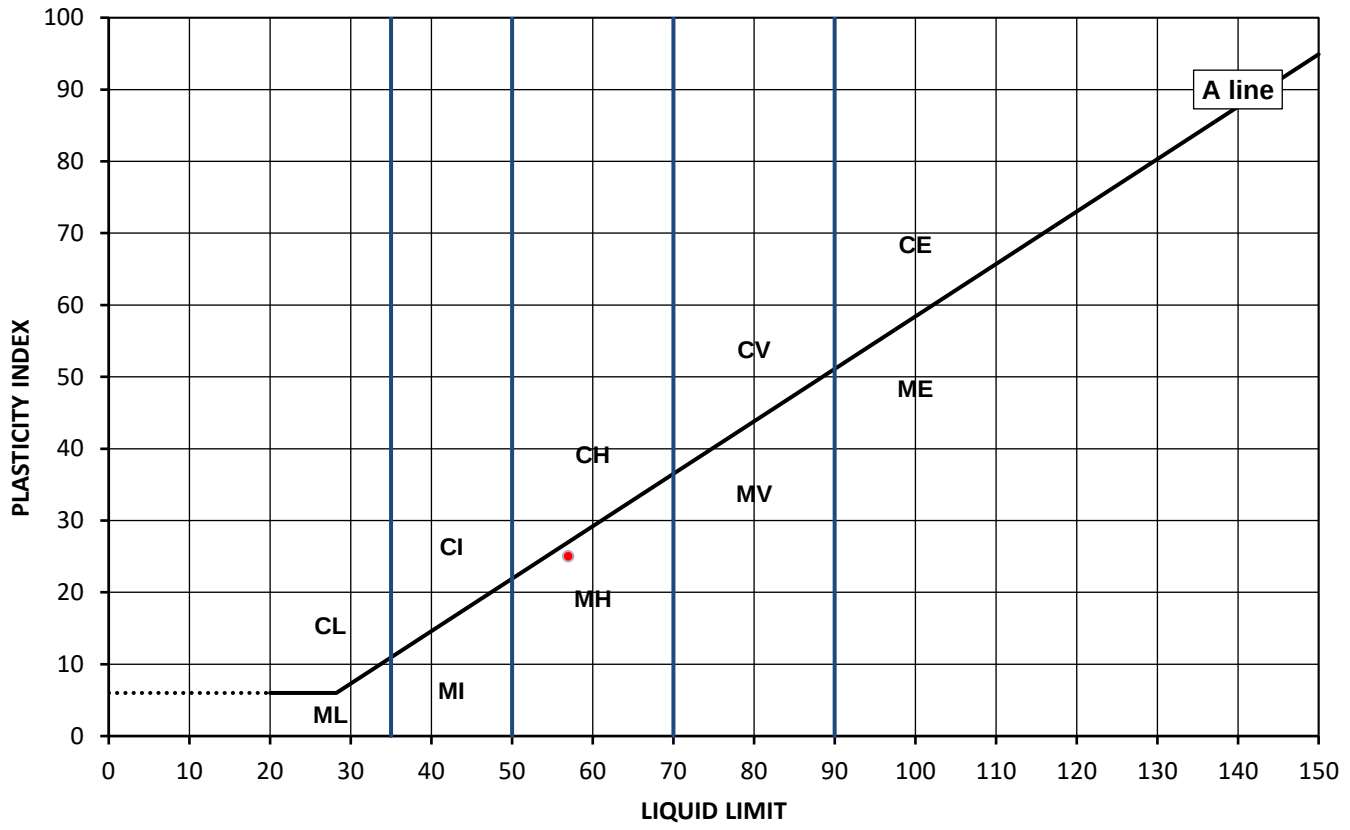
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	JNP Midlands LLP	Client Reference:	B22335
Client Address:	3rd Floor, Marlborough House, 48 Holly Walk, Leamington Spa, CV32 4XP	Job Number:	20-79334
		Date Sampled:	16/12/2019
		Date Received:	17/12/2019
Contact:	Charley Wainwright	Date Tested:	31/12/2019
Site Name:	Burn Road	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1403404	Depth Top [m]:	0.50
Hole No.:	WS04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Orangish brown slightly gravelly slightly sandy CLAY with shales		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	57	32	25	71



