JNP GROUP

CONSULTING ENGINEERS

Phase II Geo-environmental Report

Project: Hallington Mill,
Hallington,
Northumberland,
NE19 2LJ

Client: Mr & Mrs R Wiggins

Reference: H77273-JNP-XX-XX-RP-G-1002 P01

Date: September 2021

DOCUMENT CONTROL SHEET

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FOR AND ON BEHALF OF JNP GROUP

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EXECUTIVE SUMMARY

Site location	Hallington Mill, Hallington, Northumberland, NE19 2LJ	
Development scheme	Two agricultural buildings in the north of the site; the stone barn in the centre of the site will be extended to provide holiday accommodation. The barn in the north east will be demolished and a new function suite built on the footprint.	
NGR	NY 98288 74391	
Current use	On-site: Storage	Off-site: Grazing pasture, woodland.
Geology	Made ground Devensian Till Alston Formation	
Hydrogeology	The site is underlain partially by a superficial Secondary-A Aquifer (Alluvium) and Secondary Undifferentiated Aquifer (Devensian Till), underlain by a bedrock Secondary A Aquifer (Alston Formation).	
Hydrology	Nearest surface water features are Fairspring Burn and Hallington Burn, which both flow south, adjacent to the eastern and western areas of site.	
Environmentally sensitive sites	Buildings housing sensitive species to be demolished / modified, risks reduced by mitigation proposed in ecological assessment.	
Geology (from GI)	**Made ground -** light grey sandy gravel of brick, sandstone, limestone and detritus material. **Devensian Till -** brown, grey, silty, sandy, gravelly clay. At the sample location of WS1, a high organic content was noted. The gravel fraction comprised coal, sandstone, mudstone and limestone. **Alston Formation -** dark grey very silty gravel or a dark grey silty gravelly clay. Beds of very weak mudstone were encountered at the sample location of WS5. **All boreholes were stable.**	
Groundwater	1 No. groundwater strike noted in WS5.	
Foundation design	**Traditional foundations recommended at a minimum depth of 0.9m.** JNP Group recommends that a tree survey be undertaken at the site, in order to be able to assess their impact upon foundation types and depths. Design Sulphate **Class of DS1,** with an **ACEC of AC-1,** would be applicable for concrete buried within the Devensian Till. For concrete placed within the Alston Formation a concrete classification of **DS3**, with an **ACEC of AC3** would apply.	
Road construction	The near surface soils comprise variable made ground deposits of clay and gravel and as such a design CBR value of <2.5 % should be used for the made ground. If a higher CBR value is required, the subbase should be placed within the Devensian Till soils, which has a CBR value of 4%.	
Contamination	**No Risk** to human health as no contaminants identified above screening values. Watching brief recommended during site clearance works for unanticipated areas of contamination.	
Ground gas	**No radon protection measures required.**	

1 INTRODUCTION

1.1 General

1.1.1 JNP Group was instructed by the client Mr & Mrs R Wiggins to undertake a ground investigation of:

Hallington Mill,
Hallington,
Northumberland,
NE19 2LJ

hereinafter referred to as 'the site'. This report is subject to the limitations presented in Appendix A.

1.1.2 It is understood that the two existing barn structures in the north of the site are to be converted into a function suite and a holiday home as shown in Drawings 1831 nos. 2 and 3.

1.1.3 All comments given are based on the understanding that the proposed redevelopment will be as detailed above.

1.2 Objectives

1.2.1 The purpose of the investigation was to determine the geotechnical and geo-environmental ground conditions at the site and assess the implications of such relative to the proposed redevelopment. The scope of work comprised desk-based research, and a site inspection together with intrusive investigation and laboratory testing. This report contains details of the site, the work and laboratory testing undertaken, strata encountered, geotechnical and chemical laboratory test results, and provides an interpretative assessment of the ground conditions with regard to geotechnical and contaminated land issues.

1.2.2 This report has been produced in support of Planning Permission Ref 20/02786/FUL.

1.3 Methodology

1.3.1 This report has been compiled in accordance with the on-line Land contamination: risk management (LCRM) guidance produced by the Environment Agency (June 2019). This can be found on the UK government website: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks.

1.3.2 With regard to geotechnical aspects, reference is also made to the requirements of BS EN 1997, Eurocode 7, Geotechnical Design, and associated standards.

1.3.3 This report has been prepared following review of a previous desk study undertaken on the site by JNP Group 'Phase 1 Geo-environmental Report' (Ref: H77273-JNP-XX-XX-RP-G-1001 P01) dated May 2021.

2 SITE DESCRIPTION

2.1.1 The site is located off an unnamed road, in Hallington, Northumberland, approximately 4.7km south-west of Kirkheaton (see Figure 1 Key Plan). The centre of the site is located at National Grid Reference NY 98288 74391. The site covers an area of approximately 0.6 hectares.

2.1.2 The site includes a complex of buildings associated with the 16th century water mill. There is the mill building and cottage in the south of the site which are not part of the redevelopment plans. There are two further agricultural buildings in the north of the site; the stone barn in the centre of the site will be extended to provide holiday accommodation. The barn in the north east will be demolished and a new function suite built on the footprint.

2.1.3 An engineer from JNP Group visited the site on 02 September 2021, the weather was cloudy with occasional sun. Photos of the site are included within Appendix C.

2.1.4 The boundaries of the site were open fields to the north, a small wooded area and Fairspring Burn to the east, an unnamed road along the southern margin of the site, and a small wooded area to the west, with agricultural fields beyond.

2.1.5 Adjacent land uses were agricultural in all directions, with road infrastructure along the southern margin of the site.

2.1.6 The site sloped gently from the east (105.09m AOD) to the west (101.89m AOD). A steeper decline was noted off site near the southern boundary, this dropping from north (102.27m AOD) to south (100.64 AOD). This lower southern area featured the mill building and associated cottage.

2.1.7 The ground coverage was noted to be 90% soft standing of grass and 10% of gravel and concrete. It is of note that the area between the stone barn and the barn in the north east featured hardcore beneath the grass surface covering. Anecdotal evidence from the sites owner suggests that this area was previously used as a yard area.

2.1.8 The two northern agricultural buildings that are part of the redevelopment plans were noted to be in use as storage areas at the time of the site works. The stone barn in the centre of the site had a slate roof and was single storey in height. A pitched steel sheet roofed wraparound extension surrounded the stone barn on its eastern, northern and western sides. This extension was noted to be in poor condition.

2.1.9 The barn in the north east was noted to be of wooden frame construction clad with steel sheets on the roof and sides. The barn roof sloped from a two storey height in the west to a single storey height in the east.

2.1.10 Several semi-mature trees were present along the eastern, southern, and western boundary of the site, these being of Ash, Spruce, Holly and Oak. No other trees were present

2.1.11 In general, the site was in good condition at the time of the site works. An area used for burning was noted in the north eastern area of the site.

2.1.12 The JNP Group Phase I Geo-Environmental Report (Ref: H77273-JNP-XX-XX-RP-G-1001 P01) noted that historically there were two artificial channels running south-west and south east off-site from Fairspring Burn and Hallington Burn, both labelled 'Old Mill Race', which met in a small, dammed pond in the north-eastern corner of the site, which then fed water through a small weir and sluice to Hallington Mill. These features were present from the earliest

available maps (1859); the water channels were apparently infilled by 1963, and the dammed pond appears to have been infilled by 2003.

2.1.13 These were investigated as part of the Phase I report, two shallow trenches were excavated in two areas of the former dam and mill race. No organic/putrescible material was notated during these preliminary investigations.

2.1.14 No evidence of former buildings or tanks was noted at the time of the site works.

2.1.15 No invasive species were noted during the site work. However, as JNP Group recommend that a specialist arboreal consultant is consulted.

2.1.16 The surrounding land uses are summarised in Table 2.1 below.

Table 2.1 Surrounding Land Use

Direction	Land Use
North	Grazing pasture
East	Woodland, grazing pasture
South	Unnamed road, woodland, grazing pasture
West	Woodland, grazing pasture

2.1.17 Reference should be made to the photographs included in Appendix C taken during the site investigation for full details of the site features and setting at the time of investigation/inspection.

3 GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

3.1 Geology

3.1.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online Geoindex Tool (**http://mapapps2.bgs.ac.uk/geoindex/home.html**); as well as to the BGS 1:50,000 Series published geological map, Sheet 13 Bellingham (Solid and Drift etc. dated 1980), accessed via the website (**http://www.bgs.ac.uk/data/maps/home.html**); these were both accessed on 05/05/2021.

3.1.2 No recorded artificial or Made Ground is indicated at the site, however, given the developed nature of the site, Made Ground may be present.

3.1.3 The superficial geology of the site to be is indicated to be Devensian Till (Diamicton) across most of the site, with small areas of Alluvium along the south-eastern and western margins of the site, associated with the adjacent Fairspring Burn and Hallington Burn. The Till is described by the BGS as "*unsorted and unstratified drift, generally overconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton)*". The Alluvium is described by the BGS as "*the unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat, and basal gravel. A stronger, desiccated surface zone may be present*".

3.1.4 The underlying bedrock geology is indicated to be strata of the Alston Formation, which is described by the BGS as "*bioclastic limestones, sandstones, mudstones, siltstones and rare coals typically in regular cyclothemic sequence*".

3.1.5 The BGS maps show an inferred coal seam 250m south-west of the site, and another 640m north-west of the site.

3.1.6 There is an inferred normal fault 500m east of the site, running east to west.

3.2 BGS Borehole Records

3.2.1 There are no records of any boreholes within 250m of the site.

3.3 Hydrogeology

3.3.1 The Aquifer Maps contained in the Groundsure Report indicates that the site is underlain by a superficial Secondary-A Aquifer (Alluvium) and Secondary Undifferentiated Aquifer (Devensian Till), underlain by a bedrock Secondary A Aquifer (Alston Formation).

3.3.2 The Environment Agency define a Secondary-A Aquifer as:

"Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers."

3.3.3 The Environment Agency define a Secondary (undifferentiated) Aquifer as:

"Cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."

3.4 Hydrology

3.4.1 The nearest surface water features are Fairspring Burn and Hallington Burn, which both flow south, adjacent to the eastern and western margins of the site respectively, into Erring Burn, a tributary of the River Tyne, just to the south of the site, at NY 98235 74205.

4 UK CONTAMINATED LAND LEGISLATIVE FRAMEWORK

4.1 General

4.1.1 Given that the site is being assessed with the potential for future development, the most applicable appraisal relates to the requirements of the Planning Regime as described in the National Planning Policy Framework.

4.1.2 In order to proceed with an assessment of contamination issues it is essential that there is compliance with UK guidance as detailed in the on-line Land contamination: risk management (LCRM) guidance produced by the Environment Agency (June 2019). This can be found on the UK government website: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks.

4.1.3 Part IIA of the Environmental Protection Act, 1990, which was enacted by Section 57 of the Environment Act 1995, and the associated Contaminated Land (England) Regulations 2000 (SI 2000/227), was introduced on 1 April 2000. It created a new statutory regime for the identification and remediation of land where contamination poses an unacceptable risk to human health and the environment. The guidance was subject to a review by DEFRA in 2012, and a revision was published.

4.1.4 Part IIA provides a statutory definition of contaminated land:

4.1.5 *"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 the land, that significant harm is being caused, or that there is a significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused".*

4.1.6 Controlled waters are considered to be all groundwaters, inland surface waters, and estuarine and coastal waters.

4.1.7 To determine whether land falls under the Part IIA definition of contaminated land, the site should be evaluated in the context of a risk-based framework. The assessment of contaminated land is typically a two-phase process, which is initially based on a qualitative assessment of the likelihood of complete pollution linkages, with a quantitative element that seeks to determine the degree and the significance of the harm. Land is only defined as 'Contaminated Land' if a "significant pollutant linkage" is present.

4.1.8 A pollutant linkage must comprise the following:

Source *- a contaminant at a concentration capable of causing adverse health or environmental effects.*

Receptor *- there must be a receptor (e.g. human, controlled waters, ecological, or property) present, which may be at risk of harm or impact from the source.*

Pathway *- there must be an exposure pathway through which the receptor comes into contact with the contamination source.*

4.1.9 Each of these elements can exist independently, but they create risk only when they are linked together, so that a particular contaminant affects a particular receptor, through a particular pathway.

4.1.10 The responsible authority then needs to consider whether the identified pollution linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage;

- presents a significant possibility of significant harm being caused to that receptor;
- is resulting in the pollution of controlled waters, which constitute the receptor; or is likely to result in such pollution.

4.1.11 If a pollutant linkage is demonstrated, then the Part IIA legislation provides powers for remedial action to be enforced by the Local Authority in whose area the contaminated land is situated.

4.1.12 In addition, JNP Group has undertaken a preliminary risk assessment based on the probability of receptor exposure to the identified source and the consequences of such exposure.

4.1.13 Risk management, which can include site surfacing, formal management systems, legal requirements; is then considered to provide an overall residual risk. The categories of environmental risk used by JNP Group are given in the table that follows.

Table 4.1 Risk Matrix

Environmental Risks		
HIGH		Issues within this category likely to provide a significant cost or liability. Further detailed investigation may be required to clarify the risk.
MEDIUM		It is possible that issues within this category may provide a cost or liability. Further investigation may be required to clarify the risk.
LOW		It is unlikely that issues within this category will provide a significant cost or liability. Basic investigation may be required to clarify the risk.
NONE		No source – pathway – receptor linkage present.

5 CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

5.1 General

5.1.1 This section uses information from field observations and all the data sources presented herein to provide a conceptual model and qualitative assessment of the potential risks posed to human health and environmental receptors from potential on-site and off-site sources of contamination. The assessment is presented as a 'source-pathway-receptor' model in accordance with Part IIA of the Environmental Protection Act 1990.

5.1.2 The conceptual site model has been developed assuming that the site will be redeveloped for holiday accommodation and a function suite.

5.2 Potential Sources of Contamination

5.2.1 Potential On-Site Sources of Contamination

- Agricultural site usage and building fabric;
- Area used for burning materials on-site;
- Heavy metals and hydrocarbons associated with limited Made Ground materials may be present;
- In accordance with C733 guidance, any structure built, refurbished or modified during the Twentieth Century has the potential to contain asbestos containing materials (ACM). In addition, any demolition material either stockpiled or used as backfill on site also has the potential to contain asbestos containing materials (intact or broken up).

5.2.2 Potential Off-Site Sources of Contamination

- There are no potential off-site sources of contamination that could impact on ground conditions at the site.

5.3 Receptors

5.3.1 The site is to be redeveloped as a leisure facility. In addition, the site overlies Secondary-A Aquifers (Alluvium and Alston Formation) and is adjacent to two watercourses. The primary receptors, considered to be potentially at risk from any identified contamination are as follows:

Human Health

- Construction workers during the redevelopment phase;
- End users.

Controlled Waters

- Secondary-A Aquifers (Alluvium and Alston Formation).
- Hallington Burn and Fairspring Burn.