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager

Signed: Darren Berrill
eotechnical General Manager

Date Reported: 09/01/2020

for and on behalf of i2 Analytical Ltd **GF 232.5**

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SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Environmental Science

Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; WC by BS EN 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990: Clause 8.2

Client: JNP Midlands LLP

Client Address: 3rd Floor, Marlborough House, 48 Holly Walk, Leamington Spa, CV32 4XP

Contact: Charley Wainwright

Site Name: Burn Road

Site Address: Not Given

Client Reference: B22335

Job Number: 20-79334

Date Sampled: 16/12/2019

Date Received: 17/12/2019

Date Tested: 31/12/2019

Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC	WC	Atterberg				Density			Total Porosity#		
		Reference	Depth Top m	Depth Base m	Type			%	%	% Passing 425um %	LL %	PL %	PI %	bulk Mg/m3	dry Mg/m3	PD Mg/m3	%		
1403403	WS01	Not Given	0.70	Not Given	D	Yellowish brown slightly gravelly slightly sandy CLAY with shales	Atterberg 1 Point	31		92	53	34	19					Nat	
1403404	WS04	Not Given	0.50	Not Given	D	Orangish brown slightly gravelly slightly sandy CLAY with shales	Atterberg 1 Point	23		71	57	32	25					nat	
1403401	WS07	Not Given	0.70	Not Given	D	Yellowish brown slightly gravelly slightly sandy CLAY with shales	Atterberg 1 Point	25		65	49	29	20					nat	
1403402	WS10	Not Given	0.60	Not Given	D	Orangish brown slightly gravelly CLAY with shales	Atterberg 1 Point	29		74	65	33	32					nat	

Note: # Non accredited; NP - Non plastic

Comments:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager

Darren Berrill
Geotechnical General Manager

Date Reported: 09/01/2020

for and on behalf of i2 Analytical Ltd **GF 234.7**

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Appendix D

Chemical Test Results

Charley Wainwright
JNP Midlands LLP
3rd Floor
Marlborough House
48 Holly Walk
Leaminton Spa
CV32 4XP

e:

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 19-78991

Project / Site name:	Burn Road	**Samples received on:**	17/12/2019
Your job number:	B22335	**Samples instructed on:**	20/12/2019
Your order number:		**Analysis completed by:**	08/01/2020
Report Issue Number:	1	**Report issued on:**	08/01/2020
Samples Analysed:	9 soil samples		

Signed:

Karolina Marek
Technical Reviewer (Reporting Team)

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-78991

Project / Site name: Burn Road

Lab Sample Number				1401276	1401277	1401278	1401279	1401280
Sample Reference				WS06	WS07	WS08	WS10	WS01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.20	0.20	0.30	0.30
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	49	32	31	25	26
Total mass of sample received	kg	0.001	NONE	0.50	0.60	0.60	0.60	0.60
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	5.4	-	-	-
Total Sulphate as SO_4	%	0.005	MCERTS	-	0.163	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.038	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	38.3	-	-	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	4.5	-	-	-
Total Sulphur	%	0.005	MCERTS	-	0.073	-	-	-
Ammonium as NH_4	mg/kg	0.5	MCERTS	-	< 0.5	-	-	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	< 0.05	-	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	3.0	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.33	-	0.26	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.26	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.43	-	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.34	-	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	4.1	-	0.83	0.34	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.61	-	0.16	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	7.2	-	0.84	0.38	< 0.05
Pyrene	mg/kg	0.05	MCERTS	6.7	-	0.78	0.34	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.2	-	0.45	0.23	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.5	-	0.48	0.23	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.4	-	0.44	0.24	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.9	-	0.15	0.07	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.7	-	0.31	0.17	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.9	-	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.64	-	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.0	-	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	40.2	-	4.70	2.00	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	39	-	32	17	23
Barium (aqua regia extractable)	mg/kg	1	MCERTS	120	-	120	120	310
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.3	-	2.9	1.8	2.0
Boron (water soluble)	mg/kg	0.2	MCERTS	1.0	-	0.9	1.0	2.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.1	-	2.7	0.6	0.5
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	-	35	34	35
Copper (aqua regia extractable)	mg/kg	1	MCERTS	62	-	190	30	37
Lead (aqua regia extractable)	mg/kg	1	MCERTS	270	-	160	130	200
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	-	31	26	34
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	55	-	72	55	64
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	300	-	210	180	270
Magnesium (water soluble)	mg/kg	5	NONE	-	< 5.0	-	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	< 2.5	-	-	-