Ecological

- The site is not located within an environmentally designated sensitive area;
- The ecological survey indicates that sensitive species are considered likely to be present at the site.

Property / Infrastructure

- Concrete vulnerability to aggressive ground conditions;
- Water supply pipework.

5.4 Pathways

5.4.1 Potential contaminant migration pathways considered relevant to the site are:

Human Health

- Ingestion of contaminated soils and dust particles;
- Direct physical contact with near surface soils and contaminated dust particles;
- Inhalation of wind-blown contaminated dust;
- Inhalation of vapours and gases, migrating vertically into the atmosphere;
- Inhalation of vapours and gases, migrating vertically into buildings and confined spaces;
- Consumption of contaminated potable water.

Controlled Waters

- Leaching of contaminants in Made Ground / natural ground into groundwater;
- Lateral migration of contaminated groundwater into watercourses;
- Vertical migration of contaminated shallow groundwater impacting deeper groundwater in the aquifer sequence;
- Run-off of site-derived contamination into watercourses during construction.

Ecological

- Migration of contamination through groundwater and subsequent uptake by plant roots;
- Direct contact between ecological receptors and contaminated surface water;
- Direct contact between ecological receptors and contaminated soils;
- Ingestion of contaminated soils/surface waters by ecological receptors;
- Inhalation of vapours or wind-blown dust by ecological receptors.

Property

- Direct physical contact with near surface soils;
- Migration of gases into buildings and confined spaces.

5.5 Pollutant Linkages

5.5.1 A 'pollutant linkage' describes the relationship between a contaminant, a pathway and a receptor, a 'pollutant' being the contaminant in a pollutant linkage. A contaminant, pathway and receptor must all be present for a pollutant linkage to exist, which forms the basis for determination that a piece of land is Contaminated Land. Potential sources, pathways and

receptors have been assessed. The following Tables summarise the significant pollutant linkages potentially active at the site.

Table 5.1 Potential Source-Pathway-Receptor Linkages for Human Health Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Ingestion of soil / water	On-site female worker On-site construction worker
	Ingestion of building dust	
	Dermal contact with soil	
	Dermal contact with building dust	
	Inhalation of fugitive soil dust	
	Inhalation of fugitive building dust	
	Inhalation of vapours in outdoor air	
	Inhalation of vapours in indoor air	
	Consumption of contaminated potable water	
Ground gas	Vertical and lateral migration	

Table 5.2 Source Pathway Receptor Linkages for Controlled Waters Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Leaching mechanisms	Groundwater stored in the Alluvium
	Runoff during construction works	Adjacent watercourses
Contaminated groundwater	Vertical migration	Groundwater stored in the Alston Formation
	Lateral and vertical migration (baseflow)	Adjacent watercourses

Table 5.3 Potential Source-Pathway-Receptor Linkages for Ecological Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Migration of contamination through groundwater and subsequent uptake by plant roots;	Ecological receptors
	Direct contact between ecological receptors and contaminated surface water;	
	Direct contact between ecological receptors and contaminated soils;	
	Ingestion of contaminated soils/surface waters by ecological receptors;	
	Inhalation of vapours or wind-blown dust by ecological receptors.	
Ground gas	Inhalation of gases	

Table 5.4 Potential Source-Pathway-Receptor Linkages for Property Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Contact with contaminated soils	Concrete
		Water supply pipe materials
Ground gas	Vertical and lateral migration and accumulation in voids	Commercial properties

5.6 Preliminary Risk Assessment

5.6.1 From the information obtained from the desk study JNP Group has undertaken a preliminary risk assessment.

Table 5.5 Preliminary Risk Assessment

Risk Receptor	Risk		Justification
HUMAN HEALTH	MEDIUM		Historical land use as mill / agricultural buildings suggests potential sources of contamination present on site. Potential for direct contact.
GROUNDWATER	MEDIUM		Historical land use as mill / agricultural buildings suggests potential sources of contamination present on site. The site is located on productive strata (Secondary A Aquifers).
SURFACE WATER	MEDIUM		Historical land use as mill / agricultural buildings suggests potential sources of contamination present on site. Potential for run-off or baseflow into adjacent watercourses.
PROPERTY & INFRASTRUCURE	MEDIUM		Historical land use as mill / agricultural buildings suggests potential sources of contamination present on site.
ECOLOGY	LOW		Historical land use as mill / agricultural buildings suggests potential sources of contamination present on site. Buildings housing sensitive species to be demolished / modified, risks reduced by mitigation proposed in ecological assessment.

5.6.2 In line with BS ISO 18400-202:2018 based on the conceptual site model as above the site is considered to be probably uncontaminated.

6 DESK STUDY CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

6.1.1 The desk-based research has identified that:

- The geological succession below the site comprises Devensian Till and Alluvium overlying the Alston Formation.
- It identifies that the site has a current potentially contaminative use as a mill/ agricultural buildings, and a dam and mill races are also understood to have been present on site and may have been infilled.
- Agricultural site usage and building fabric could have resulted in ground contamination;
- Heavy metals, hydrocarbons and asbestos associated with limited Made Ground materials may be present.

6.1.2 The Health Protection Agency identified between 1% and 3% of homes above the action level for Radon. Protection measures are not necessary for the intended development at the site.

6.1.3 The site is at medium to high risk of surface water flooding so a Flood Risk Assessment will be required.

6.1.4 There is a moderate risk of compressible soils on the site.

6.1.5 Based on information contained within this desk study, it is the opinion of JNP Group that the potential site conditions provide a MEDIUM environmental risk and hence further investigation and assessment is required.

6.2 Recommendations

6.2.1 Based on the conclusions from the desk study and the intended redevelopment of the site JNP Group recommends that the following intrusive works are undertaken:

- Chemical testing of Made Ground and natural soils beneath the site. This testing should concentrate on the footprint of the barn and near the proposed accommodation block;
- Testing of the soils to identify volume change potential of any cohesive material, concrete classification, and design CBR values.

6.2.2 JNP Group recommend that the scope of the intrusive works is agreed with the Regulatory Authorities as they may have particular requirements that need to be taken into account.

7 SITE WORK AND MONITORING

7.1 Introduction

7.1.1 The intrusive site work was undertaken by JNP Group on 2 September 2021 and comprised seven dynamic sampling boreholes. Three of these locations were installed with a 50mm plastic standpipe and gas bung.

7.1.2 All site work was completed under the instruction and supervision of JNP Group with the ground investigation procedures and sample descriptions given in the following publications:

- BS 5930 (2015).Code of Practice for Site Investigations;
- BS 10175 (2001+A1:2013+A2:2017). Investigation of potentially contaminated sites - code of practice;
- BS EN ISO 14688-1. "Soil - Identification and Description;
- BS EN ISO 14688-2. Soil - Classification principles and quantification of descriptive characteristics;
- BS 18400-104:2018. Soil Quality – Sampling. Part 104: Strategies;
- BS 18400-202:2018. Soil Quality – Sampling. Part 202: Preliminary Investigations;
- BS 18400-203: 2018. Soil Quality – Sampling. Part 203: Investigation of potentially contaminated sites;
- BS 18400-205: 2018. Soil Quality – Sampling. Part 205: Guidance on the procedure for investigation of natural, near natural and cultivated sites;

7.1.3 For sites affected by asbestos impacted soils, the guidance given in the following publications has been followed:

- Industry Guidance on Interpretation for Managing & Working with Asbestos in Soil and Construction and Demolition Materials (CL:AIRE 2016);
- Asbestos in Soil and made ground: a guide to understanding and managing risks (CIRIA C733 2014).

7.1.4 The design and installation of groundwater quality monitoring points has been undertaken following the guidance given in the Environment Agency science report:

- SC020093. Guidance on the design and installation of groundwater quality monitoring points. 2006.

7.1.5 The locations of the exploratory holes are shown on JNP Group Drawing No. H77273-JNP-XX-ZZ-DR-G-0001. The exploratory hole records including strata and groundwater encountered, in-situ testing and samples taken are presented in Appendix D. The full details of the site work undertaken are summarised in the following sections.

7.1.6 The purpose of the intrusive sitework was to obtain data to discharge condition 17B of Planning Permission Ref 20/02786/FUL.

7.1.7 The site investigation strategy comprised judgemental (i.e. targeted) locations of the footprint of the barn and proposed accommodation block, former mill race and small dammed pond, or locations considered to be sensitive as part of the development The

remainder of the positions providing a systemic distribution across the site to suit the proposed redevelopment and address relevant spatial locations considered most likely to be sensitive. Table 7.1 shows the rationale for the location of each exploratory hole.

Table 7.1 Exploratory Hole Location Rationale

Exploratory Hole Reference	Rationale
WS1-2,7	To target area of burning, building and old mill pond.
WS3-4	To target mill race and general site coverage.
WS5	To target ground around near old barn.
WS6	To find natural strata.

7.1.8 The general sampling strategy was to take representative soil samples from the ground to characterise the strata encountered and to provide suitable horizontal distribution, however, where visible contamination was present or suspected, targeted spot samples were taken.

7.2 Dynamic Sampling Boreholes

7.2.1 Seven dynamic sampling boreholes, designated WS1 to WS7 (inclusive) were formed on 02 September 2021, to depths of between 0.40m and 3 - 4m below ground level (bgl) at various locations across the site. The majority of the holes were formed to depths of 3.00m bgl; however, obstructions limited the maximum depths of WS1, WS2, WS3, WS3B and WS7 to 2.0 m, 3.0 m, 0.40 m and 3.0m bgl respectively. An additional location, WS6, was undertaken solely to provide further information on ground conditions, and therefore terminated at 4.00m bgl.

7.2.2 The dynamic sampling technique uses a lightweight tracked rig to advance a borehole by 1m intervals using 1m long steel sampler tubes, at diameters of 100 mm, reducing to 70 mm. The soils are then recovered from each sample tube as continuous core samples, which are logged and sub-sampled on site. Environmental soil samples were generally taken from each made ground material, together with any materials suspected of containing elevated concentrations of contaminants, based on visual and olfactory evidence. The environmental samples comprised a small volatiles jar, and an amber glass jar. Bulk and small plastic tub samples were also taken from selected materials, for laboratory geotechnical testing. In situ Standard Penetration Tests (SPTs) were undertaken in accordance with BS 5930 (2015) at 1.0m depth intervals in the boreholes in order to obtain in situ strength or relative density parameters for geotechnical design.

7.2.3 Three boreholes (WS2, WS4 and WS5) were completed with 50 mm gas monitoring standpipe installations, with flush fitting steel covers set in concrete at ground level. The remaining boreholes were backfilled with arisings and the ground surface left in a safe and tidy manner.

7.2.4 Response zones within the installations were installed between depths of 1m bgl to 5m bgl in order to target the made ground, underlying Devensian Till and Alston Formation.

7.3 Monitoring

7.3.1 At the time of writing this report, monitoring of the installed standpipes/wells was not scheduled to be undertaken. Three of the window sampler locations were installed as a precautionary measure, this is to allow for future rounds of monitoring, if required by the Regulatory Authorities.

Table 7.2 Response Zone Rationale

Exploratory Hole Reference	Response Zone (m bgl)	Rationale
WS1,WS4, WS5	1-2 m	To monitor groundwater levels and gas concentrations levels within the made ground and Devensian Till.

7.3.2 It should be noted that once the groundwater monitoring boreholes are no longer required they need to be decommissioned following the guidance given in the EA science report SC020093 (EA 2008).

8 LABORATORY TESTING

8.1 Geotechnical

8.1.1 A programme of laboratory testing was scheduled by JNP Group to determine geotechnical properties of selected soil samples obtained from the investigation. The details of the geotechnical testing are summarised below:

Table 8.1 Scheduled Geotechnical Laboratory Tests

Test Description	Number of Tests
Atterberg limits including moisture content	4
Ground Aggressivity Suite (in accordance with BRE SD1)	5

8.1.2 Tests were undertaken in accordance with BS1377 (1990) "Methods of test for Soils for Civil Engineering purposes". The results of the geotechnical testing are presented in Appendix E.

8.2 Environmental

8.2.1 A programme of chemical laboratory testing was scheduled by JNP Group on selected soil samples taken from various depths in the made ground and natural ground recovered from the exploratory holes. Samples of any soils displaying visual or olfactory evidence of contamination were also collected and submitted for laboratory analyses. The samples were placed into suitable containers for the required chemical analyses. The results of the chemical testing are presented in Appendix F.

8.2.2 All samples were transported, to i2 Analytical Testing Services in Watford which is accredited under UKAS and MCerts. The following table summarises the contaminants scheduled:

Table 8.2 Scheduled Soil Chemical Analyses

Determinant	No
Metals and semi-metals (arsenic, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc)	5
Polycyclic Aromatic Hydrocarbons (PAH) 16 USEPA Speciated	4
TPH Criteria Working Group (TPH CWG)	2
Pesticide Screen	1
pH	5
Soil Organic Matter (SOM)	2
Asbestos screening	5

9 GROUND AND GROUNDWATER CONDITIONS

9.1 Strata Encountered

9.1.1 The ground conditions encountered during the intrusive investigation were generally consistent with the published geological map. A variable thickness of made ground was found to be underlain by cohesive Devensian Till, which in turn was underlain by cohesive and granular strata of the Alston formation; this graded as a weak mudstone with increasing depth. The deepest made ground was encountered in WS2 to the north, of the existing eastern barn.

9.1.2 A summary of the stratigraphy encountered during the investigation is presented in Table 9.1 and described in the following sections, but for full details and descriptions, reference should be made to the exploratory hole records presented in Appendix D.

Table 9.1 Stratigraphy Encountered

Stratum	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)
Topsoil WS2-WS7	Ground Level	0.05 – 0.35	0.05 – 0.35
Made ground WS1-WS4	0.00 – 0.10	0.30 – 0.48	0.30 – 0.38
Devensian Till WS1, WS2, WS4, WS5, WS6 and WS7	0.20 – 0.48	2.00 – 3.50	1.80 – 3.02
Alston Formation WS2, WS5, WS6 and WS7	2.30 – 3.50	Not proven	Not proven

9.2 Topsoil and Made Ground

9.2.1 A topsoil surface covering was encountered in all exploratory locations with the exception of WS1. The topsoil was generally described as brown and gravelly with abundant rootlets. The gravel fraction consisted of fine limestone and sandstone. At the location of WS1 a loamy gravel was encountered as the surface covering. The gravel fraction at this location was noted to feature fine, angular bricks, limestone and sandstone.

9.2.2 Made ground was encountered below the topsoil in the locations of WS1 to WS4. This consisted of light grey to brown sandy, clay and gravel. The proportion of clay, sand and gravel varied between the exploratory locations. The gravel fraction comprised brick, sandstone, limestone, plastic, coal and concrete.

9.3 Devensian Till

9.3.1 Soils inferred to be that of Devensian Till were encountered in WS1, WS2, WS4, WS5, WS6 and WS7. The top of the lithological unit was encountered at depths of between 0.20m and 0.48m bgl, extending to depths of between 2.00m and 3.50m bgl, with a maximum thickness of 3.25m encountered in WS5.

9.3.2 The Devensian Till consisted of brown, grey, silty, sandy, gravelly clay. At the sample location of WS1 a high organic content was noted. The gravel fraction comprised coal, sandstone, mudstone and limestone.

Table 9.2 Devensian Till – Geotechnical Laboratory Test Results Summary

Property	Number of Tests	Range	Mean	Assessment
Natural Moisture Content	2	15 - 31	22.5	Low to medium volume change potential. Low - Intermediate plasticity/silts (MI).
% passing 425 sieve	2	100 - 90	95	
Liquid Limit %	2	31 – 50	40	
Plastic Limit %	2	14 – 27	20	
Plasticity Index %	2	17 - 23	20	
Modified Plasticity Index %	2	15 - 23	19	
c_u = 4.5 x SPT 'N' Value (kN/m^2)	14	27 - 225	93	Soft to Firm strength

9.3.3 The SPT N value / depth profile is presented as Figure 2, the undrained shear strength / depth profile as Figure 3, and a plasticity chart as Figure 4.

9.4 Alston Formation

9.4.1 Strata of the Alston Formation were encountered in WS2, WS5, WS6 and WS7. The depth to the top of the Alston Formation varied form 2.30 – 3.50m bgl. The base of the lithology was unproven, with the maximum depth penetrated, 5m bgl in WS5.

9.4.2 The lithological unit was found to comprise, dark grey very silty gravel or a dark grey silty gravelly clay. Thinly laminated very weak mudstone was encountered at the sample location of WS5.

Table 9.3 Alston Formation – Geotechnical Laboratory Test Results Summary

Property	Number of Tests	Range	Mean	Assessment
Natural Moisture Content	2	13 - 17	15	Low volume change potential. Intermediate plasticity/silts (MI).
% passing 425 sieve	2	67 - 96	81	
Liquid Limit %	2	35 – 40	37	
Plastic Limit %	2	18 – 19	18.5	
Plasticity Index %	2	16 - 22	19	
Modified Plasticity Index %	2	12 - 18	15	
SPT 'N' Values (granular)	1	50	50	Very Dense
c_u = 4.5 x SPT 'N' Value (kN/m^2)	4	131 - 225	162	Stiff to very stiff strength

9.4.3 The SPT N value / depth profile is presented as Figure 2, the undrained shear strength / depth profile as Figure 3, and a plasticity chart is presented as Figure 4.

9.5 Groundwater

9.5.1 Details of groundwater entries recorded during the site work period are summarised in the table which follows.

Table 9.4 Summary of groundwater observations

Exploratory Location	Groundwater during site work	
	Strikes (m bgl)	Comments
WS5	3.50	Seepage

9.6 **Ground Contamination and Deleterious Material**

9.7 No visual or olfactory evidence of ground contamination was observed during the ground investigation.

9.8 Fragments of plastic, glass and other detritus were observed in the made ground of WS1.

9.9 **Trees and Tree Roots**

9.9.1 Several semi-mature trees were present along the eastern, southern, and western boundary of the site, these being of Ash, Spruce, Holly and Oak. No other trees were present

9.9.2 The presence of rootlets was noted within the topsoil of all the sample locations. These observations were limited to the topsoil strata with no roots observed in deeper samples.

9.10 **Desiccation**

9.10.1 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:

1. *Desiccation has occurred when the moisture content is less than the Plastic Limit;*
2. *Significant desiccation has occurred when the moisture content is less than 0.4 x the Liquid Limit (this is known as the Driscoll Limit).*

9.10.2 When the results of laboratory testing are compared with Method 1, samples from WS2 at 3m and WS5 at 5.00m bgl are indicated to be desiccated.

9.10.3 When the results of laboratory testing are compared with Method 2, no samples are indicated to be desiccated.

9.10.4 A plot comparing moisture contents with the Liquid Limits and the Driscoll Limits is included as Figure 5.

9.11 **Obstructions**

9.11.1 WS1, WS2, WS3, WS3B, WS4, and WS7 all terminated early due to refusals at depths of 0.40m to 2.00m bgl.

9.11.2 WS3 and WS3B, located in the area between the two barns, both refused at a depth of 0.40m bgl within the made ground.

Data Gaps and Uncertainties

9.12.1 There are no data gaps or uncertainties.

10 HUMAN HEALTH DETAILED QUANTITATIVE RISK ASSESSMENT

10.1 Introduction

10.1.1 Qualitative assessment of risks may be sufficient in many cases to eliminate the possibility of significant pollutant linkages. However, quantitative risk assessment is formally required to determine whether there is a 'significant possibility of significant harm being caused'. Part IIA of the Environmental Protection Act 1990 recommends that 'authoritative and scientifically based guideline values for concentrations of the potential pollutants in or under the land' be used to quantify the risk posed by contamination.

10.1.2 Under the Planning Regime, a quantitative risk assessment can be used to decide whether the site is suitable for the proposed use. In addition, the National Planning Policy Framework (March 2012) also indicates that after remediation, as a minimum land should not be capable of being determined as contaminated land under Part IIA.

10.2 Current UK Screening Values

10.2.1 The UK technical guidance for assessing risks to human health is issued from various UK bodies, including the Environment Agency (EA), DEFRA, Contaminated Land: Applications in Real Environment (CL:AIRE), Chartered Institute of Environmental Health (CIEH), and Land Quality Management (LQM) Ltd (part of the University of Nottingham).

10.2.2 New and updated screening values in the form of provisional Category 4 Screening Levels (C4SL) (published in 2014), and Suitable for Use Levels (S4UL), (published 2015), have been produced by DEFRA and CIEH / LQM respectively using modified versions of the EA's Contaminated Land Exposure Assessment (CLEA) software.

10.2.3 C4SL

10.2.4 Provisional C4SL have been derived by CL:AIRE (project team for DEFRA's SP1010 project) following revised statutory guidance, and as a tool to assist in applying the Part IIA Category 1- 4 classifications to a site. The purpose of the C4SL is to provide a simple test for deciding that land is suitable for use, and definitely not contaminated land under Part IIA. They describe a level of risk that is above minimal, but is still low.

10.2.5 In calculating provisional C4SL some of the exposure modelling scenarios and exposure parameters used in the CLEA software have been modified. These modifications are not discussed further, but reference should be made to the original CL:AIRE / DEFRA publications should further information or clarification be required. A list of the new publications is included in the references section at the end of this report.

10.2.6 To date, six contaminants have been assigned provisional C4SL: arsenic; benzene; benzo[a]pyrene; cadmium; chromium VI, and lead, for the standard land uses (residential with, and without plant uptake, allotments, commercial, and public open space (parks and residential).

10.2.7 The C4SL are also considered suitable to be used under the planning regime, and DEFRA have confirmed this to all local authorities.

10.2.8 S4UL

10.2.9 The LQM / CIEH S4UL represent generic assessment criteria based on minimal or tolerable risk that are intended to be protective of human health. They have been derived in

accordance with current UK legislation using a modified version of the CLEA software, and are still based on many conservative assumptions. They represent values above which further assessment of the risks or remedial actions may be needed.

10.2.10 S4UL have been derived for a comprehensive list of metals, non–metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, chlorinated hydrocarbons, phenolic compounds, explosives, and pesticides, for the standard land uses (residential with, and without plant uptake, allotments, commercial, and public open space (residential and park)).

10.2.11 For details of the exposure parameters and scenarios used to derive the S4UL the reader is reference to the original LQM / CIEH document "The LQM/CIEH S4UL for Human Health Risk Assessment" (2015).

10.2.12 Both sets of screening values can be used to undertake a generic risk assessment by comparing the data directly to the screening value which is considered a conservative approach or statistically to the screening value. Alternatively and if a sufficient dataset is available, a statistical assessment can be undertaken following the guidance given in the joint Chartered Institute of Environmental Health (CIEH) and the Contaminated Land: Applications in Real Environment (CL:AIRE) organisation publication "Guidance On Comparing Soil Contamination Data with a Critical Concentration" (CIEH / CL:AIRE May 2008).

10.3 Petroleum Hydrocarbons

10.3.1 JNP Group have followed the guidance given in the Environment Agency publication 'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils' (Environment Agency, 2005). LQM S4UL values have been published based on carbon banded hydrocarbons with aliphatic and aromatic split, corresponding to the TPH CWG bands.

10.3.2 The Society of Brownfield Risk Assessment (SoBRA) have produced some Generic Assessment Criteria for assessing chronic risks from the inhalation of vapours arising from groundwater (GAC_{gwvap}) for a short list of 66 organic contaminants (SoBRA February 2017). These are designed to a defensible screening criteria to assist in evaluating this exposure pathway. They represent concentrations below which the chronic risks from vapour migration and inhalation can be considered low / tolerable. GAC_{gwvap} have been developed in line with current UK risk assessment guidance, and CLEA v1.07 software was used for residential and commercial land use scenarios.

10.3.3 Further details of the input parameters selected for use to generate the GAC_{gwvap} can be found in the SoBRA report, and have not been reproduced here. However, it should be noted that they have been derived using some conservative assumptions:

- Impacted ground / perched water is beneath the buildings;
- An infinite source term is present;
- There is no biodegradation;
- Groundwater depth is 0.65m below ground;
- Use of a sand soil type (in line with SR3)

11 SOIL AND GROUNDWATER ASSESSMENT RESULTS

11.1 Soil Results

11.1.1 The chemical testing results of three topsoil samples, three samples of made ground and two samples of natural soils have been compared with the C4SL and the LQM S4UL values for a 'residential without plant uptake'. These comparisons are summarised in the following tables.

11.1.2 The following determinants were recorded at concentrations less than their respective limits of laboratory detection, and hence have not been included in this assessment: selenium, mercury, benzene, toluene, ethylbenzene, p-xylene, o-xylene, naphthalene, acenaphthylene, fluorene, anthracene, dibenzo(a,h)anthracene, TPH Aliphatic C5 – C12, TPH Aromatic C5 – C35, and asbestos.

11.1.3 One topsoil sample was tested for pesticide contamination, all of the pesticides determinants were recorded at less than their respective limits of laboratory detection.

11.1.4 Two soil organic matter (SOM) tests were undertaken on the made ground and topsoil material types identified at the site. A SOM of 6% is applicable for the topsoil across the site, and a SOM of 1% is applicable to the made ground soils.

Table 11.1 Comparison of Soil Chemical Test Results with Residential without plant uptake Guideline Values

Determinant	Maximum Measured Concentration (mg/kg)	Background Concentration (mg/kg)	LQM/CIEH S4UL: Residential without plant uptake Value (mg/kg)			Number of tests	Number of exceedances
Arsenic	15	15	40			5	0
Beryllium	1.2		1.7			5	0
Boron	2.2		11000			5	0
Cadmium	1.2	1.8	85			5	0
Chromium (total or trivalent)*	23	60 - 90	910			5	0
Copper	23	15	7100			5	0
Lead	34	100	310**			5	0
Nickel	37	15 -30	180			5	0
Vanadium	31		1200			5	0
Zinc	320	98	40000			5	0
			1%	2.5%	6%		
Phenanthrene	1.6		1300	1500	1500	4	0
Fluoranthene	1.1		1500	1600	1600	4	0
Pyrene	0.87		3700	3800	3800	4	0
Benzo(a)anthracene	0.54		11	14	15	4	0
Chrysene	0.90		30	31	32	4	0
Benzo(b)fluoranthene	1.1		3.9	4.0	4.0	4	0
Benzo(k)fluoranthene	0.60		110	110	110	4	0
Benzo(a)pyrene	0.51		3.2	3.2	3.2	4	0
Indeno(1,2,3-c,d)pyrene	0.40		45	46	46	4	0
Benzo(g,h,i)perylene	0.56		360	360	360	4	0
TPH Aliphatic $C_{12} – C_{16}$	4.7		1100	2400	4400	2	0
TPH Aliphatic $C_{16} – C_{35}$	140		65000	92000	110000	2	0
Asbestos	Not Detected						

*assumes all chromium on site is in trivalent form

**provisional C4SL
***most sensitive fraction within wider TPH band (specified)

11.2 Interpretation

11.2.1 The analyses recorded no elevated concentrations of contaminants with respect to the selected screening values.

11.2.2 The samples have also undergone further screening by LQM/CIEH S4UL: Residential with Plant Uptake, these being a more stringent screening criteria. When screened against these values, no elevated concentrations of contaminants were noted.

11.3 Summary

11.3.1 On the basis of the chemical testing undertaken, JNP Group considers that there is no viable risk to human health from elevated concentrations of contaminants within the soil.

11.4 Risk to Controlled Waters

11.4.1 Based upon a review of the contaminants recorded in Table 11.1, highly mobile organic hydrocarbons, such as BTEX, lighter TPH fractions, or naphthalene, were not recorded within the made ground. The metal concentrations recorded are similar to typical background concentrations. JNP Group considers that there is no viable risk to controlled waters from elevated concentrations of contaminants within the soil.

11.5 Summary

11.5.1 On the basis of the chemical testing undertaken, JNP Group consider that the concentrations of contaminants within the soil do not pose significant risk to human health or controlled waters.

12 GROUND GAS PROTECTION REQUIREMENTS

12.1 Guidance and Standards

12.1.1 JNP Group has used the guidance given in the following document to assess the risks from ground gases

- CIRIA C665. Assessing risks posed by hazardous gases to buildings. 2007;
- BS 8485. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. 2015 +A1 2019;

CL:AIRE RB 17. A Pragmatic Approach to Ground Gas Risk Assessment. 2012.

12.1.2 During JNP Group's Phase II Ground Investigation, no significant amounts of made ground were encountered in the exploratory holes undertaken. Furthermore, samples of made ground scheduled for chemical testing recorded no elevated concentrations of contaminants, suggesting that a gas generation source is not present at the site.

12.1.3 Due to no source of gas generation being identified at the site, JNP Group consider that future ground gas monitoring would not be required.

13 REVISED CONCEPTUAL SITE MODEL AND OVERALL ENVIRONMENTAL RISK

13.1 Summary

13.1.1 Following the ground investigation and subsequent assessment undertaken, the conceptual site model and overall environmental risk assessment have been updated as detailed in the following table.

Table 13.1 Updated Conceptual Model and Risk Assessment

Issue	Risk		Justification
HUMAN HEALTH	LOW		No contaminant exceedances were noted with levels similar to background concentrations, hence not considered to be of significant concern. No source of gas generation identified from observation and the chemical testing at the site.
GROUNDWATER	LOW		Contamination concentrations are similar to background. No mobile species of metals or hydrocarbons present.
SURFACE WATER	LOW		Contamination at concentrations similar to background. No mobile species of metals or hydrocarbons present.
PROPERTY & INFRASTRUCTURE	LOW		No gas generation source has been identified. Highly acidic or mobile hydrocarbons have not been recorded at the site.
ECOLOGY	LOW		Building's housing sensitive species to be demolished / modified, risks reduced by mitigation proposed in ecological assessment. No contaminant exceedances were noted.