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Analytical Report Number: 19-78991

Project / Site name: Burn Road

Lab Sample Number				1401276	1401277	1401278	1401279	1401280
Sample Reference				WS06	WS07	WS08	WS10	WS01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.20	0.20	0.30	0.30
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	21	-	-	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	21	-	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	4.7	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	14	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	60	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	100	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	180	-	-	-	< 10

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Analytical Report Number: 19-78991

Project / Site name: Burn Road

Lab Sample Number				1401281	1401282	1401283	1401284	
Sample Reference				WS02	WS02	WS02	WS05	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.60	0.30	0.30	0.50	
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	12	25	12	17	
Total mass of sample received	kg	0.001	NONE	0.60	0.60	0.60	0.40	
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	5.1	4.7	-	4.9	
Total Sulphate as SO_4	%	0.005	MCERTS	0.041	0.097	-	0.090	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.029	0.020	-	0.049	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	29.3	19.7	-	48.6	
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	4.5	1.7	-	1.4	
Total Sulphur	%	0.005	MCERTS	0.013	0.041	-	0.027	
Ammonium as NH_4	mg/kg	0.5	MCERTS	< 0.5	< 0.5	-	< 0.5	
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	-	< 2.0	
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	< 0.80	-	
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.0	-	3.0	-	
Barium (aqua regia extractable)	mg/kg	1	MCERTS	96	-	110	-	
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.6	-	1.7	-	
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	-	0.2	-	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	58	-	60	-	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	33	-	34	-	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	23	-	24	-	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	-	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	43	-	45	-	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	46	-	48	-	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	-	150	-	
Magnesium (water soluble)	mg/kg	5	NONE	19	< 5.0	-	5.0	
Magnesium (leachate equivalent)	mg/l	2.5	NONE	< 2.5	< 2.5	-	2.5	

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Project / Site name: Burn Road

Lab Sample Number				1401281	1401282	1401283	1401284	
Sample Reference				WS02	WS02	WS02	WS05	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.60	0.30	0.30	0.50	
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	
Toluene	µg/kg	1	MCERTS	-	-	-	-	
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	
o-xylene	µg/kg	1	MCERTS	-	-	-	-	
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	

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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1401276	WS06	None Supplied	0.10	Brown loam and clay with vegetation.
1401277	WS07	None Supplied	0.20	Brown loam and clay with vegetation and gravel
1401278	WS08	None Supplied	0.20	Brown loam and clay with vegetation and gravel
1401279	WS10	None Supplied	0.30	Brown loam and clay with vegetation and gravel
1401280	WS01	None Supplied	0.30	Brown loam and clay with vegetation and gravel
1401281	WS02	None Supplied	0.60	Brown loam and sand with gravel.
1401282	WS02	None Supplied	0.30	Brown loam and clay with vegetation and gravel
1401283	WS02	None Supplied	0.60	Brown loam and sand with gravel.
1401284	WS05	None Supplied	0.50	Brown loam and clay with vegetation and gravel

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Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests. 2:1 extraction.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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