14 GEOTECHNICAL ENGINEERING ASSESSMENT

14.1 Proposed Development / Redevelopment

14.1.1 The proposed development is limited to the agricultural buildings in the north of the site. The stone barn in the centre of the site will be extended to provide holiday accommodation. The barn in the north east will be demolished and a new function suite built on the footprint.

14.2 Summary of Ground and Groundwater Conditions

14.2.1 The ground conditions encountered during the intrusive investigations were generally consistent with the published geological records. A variable thickness of made ground was found to be underlain by cohesive Devensian Till, which in turn was underlain by cohesive and granular strata of the Alston formation; this graded as a weak mudstone with increasing depth. The deepest made ground was encountered in WS2 to the north of the existing eastern barn.

14.3 Site Preparation and Earthworks

14.3.1 The stone barn in the centre of the site features a wraparound agricultural shed. It is proposed that this will be demolished whilst retaining the stone barn. A replacement structure will then be constructed to the west, south and north the barn featuring a single storey vertical wooden walled and corrugated metal sheeting roof construction; this will be single storey.

14.3.2 The large agricultural barn in the north east will be demolished and a single storey wooden boarded with timber cladded roof will be constructed. This will be within the existing buildings footprint.

14.4 Shallow Foundations

14.4.1 The made ground deposits are considered unsuitable to support foundation loads due to their poor engineering characteristics, and inherent variability.

14.4.2 Traditional shallow strip or pad foundations are considered feasible, placed within the Devensian Till.

14.4.3 Foundation excavations should be taken through all topsoil and made ground deposits, and foundations placed within the cohesive Devensian Till at a minimum founding depth of 0.9 m bgl, based upon soils of medium volume change potential. An allowable bearing pressure of 75 kN/m^2 would be available at 0.9m bgl. If a greater bearing capacity is required, the foundations should be deepened to 2.0m bgl. This would provide an allowable bearing pressure of 150 kN/m^2. Both bearing pressures are based upon a standard 0.6m wide foundation. The allowable bearing capacity includes an overall factor of safety of three against bearing capacity failure, whilst ensuring total settlements are maintained at less than 25mm. However, there are several trees, in and around the site, and the influence of these may be the controlling criteria for determining foundation type and depth.

14.4.4 It should also be noted that the ground surface sloped gently from the east (105.09m AOD) to the west (101.89m AOD); therefore, some foundations may need to be stepped.

14.4.5 When the natural moisture content of a soil lies close or less than the value of the Plastic Limit, the soil can be considered desiccated. In addition, Driscoll (1983) suggested that desiccation is assumed to be present when the moisture content falls below a level of 40%

of the Liquid Limit. The index tests indicate that two samples of Alston Formation, are desiccated.

14.4.6 Where foundations are to be constructed within the influence of existing, felled or proposed trees, they are likely to need deepening, and heave precautions adopted in accordance with National House Building Council (NHBC) Chapter 4.2 'Building Near Trees', based upon soils of medium volume change potential. It is recommended that collapsible materials are used between foundations and cohesive soils to reduce heave pressures. JNP Group recommends that a tree species survey is undertaken, and the results are used to calculate their zones of influence, in order to define areas where foundations would require deepening.

14.4.7 The presence of rootlets was noted within the topsoil of all the sample locations. These observations were limited to the topsoil strata with no roots observed in deeper strata.

14.4.8 It should be noted that trench fill foundations deeper than 2.50m would only be acceptable by the NHBC if they were designed by an engineer.

14.5 Ground Floor Slabs

14.5.1 The underlying soils are considered to have medium volume change potential, and consequently may heave. Therefore, suspended ground floor slabs should be used incorporating suitable underfloor voids, based on the recommendations in NHBC Chapter 4.2, with reference to soils of medium volume change potential.

14.6 Groundwater and Excavations

14.6.1 All window sampler holes remained stable during drilling and therefore foundation / service trenches should not undergo collapse or spalling. In addition, groundwater encounters were limited to WS5 at 3.5m bgl, this was noted to be seepage. Hence, JNP Group does not consider that groundwater inflow or excavation collapse will present practical difficulties during foundation excavation.

14.7 Pavement Design

California Bearing Ratio

14.7.1 The near surface soils comprise variable made ground deposits of clay and gravel, which indicates an equilibrium subgrade CBR value of <2.5 % (based upon Table 3.1 in Interim Advice Note 73/06 Rev 1 2009).

14.7.2 If a higher CBR value is required, the near surface made ground deposits should be removed and the subgrade placed within the Devensian Till. A mean Plasticity Index Value of 20% was recorded in the near surface Devensian Till soils, which indicates an equilibrium subgrade CBR value of 4% (based upon Table 3.1 in Interim Advice Note 73/06 Rev 1 2009), assuming average construction conditions, and medium water table.

14.8 Ground Aggressivity to Buried Concrete

14.8.1 Chemical analyses of 5 No. samples have been undertaken in accordance with BRE SD1 2005 "Concrete in aggressive ground" to determine their concrete classification.

Table 14.1 Concrete Classification Assessment

Strata	Details	Range	Concrete Class
Devensian Till	Number of Tests	3	DS1 – AC1
	Water Soluble Sulphates (mg/l)	17 - 39	
	pH	7.5 – 8.2	
	Total Potential Sulphate %	0.07 – 0.14	
Alston Formation	Number of Tests	2	DS3 – AC3
	Water Soluble Sulphates (mg/l)	69 - 190	
	pH	8.3 – 8.8	
	Total Potential Sulphate %	0.58 – 0.94	

14.8.2 On the basis of the above assessment, and in accordance with BRE SD1 (2005) "Concrete in aggressive ground", a Design Sulphate Class of DS1, with an ACEC of AC-1, would be applicable for concrete buried within the Devensian Till. For concrete placed within the Alston Formation a concrete classification of DS3, with an ACEC of AC3 would apply.

15 CONCLUSIONS AND RECOMMENDATIONS

15.1 Conclusions

15.1.1 JNP Group has determined through desk-based research, intrusive investigation, laboratory testing, and assessment that:

- Ground conditions at the site comprise a variable thickness of topsoil and made ground underlain by cohesive Devensian Till, which in turn was underlain by cohesive and granular strata of the Alston formation; this graded as a weak mudstone with increasing depth. The deepest made ground was encountered in WS2 to the north of the existing eastern barn.
- On the basis of the chemical testing undertaken, JNP Group consider that the concentrations of contaminants within the soil do not pose significant risk to human health or controlled waters.
- Radon gas protection measures are not required for this development;
- Traditional shallow strip or pad foundations are considered feasible, placed within the Glacial Till. An allowable bearing pressure of 75 kN/m^2 would be available at 0.9m bgl, based upon standard 0.6m wide foundations;
- The site contains several mature trees, which would require foundations within influencing distance to be deepened, based upon soils of medium volume change potential;
- Due to no source of gas generation being identified at the site, JNP Group consider that ground gas monitoring would not be required.

15.2 Recommendations

15.2.1 In line with the guidelines given LCRM and consequent to the ground investigation conclusions; JNP Group recommends that:

- A tree survey be undertaken at the site, in order to be able to assess their impact upon foundations types and depths.
- A copy of this report is submitted to the Regulatory Authorities for their approval before any further work is undertaken at the site.

15.2.2 In addition, JNP Group recommends that the proposed development works are undertaken in accordance with the definition of Waste Code of Practice (DoWCoP); in following this guidance and to ensure materials are managed correctly, A Materials Management Plan will need to be prepared and declared in advance by a Qualified Person, then implemented and documented in a Verification Report. If this process is not undertaken, then following recent changes in Landfill Tax Regulations by HMRC. There is a risk of penalties equating to twice the Landfill Tax being applied to the re-use of material o site. If the proposed works are to be undertaken outside the DoWCoP, there would need to be some of Environmental Permitting or suitable equivalent. The requirements of such are likely to be more onerous and may take longer to be granted.

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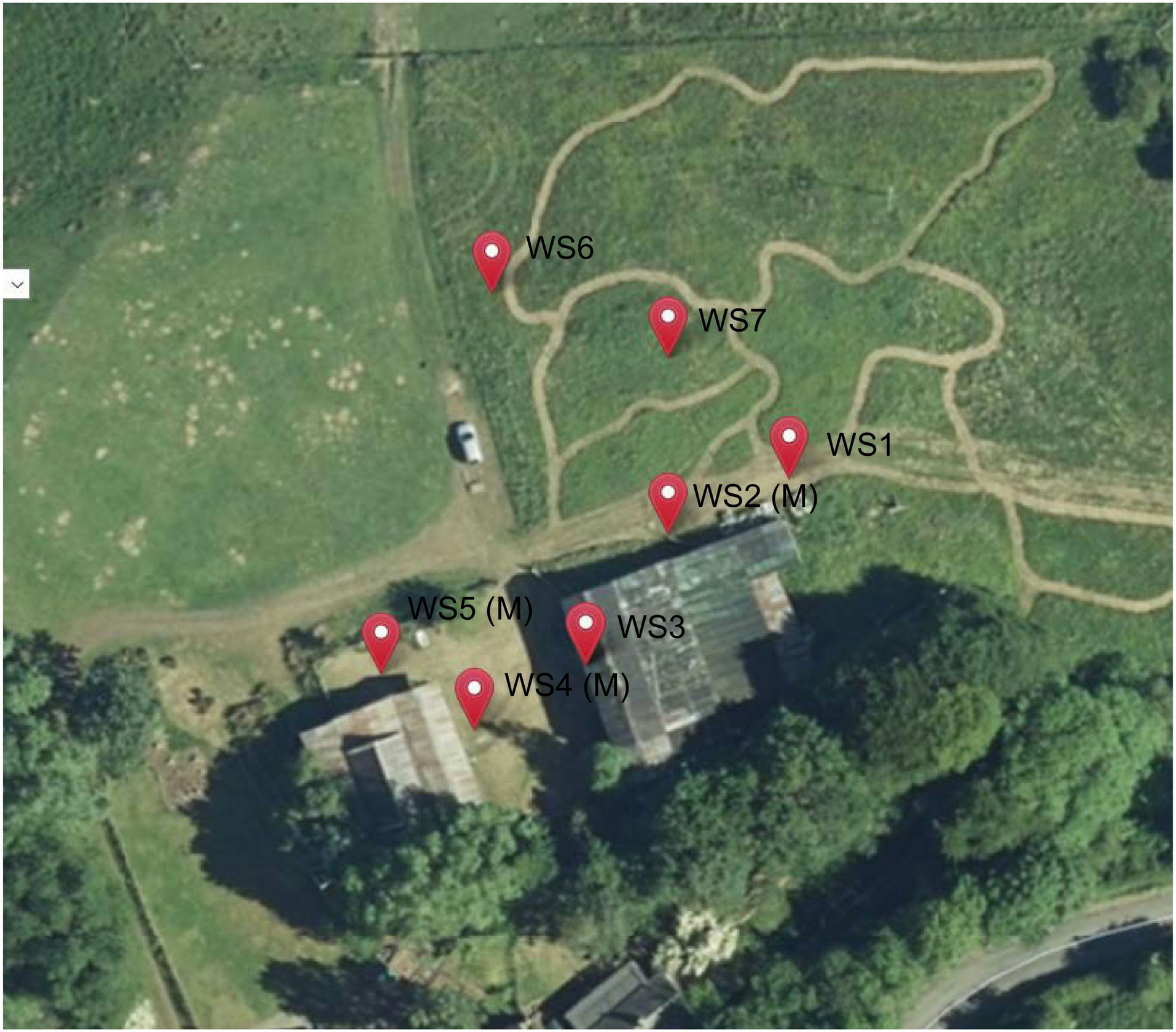
FIGURES / DRAWINGS



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Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants

Hallington Mill, Northumberland

Window Sampler Location Plan

Classification: FI_60_20

NTS

Project - Originator - Volume/System - Level/Location - Type - Discipline - Number: H77273-JNP-XX-ZZ -DR-G-0001

Revision: -

Figure 1

Site Location Plan

Project:

Hallington Mill

Project No:

H77273

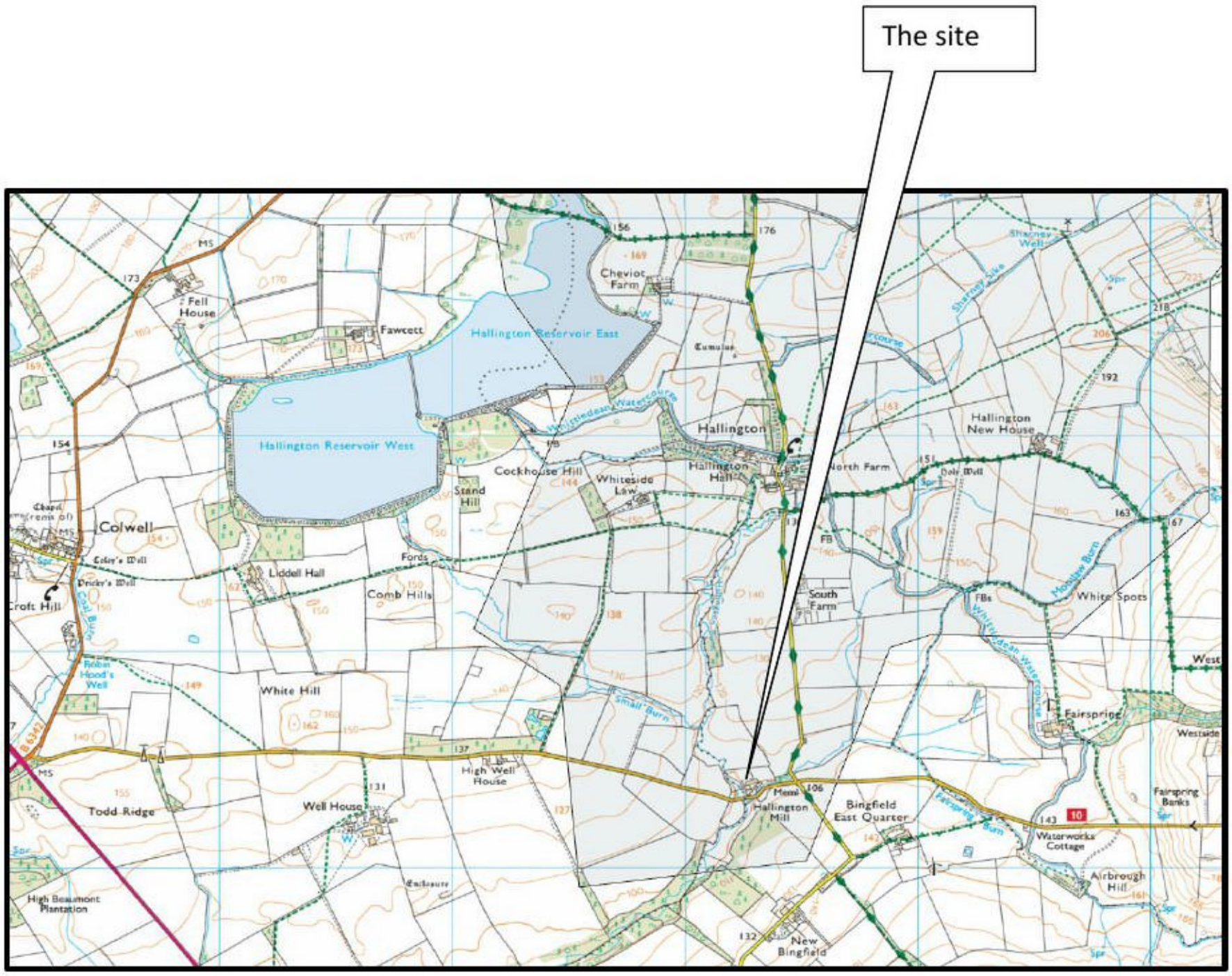

Figure 2

SPT / Depth Relationship

Project:

Hallington Mill

Project No:

H77273

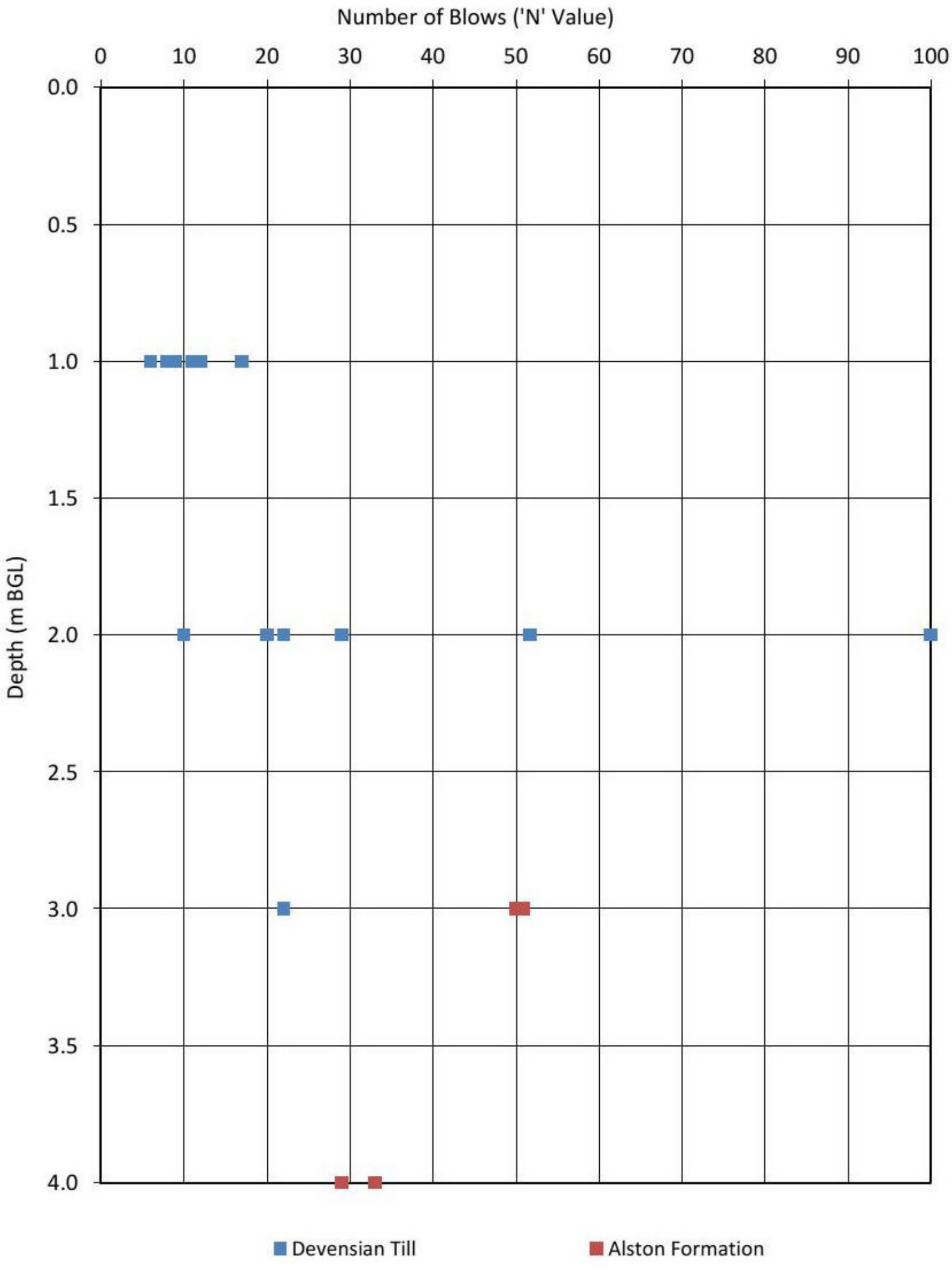

Figure 3

Project:

Hallington Mill

Project No:

H77273

Undrained Shear Strength / Depth Relationship

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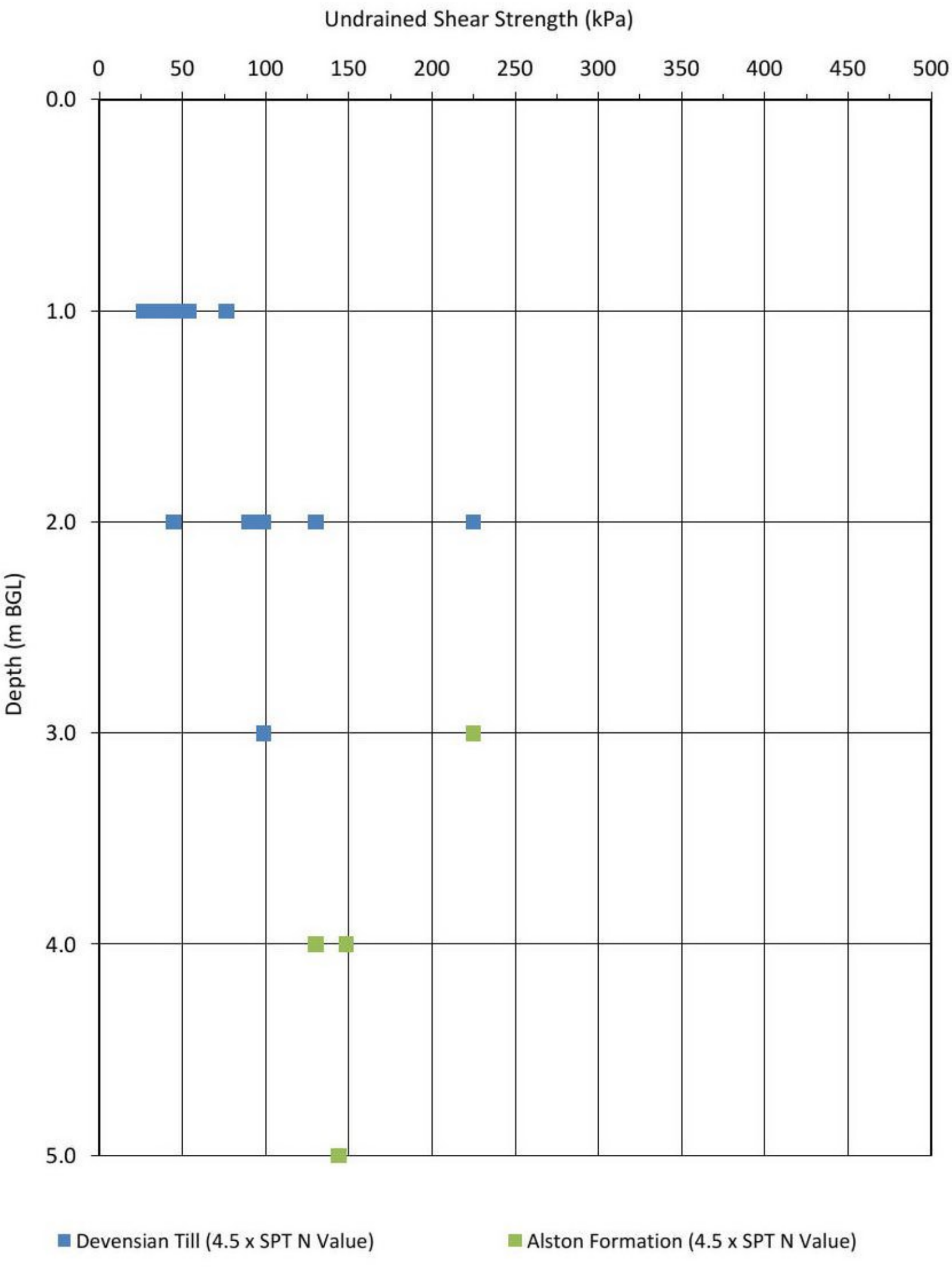


Figure 4

Project:

Hallington Mill

Project No:

H77273

Plasticity Index Chart

Key:
C Clay M Silt

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

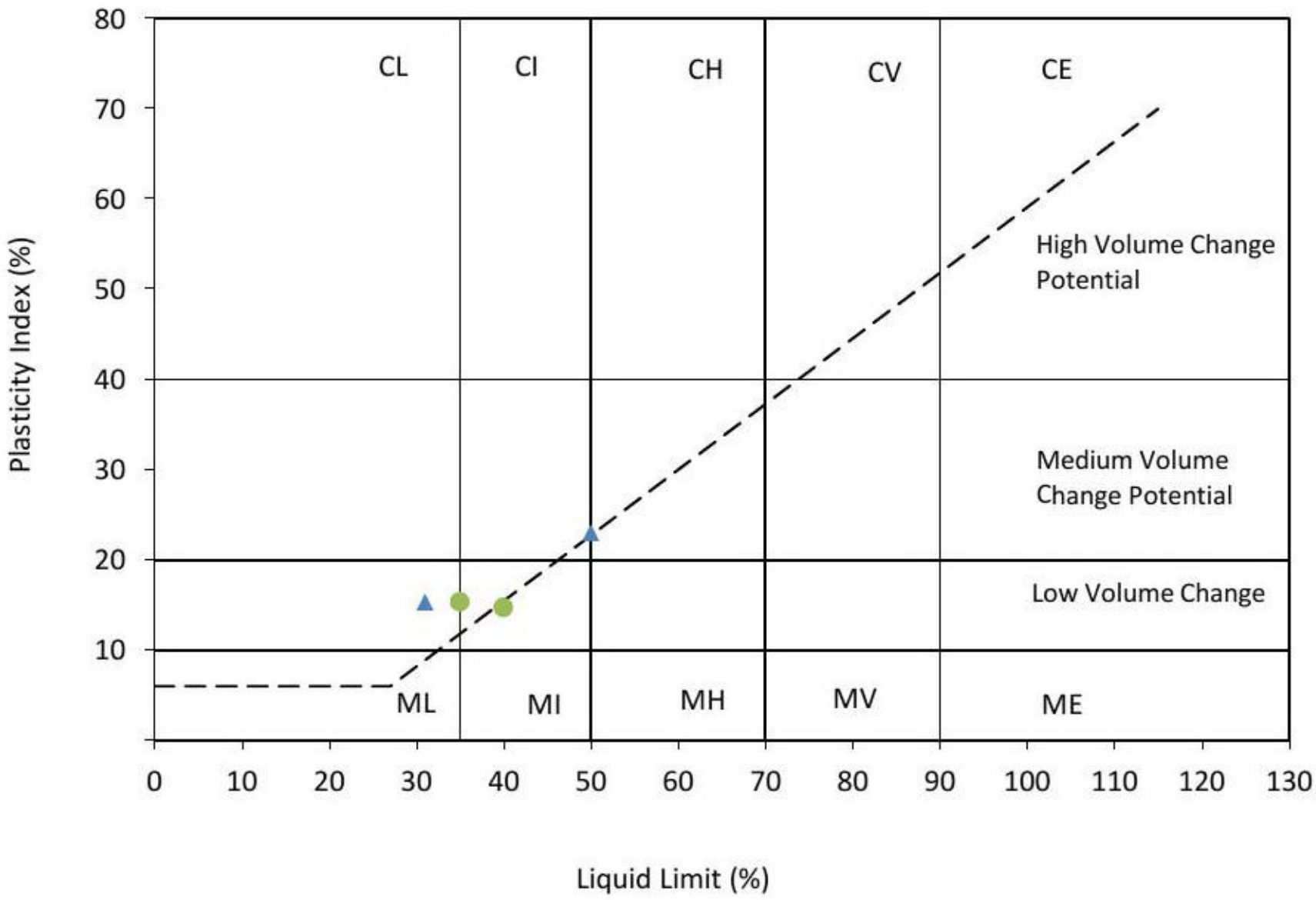


Figure 5

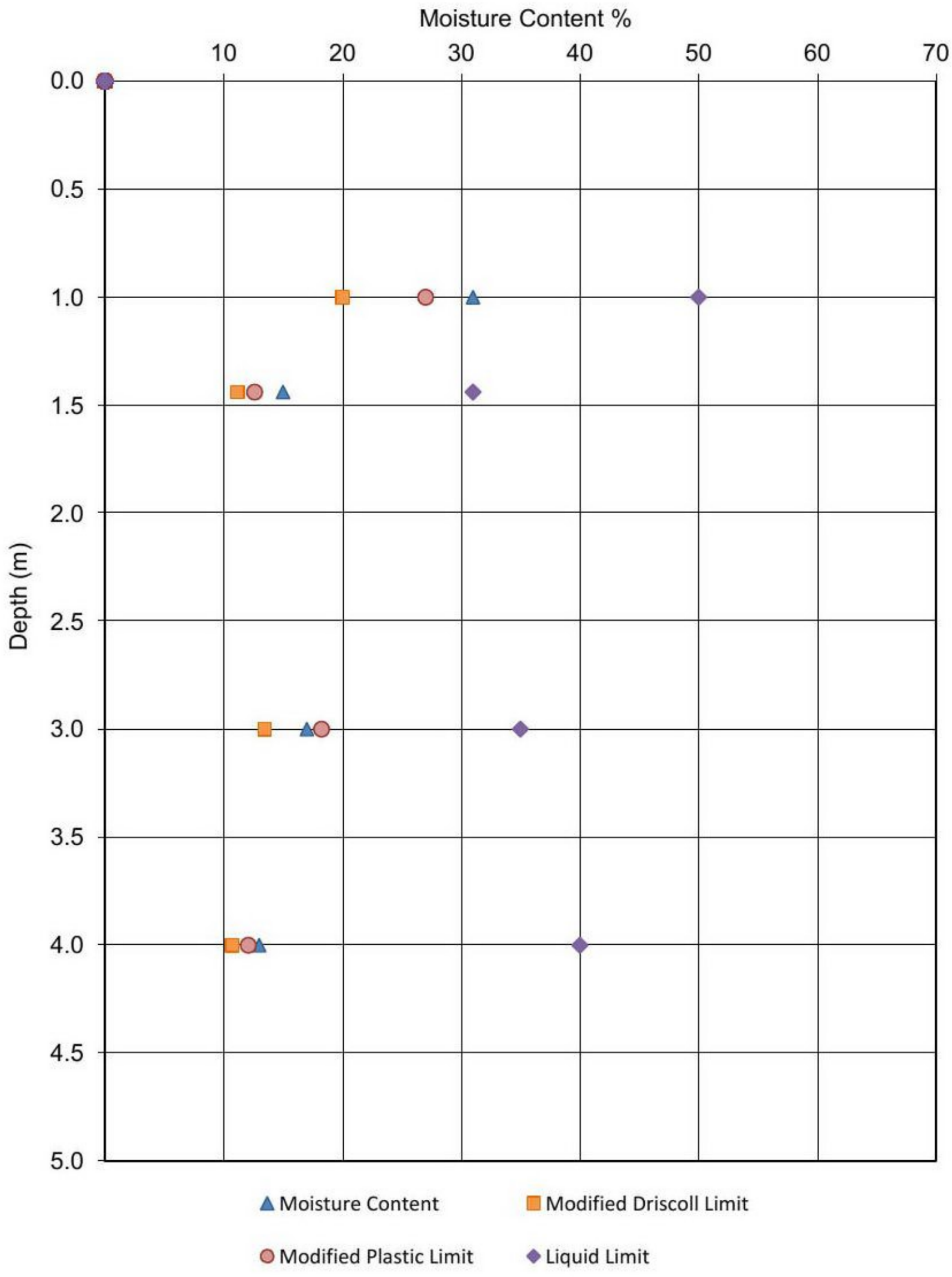
Moisture Content / Depth Relationship

Project:

Hallington Mill

Project No:

H77273



Appendix A LIMITATIONS

INTRODUCTION

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 JNP Group; a charge may be levied against such approval. JNP Group 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.

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 JNP Group and JNP Group will not accept any liability or responsibility for any inaccuracy in such information.

Any deviation from the recommendations or conclusions contained in this report should be referred to JNP Group in writing for comment and JNP Group reserve the right to reconsider their recommendations and conclusions contained within. JNP Group 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.

The details contained within this report reflect the site conditions prevailing at the time of investigation. JNP Group 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 JNP Group for re-assessment and, if necessary, re-appraisal.

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 JNP Group' belief, JNP Group cannot guarantee the accuracy or completeness of any information provided by third parties.

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

JNP Group 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.

Objectives

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, JNP Group 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.

Phase II Intrusive Investigations

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.

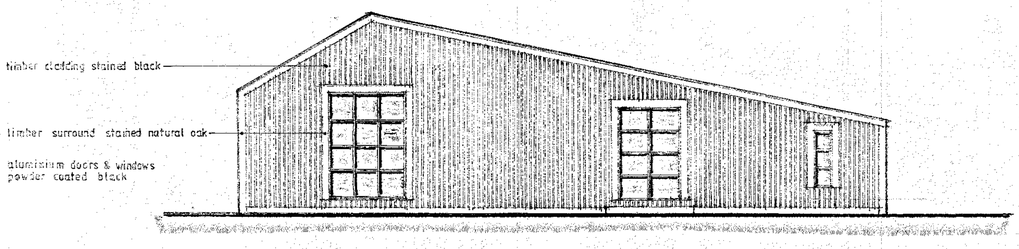
Where intrusive investigations have been undertaken, they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature sampling, no investigation technique is capable of identifying all conditions present in all areas. The number of sampling points and the 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.

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.

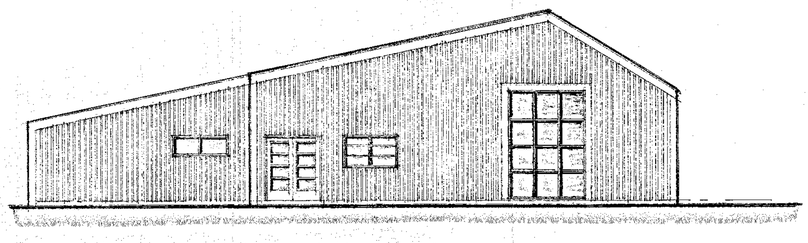
Gas and groundwater levels may vary from those reported due to seasonal, or other effects.

Although preliminary comment has have been provided by JNP Group regarding UXO and Invasive Species, JNP Group not experts in these and as such specialist advice should be sought regarding the presence of UXO and invasive species at the site.

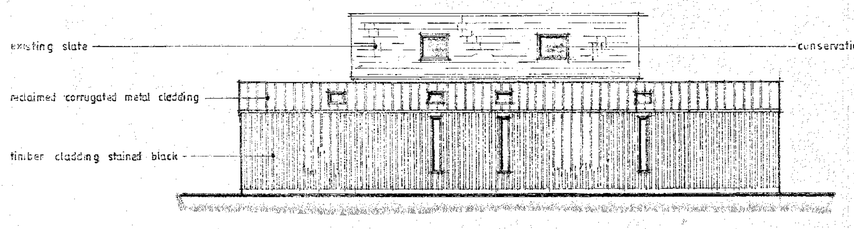
Appendix B THIRD PARTY DRAWINGS



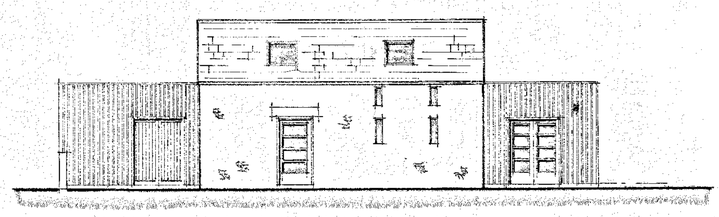
WEST ELEVATION



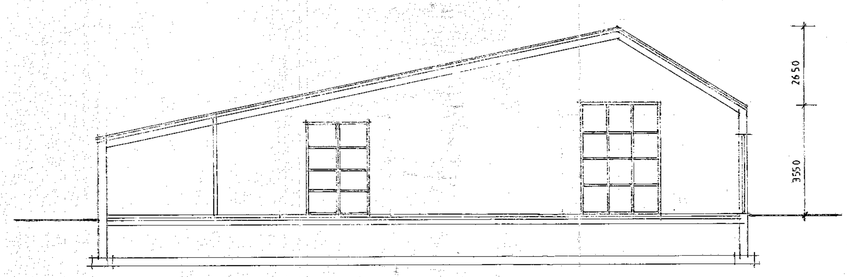
EAST ELEVATION



WEST ELEVATION (threshing barn)



EAST ELEVATION (threshing barn)



SECTION

John Eives Associates
Architectural consultants

22 The Fellside
Kenton
Newcastle upon Tyne
NE3 4LJ

tel/fax 0191 2135066
mob 07984 064638

Client

Mr & Mrs R. Wiggins

Project

Proposed multi-purpose rural events venue, and holiday home
at Hallington Hill
Northumberland

Title

Proposed east and west elevations, sections A – A

Project 1831	Scale 1:100,
Drg no 3	Date 08 - 20

Appendix C PHOTO DOCUMENT

Photograph: 1 Looking west onto the eastern agricultural barn (proposed to be demolished)

Photograph: 2 Example of items stored within the eastern former agricultural barn

Photograph: 3 Showing example of usage within eastern former agricultural barn

Photograph: 4 Looking south away from the site towards Hallington Mill building. Also note presence of trees and decrease in height on the southern boundary of the site.

Photograph: 5 Area of former yard, between the two northern sheds

Photograph: 6 Showing an internal view of the stone built thrashing barn in the north west of the site. This will be retained as part of the development.

H77273
Hallington Mill, Northunberland
Photographs of Site

Photograph: 8: Ground conditions in WS1

Photograph: 8:Showing ground conditions in WS2

Photograph: 9 Showing WS3

Photograph: 10 Showing WS3B

H77273
Hallington Mill, Northunberland
Photographs of Site

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Photograph: 12 Showing WS4

Photograph: 11 Showing WS5

H77273
Hallington Mill, Northunberland
Photographs of Site

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Photograph: 13 Showing WS6

Photograph: 14 Showing WS7

Appendix D EXPLORATORY HOLE RECORDS

Borehole Log

			Borehole No. **WS1** Sheet 1 of 1
Project Name: Hallington Mill	Project No. H77273	Co-ords: 398315.00 - 574421.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 105.09	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES					Grass over brown loamy GRAVEL with rootlets. Gravel is fine, angular of bricks, limestone and sandstone.
		0.25	ES		0.20	104.89		MADE GROUND
					0.30	104.79		Light grey GRAVEL. Gravel is fine to medium, angular of concrete, brick, sandstone, limestone and detritus material.
		0.50	ES					MADE GROUND
								Soft brown gravelly CLAY. Gravel is fine to medium, angular to rounded of coal, sandstone, limestone. (Organic matter noted in top 0.60m)
		1.00		N=6 (1,1/2,1,2,1)				DEVENSIAN TILL
					1.80	103.29		Brown very stiff gravelly CLAY. Gravel is of medium, angular sandstone and limestone.
		2.00		50 (25 for 60mm/50 for 125mm)	2.00	103.09		DEVENSIAN TILL
								End of borehole at 2.00 m

Remarks
Hole dry, terminated early due to refusal.

Borehole Log

			Borehole No. **WS2** Sheet 1 of 1
Project Name: Hallington Mill	Project No. H77273	Co-ords: 398302.00 - 574415.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 104.10	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	ES		0.10	104.00		Grass over brown gravelly TOPSOIL with abundant rootlets.
		0.30	ES					Light brown sandy, gravelly CLAY. Gravel is fine to course of brick, sandstone and limestone. MADE GROUND
		0.55	ES		0.48	103.62		Grey with green hue slightly sandy gravelly CLAY. Gravel is of mudstone, DEVENSIAN TILL
		1.00		N=11 (1,2/2,3,2,4)				
		1.44	D		1.55	102.55		Brown soft gravelly CLAY. Gravel is of fine, angular coal. DEVENSIAN TILL
		2.00 2.00	ES	N=22 (4,5/4,6,5,7)				
					2.30	101.80		Dark grey silty grey gravelly CLAY. Gravel is rounded fine to medium of sandstone, coal, mudstone and limestone. ALSTON FORMATION.
		3.00 3.00	D	N=50 (7,9/14,14,15,7)	3.00	101.10		End of borehole at 3.00 m

Remarks
Hole dry, terminated early due to refusal.

Borehole Log

Borehole No. **WS3**

Sheet 1 of 1

Project Name: Hallington Mill	Project No. H77273	Co-ords: 398293.00 - 574401.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 102.27	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.10	102.17		Grass over brown gravelly TOPSOIL with rootlets. Gravel is of fine, angular of limestone, and sandstone.
		0.30	ES		0.40	101.87		Brown very clayey GRAVEL. Gravel is fine to medium angular of bricks, coal, sandstone, concrete and limestone. MADE GROUND
								End of borehole at 0.40 m

Remarks
Hole dry, terminated early due to refusal.

Borehole Log

Borehole No. **WS3B**

Sheet 1 of 1

Project Name:	Hallington Mill	Project No. H77273	Co-ords:	398293.00 - 574401.00	Hole Type WS
Location:	Hallington, Northumberland, NE19 2LJ		Level:	102.27	Scale 1:25
Client:	Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates:	02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	102.17		Grass over brown gravelly TOPSOIL with rootlets. Gravel is of fine, angular of limestone, and sandstone.
					0.40	101.87		Brown very clayey GRAVEL. Gravel is fine to medium angular of bricks, coal, sandstone, concrete and limestone. MADE GROUND
								End of borehole at 0.40 m

Remarks
Hole dry, terminated early due to refusal.

Borehole Log

Borehole No. **WS4** Sheet 1 of 1			
Project Name: Hallington Mill	Project No. H77273	Co-ords: 398281.00 - 574394.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 102.27	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.05	102.22		Grass over brown loamy TOPSOIL with rootlets.
					0.35	101.92		Light grey GRAVEL. Gravel is fine to course, angular to rounded of, limestone. Mudstone and sandstone. MADE GROUND
		1.00		N=17 (4,6/3,5,4,5)				Brown gravelly CLAY. Gravel is fine angular to rounded of sandstone, coal and mudstone. DEVENSIAN TILL
		2.00		N=50 (6,6/50 for 290mm)	2.00	100.27		End of borehole at 2.00 m

Remarks
Hole dry, terminated early due to refusal.

Borehole Log

Project Name: Hallington Mill	Project No. H77273	Co-ords: 398271.00 - 574400.00	Borehole No. **WS5** Sheet 1 of 1
Location: Hallington, Northumberland, NE19 2LJ		Level: 101.89	Hole Type WS
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Scale 1:25
			Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.25	101.64		Grass over brown gravelly TOPSOIL with rootlets. Gravel is of fine, angular of limestone, and sandstone. TOPSOIL
		0.30	ES					Brown gravelly sandy CLAY. Gravel is fine to medium of sandstone, limestone and coal. DEVENSIAN TILL
		0.80	ES					
		1.00	D					
		1.00		N=9 (2,1/2,2,2,3)				
		1.50	D					
		2.00		N=20 (4,4/7,5,4,4)				
		3.00		N=22 (4,7/4,6,6,6)				
		4.00	D		3.50	98.39		Dark grey very silty, CLAY. Gravel is of very weak mudstone, thinly laminated. ALSTON FORMATION
		4.00		N=29 (5,6/6,7,8,8)				
		5.00		N=32 (7,6/7,8,7,10)	5.00	96.89		End of borehole at 5.00 m

Remarks
Pocket of groundwater at 3.5m bgl, target depth achieved.

Borehole Log

Borehole No. **WS6**

Sheet 1 of 1

Project Name: Hallington Mill	Project No. H77273	Co-ords: 398283.00 - 574441.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 103.42	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.35	103.07		Grass over brown clayey TOPSOIL with root-lets.
		1.00		N=12 (2,2/2,3,3,4)				Light brown gravelly silty CLAY. Gravel is fine, rounded of coal, and rounded pebbles of sandstone and mudstone. DEVENSIAN TILL
		2.00		N=10 (3,2/3,2,2,3)				
		3.00		N=22 (4,5/5,6,5,6)				
					3.50	99.92		Dark grey silty gravelly CLAY. Gravel is fine to medium, angular of mudstone and sandstone. ALSTON FORMATION
		4.00		N=33 (17,7/8,9,8,8)	4.00	99.42		End of borehole at 4.00 m

Remarks
Hole dry, target depth achived.

Borehole Log

			Borehole No. **WS7** Sheet 1 of 1
Project Name: Hallington Mill	Project No. H77273	Co-ords: 398302.00 - 574434.00	Hole Type WS
Location: Hallington, Northumberland, NE19 2LJ		Level: 104.10	Scale 1:25
Client: Mr & Mrs R Wiggins C/O John Elves Associates Architectural Consultants		Dates: 02/09/2021 - 02/09/2021	Logged By SP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.15	ES		0.20	103.90		Grass over brown loamy TOPSOIL with rootlets.
		0.60	ES					Brown slightly silty gravelly CLAY. Gravel is fine, rounded of sandstone, coal and mudstone. DE-VENSIAN TILL
		1.00 1.00	D	N=8 (2,1/2,2,2,2)				
		2.00		N=29 (5,5/7,8,7,7)				
					2.60	101.50		Dark grey very silty clayey GRAVEL. Gravel is of mudstone and sandstone. ALSTON FORMATION
		3.00 3.00	D	N=50 (3,4/50 for 295mm)	3.00	101.10		End of borehole at 3.00 m

Remarks
Hole dry, terminated early due to refusal.

Appendix E GEOTECHNICAL RESULTS

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING
4041

Environmental Science

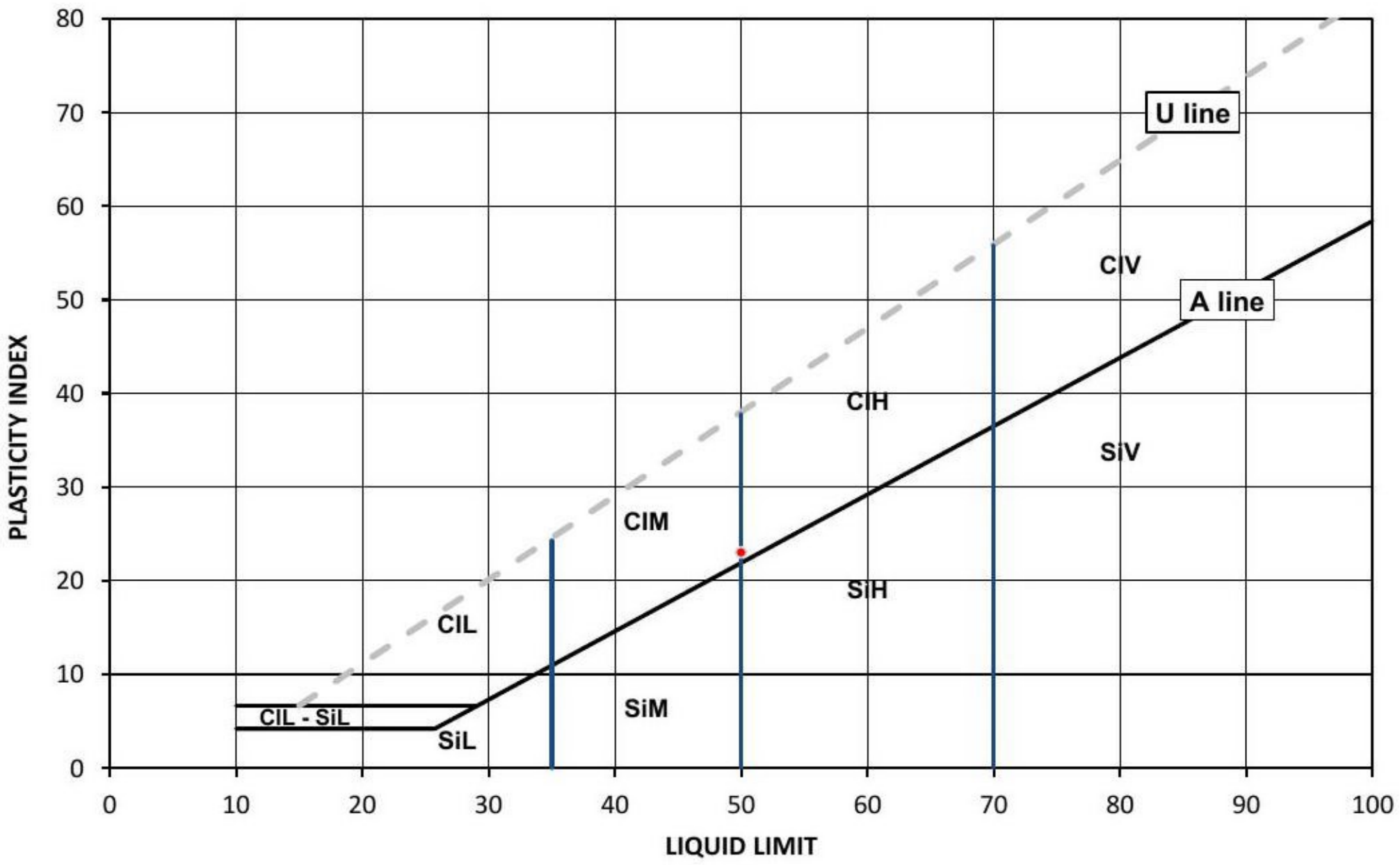
Client:	JNP Midlands LLP	Client Reference:	H77273
Client Address:	No.1 Meadowhall, Riverside, Sheffield	Job Number:	21-97780
		Date Sampled:	02/09/2021
		Date Received:	03/09/2021
Contact:	Samuel Pyott	Date Tested:	20/09/2021
Site Address:	Hallington Milll	Sampled By:	Client - SP

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2001544	Depth Top [m]:	1.00
Hole No.:	WS1 D4	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Dark brown slightly sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
31	50	27	23	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

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

Remarks:

Signed: [redacted]

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 23/09/2021

GF 236.11

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING
4041

Environmental Science

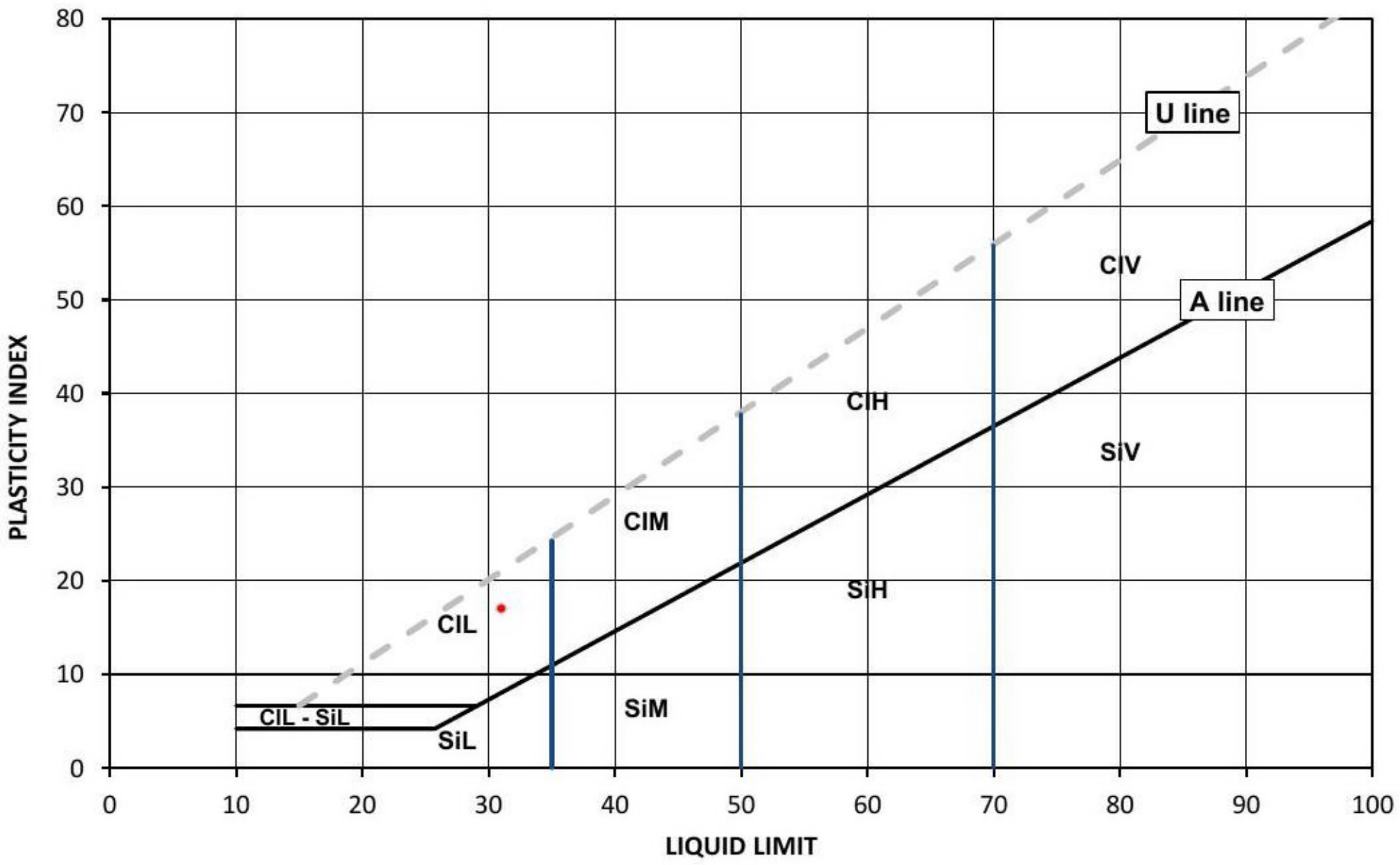
Client:	JNP Midlands LLP	Client Reference:	H77273
Client Address:	No.1 Meadowhall, Riverside, Sheffield	Job Number:	21-97780
		Date Sampled:	02/09/2021
		Date Received:	03/09/2021
Contact:	Samuel Pyott	Date Tested:	20/09/2021
Site Address:	Hallington Milll	Sampled By:	Client - SP

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2001545	Depth Top [m]:	1.44
Hole No.:	WS2 D5 N	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Dark brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	31	14	17	90



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

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

Remarks:

Signed: [redacted]

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 23/09/2021

GF 236.11

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING
4041

Environmental Science

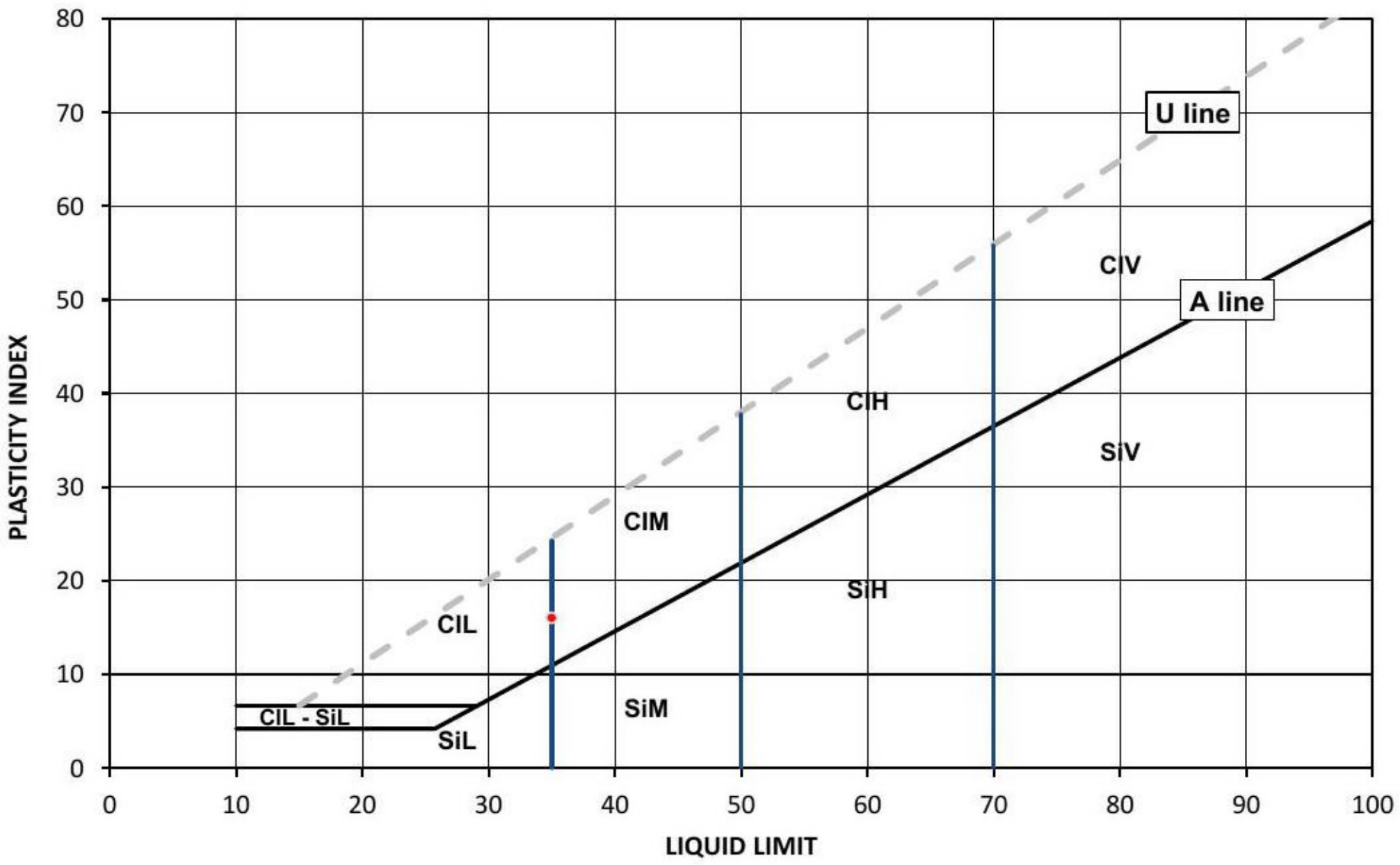
Client:	JNP Midlands LLP	Client Reference:	H77273
Client Address:	No.1 Meadowhall, Riverside, Sheffield	Job Number:	21-97780
		Date Sampled:	02/09/2021
		Date Received:	03/09/2021
Contact:	Samuel Pyott	Date Tested:	20/09/2021
Site Address:	Hallington Milll	Sampled By:	Client - SP

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2001546	Depth Top [m]:	3.00
Hole No.:	WS2 D6 N	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Dark brown slightly gravelly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
17	35	19	16	96



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

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

Remarks:

Signed: [redacted]

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 23/09/2021

GF 236.11

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING
4041

Environmental Science

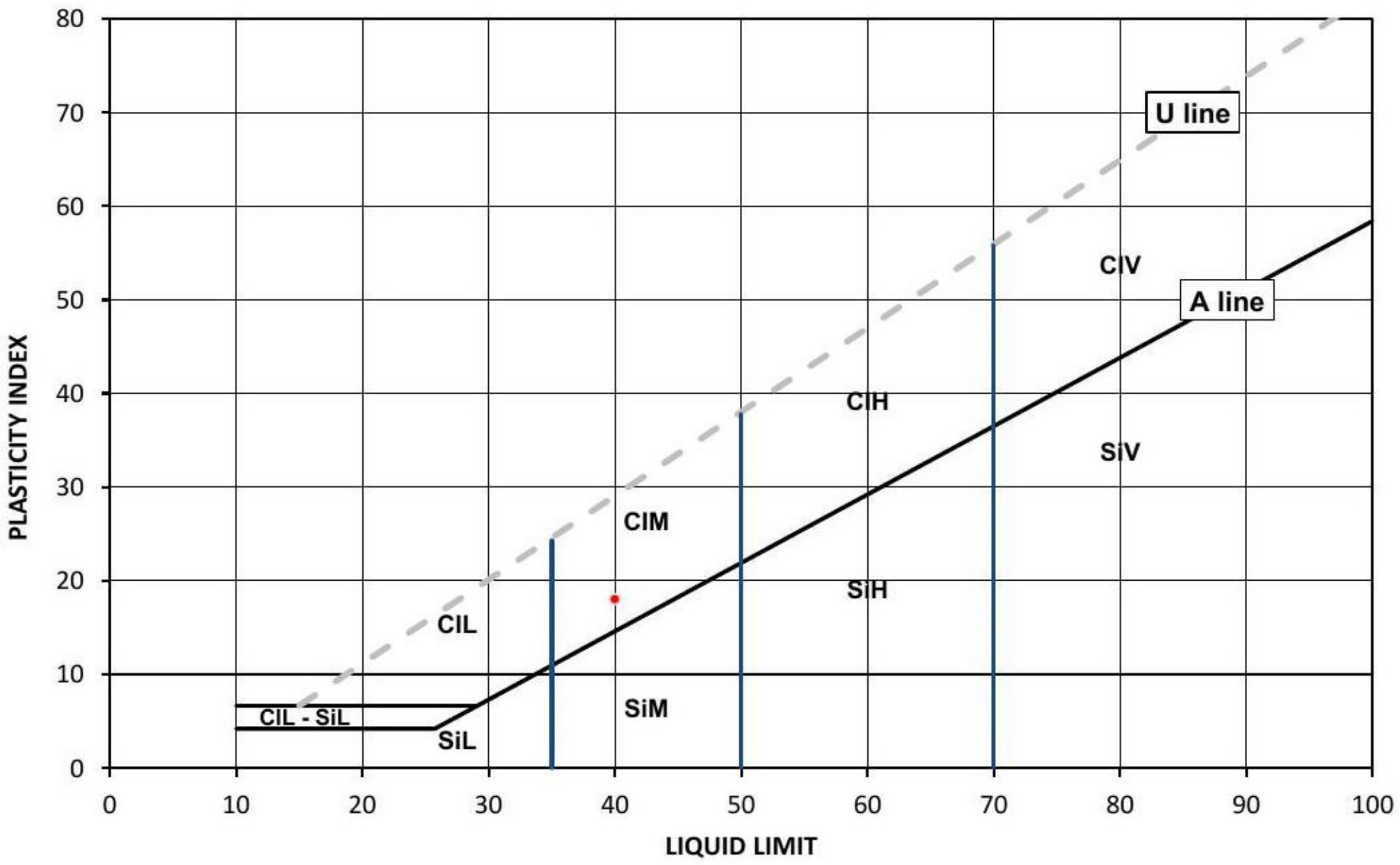
Client:	JNP Midlands LLP	Client Reference:	H77273
Client Address:	No.1 Meadowhall, Riverside, Sheffield	Job Number:	21-97780
		Date Sampled:	02/09/2021
		Date Received:	03/09/2021
Contact:	Samuel Pyott	Date Tested:	20/09/2021
Site Address:	Hallington Milll	Sampled By:	Client - SP

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2001547	Depth Top [m]:	4.00
Hole No.:	WS5 D6 N	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Dark grey slightly gravelly sandy CLAY with fragments of shales		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
13	40	22	18	67



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

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

Remarks:

Signed: [redacted]

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 23/09/2021

GF 236.11

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: JNP Midlands LLP

Client Address: No.1 Meadowhall, Riverside, Sheffield

Contact: Samuel Pyott

Site Address: Hallington Milll

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

Client Reference: H77273
Job Number: 21-97780
Date Sampled: 02/09/2021
Date Received: 03/09/2021
Date Tested: 20/09/2021
Sampled By: Client - SP

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m				%	%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3	%		
2001544	WS1 D4 MG	Not Given	1.00	Not Given	D	Dark brown slightly sandy CLAY	Atterberg 4 Point	31		100	50	27	23						
2001545	WS2 D5 N	Not Given	1.44	Not Given	D	Dark brown slightly gravelly very sandy CLAY	Atterberg 4 Point	15		90	31	14	17						
2001546	WS2 D6 N	Not Given	3.00	Not Given	D	Dark brown slightly gravelly sandy CLAY	Atterberg 4 Point	17		96	35	19	16						
2001547	WS5 D6 N	Not Given	4.00	Not Given	D	Dark grey slightly gravelly sandy CLAY with fragments of shales	Atterberg 4 Point	13		67	40	22	18						

Note: # Non accredited; NP - Non plastic

Comments:

Signed: [redacted]

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 23/09/2021

GF 238.13

Samuel Pyott
JNP Midlands LLP
No.1 Meadowhall
Riverside
Sheffield

e: Samuel.Pyott@jnpgroup.co.uk

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

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

Analytical Report Number : 21-97783

Project / Site name:	Hallington Mill	**Samples received on:**	03/09/2021
Your job number:	H77273	**Samples instructed on/ Analysis started on:**	03/09/2021
Your order number:	G1218	**Analysis completed by:**	17/09/2021
Report Issue Number:	1	**Report issued on:**	20/09/2021
Samples Analysed:	5 soil samples		

Signed: [redacted]

Agnieszka Czerwińska
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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with 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.

Analytical Report Number: 21-97783
Project / Site name: Hallington Mill
Your Order No: G1218

Lab Sample Number				2001580	2001581	2001582	2001583	2001584
Sample Reference				WS1 D4 MG	WS2 D5 N	WS2 D6 N	WS5 D4 MG	WS5 D6 N
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.44	3.00	1.00	4.00
Date Sampled				02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
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	%	0.01	NONE	21	11	11	18	9.6
Total mass of sample received	kg	0.001	NONE	0.50	0.50	0.50	0.50	0.50
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.2	8.5	8.3	7.5	8.8
Total Sulphate as SO4	%	0.005	MCERTS	0.058	0.083	0.067	0.032	0.050
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.029	0.017	0.069	0.039	0.19
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	2.4	4.7	8.2	6.4	13
Total Sulphur	%	0.005	MCERTS	0.047	0.035	0.192	0.024	0.312
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	3.3	< 2.0	< 2.0	< 2.0	< 2.0
Heavy Metals / Metalloids								
Magnesium (water soluble)	mg/kg	5	NONE	7.5	7.2	6.7	7.4	14
Magnesium (leachate equivalent)	mg/l	2.5	NONE	3.7	3.6	3.4	3.7	7.0

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 21-97783
Project / Site name: Hallington Mill

* 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 *
2001580	WS1 D4 MG	None Supplied	1	Brown clay and loam with gravel.
2001581	WS2 D5 N	None Supplied	1.44	Brown clay and loam with gravel.
2001582	WS2 D6 N	None Supplied	3	Brown clay and loam with gravel.
2001583	WS5 D4 MG	None Supplied	1	Brown clay and sand with gravel.
2001584	WS5 D6 N	None Supplied	4	Black clay and loam with gravel.

Analytical Report Number : 21-97783
Project / Site name: Hallington Mill

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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.	L038-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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	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.	L099-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
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	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.	L038-PL	D	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
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS

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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Appendix F CHEMICAL TEST RESULTS

Samuel Pyott
JNP Midlands LLP
No.1 Meadowhall
Riverside
Sheffield

e: Samuel.Pyott@jnpgroup.co.uk

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 : 21-97287

Project / Site name:	Hallington Mill	**Samples received on:**	03/09/2021
Your job number:	H77273	**Samples instructed on/ Analysis started on:**	03/09/2021
Your order number:	G1217	**Analysis completed by:**	15/09/2021
Report Issue Number:	1	**Report issued on:**	15/09/2021
Samples Analysed:	8 soil samples		

Signed: [redacted]

Karolina Marek
PL Head of 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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with 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.

Analytical Report Number: 21-97287
Project / Site name: Hallington Mill
Your Order No: G1217

Lab Sample Number				1998757	1998758	1998759	1998760	1998761
Sample Reference				WS1 ES1 TS	WS1 ES2 MG	WS1 ES3 MG	WS2 ES1 TS	WS2 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.25	0.50	0.10	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
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	%	0.01	NONE	26	3.6	23	13	10
Total mass of sample received	kg	0.001	NONE	0.40	0.30	0.40	0.40	0.40
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.6	-	7.7	7.7	-
Organic Matter	%	0.1	MCERTS	16	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	-	2.1	-	-	-
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	0.61	-	-	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.73	-	-	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.60	-	-	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.45	-	-	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.52	-	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.80	-	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.30	-	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.51	-	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.33	-	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.36	-	-	-	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	5.21	-	-	-	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.9	-	9.5	9.3	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	100	-	160	170	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.33	-	0.96	1.2	-
Boron (water soluble)	mg/kg	0.2	MCERTS	2.2	-	0.5	1.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	-	0.4	0.4	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.9	-	18	23	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	-	18	21	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	27	-	34	34	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	-	32	33	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	9.9	-	25	31	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	320	-	89	95	-

Analytical Report Number: 21-97287
Project / Site name: Hallington Mill
Your Order No: G1217

Lab Sample Number				1998757	1998758	1998759	1998760	1998761
Sample Reference				WS1 ES1 TS	WS1 ES2 MG	WS1 ES3 MG	WS2 ES1 TS	WS2 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.25	0.50	0.10	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
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	-	-	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
o-xylene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	-	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	4.7	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	60	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	77	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	140	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	< 10	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	< 10	-	-	-

Analytical Report Number: 21-97287
Project / Site name: Hallington Mill
Your Order No: G1217

Lab Sample Number				1998757	1998758	1998759	1998760	1998761
Sample Reference				WS1 ES1 TS	WS1 ES2 MG	WS1 ES3 MG	WS2 ES1 TS	WS2 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.25	0.50	0.10	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Pesticides								
Alachlor	µg/kg	10	NONE	-	-	-	< 10	-
Aldrin	µg/kg	10	NONE	-	-	-	< 10	-
Azinphos-ethyl	µg/kg	10	NONE	-	-	-	< 10	-
Azinphos-methyl	µg/kg	10	NONE	-	-	-	< 10	-
BHC-alpha (benzene hexachloride)	µg/kg	10	NONE	-	-	-	< 10	-
BHC-beta	µg/kg	10	NONE	-	-	-	< 10	-
BHC-delta	µg/kg	10	NONE	-	-	-	< 10	-
BHC-gamma (Lindane, gamma HCH)	µg/kg	10	NONE	-	-	-	< 10	-
Bifenthrin	µg/kg	10	NONE	-	-	-	< 10	-
Carbophenothion	µg/kg	10	NONE	-	-	-	< 10	-
Chlordane-cis	µg/kg	10	NONE	-	-	-	< 10	-
Chlordane-trans	µg/kg	10	NONE	-	-	-	< 10	-
Chlorfenvinphos	µg/kg	10	NONE	-	-	-	< 10	-
Chlorothalonil	µg/kg	20	NONE	-	-	-	< 20	-
Chlorpyrifos	µg/kg	10	NONE	-	-	-	< 10	-
Cyfluthrin (Sum)	µg/kg	10	NONE	-	-	-	< 10	-
Cyhalothrin (Lambda)	µg/kg	10	NONE	-	-	-	< 10	-
Cypermethrin (Sum)	µg/kg	10	NONE	-	-	-	< 10	-
DDD-o,p'	µg/kg	10	NONE	-	-	-	< 10	-
DDD-p,p'	µg/kg	10	NONE	-	-	-	< 10	-
DDE-o,p'	µg/kg	10	NONE	-	-	-	< 10	-
DDE-p,p'	µg/kg	10	NONE	-	-	-	< 10	-
DDT-o,p'	µg/kg	10	NONE	-	-	-	< 10	-
DDT-p,p'	µg/kg	10	NONE	-	-	-	< 10	-
Deltamethrin	µg/kg	10	NONE	-	-	-	< 10	-
Demeton-O	µg/kg	10	NONE	-	-	-	< 10	-
Demeton-S	µg/kg	10	NONE	-	-	-	< 10	-
Diazinon	µg/kg	10	NONE	-	-	-	< 10	-
Dichlorobenzonitrile, 2,6-	µg/kg	10	NONE	-	-	-	< 10	-
Dichlorvos	µg/kg	10	NONE	-	-	-	< 10	-
Dieldrin	µg/kg	10	NONE	-	-	-	< 10	-
Dimethoate	µg/kg	10	NONE	-	-	-	< 10	-
Dimethylvinphos	µg/kg	10	NONE	-	-	-	< 10	-
Endosulfan I (alpha isomer)	µg/kg	10	NONE	-	-	-	< 10	-
Endosulfan II (beta isomer)	µg/kg	10	NONE	-	-	-	< 10	-
Endosulfan sulfate	µg/kg	10	NONE	-	-	-	< 10	-
Endrin	µg/kg	20	NONE	-	-	-	< 20	-
Endrin aldehyde	µg/kg	10	NONE	-	-	-	< 10	-
Endrin ketone	µg/kg	10	NONE	-	-	-	< 10	-
Ethion	µg/kg	10	NONE	-	-	-	< 10	-
Etrimfos	µg/kg	10	NONE	-	-	-	< 10	-
Fenitrothion	µg/kg	10	NONE	-	-	-	< 10	-
Fenthion	µg/kg	10	NONE	-	-	-	< 10	-
Fenvalerate (Sum)	µg/kg	10	NONE	-	-	-	< 10	-
Heptachlor	µg/kg	10	NONE	-	-	-	< 10	-
Heptachlor exo-epoxide	µg/kg	10	NONE	-	-	-	< 10	-
Hexachlorobenzene	µg/kg	10	NONE	-	-	-	< 10	-
Hexachlorobutadiene	µg/kg	10	NONE	-	-	-	< 10	-
Isodrin	µg/kg	20	NONE	-	-	-	< 20	-
Malathion	µg/kg	10	NONE	-	-	-	< 10	-
Methacrifos	µg/kg	10	NONE	-	-	-	< 10	-
Methoxychlor, p,p'-	µg/kg	20	NONE	-	-	-	< 20	-

Analytical Report Number: 21-97287
Project / Site name: Hallington Mill
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Lab Sample Number				1998757	1998758	1998759	1998760	1998761
Sample Reference				WS1 ES1 TS	WS1 ES2 MG	WS1 ES3 MG	WS2 ES1 TS	WS2 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.25	0.50	0.10	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021	02/09/2021	02/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Mevinphos, E+Z	µg/kg	10	NONE	-	-	-	< 10	-
Omethoate	µg/kg	20	NONE	-	-	-	< 20	-
Parathion	µg/kg	10	NONE	-	-	-	< 10	-
Parathion-methyl	µg/kg	10	NONE	-	-	-	< 10	-
Pendimethalin	µg/kg	10	NONE	-	-	-	< 10	-
Pentachlorobenzene	µg/kg	10	NONE	-	-	-	< 10	-
Permethrin, Cis-	µg/kg	10	NONE	-	-	-	< 10	-
Permethrin, Trans-	µg/kg	10	NONE	-	-	-	< 10	-
Phorate	µg/kg	10	NONE	-	-	-	< 10	-
Phosalone	µg/kg	10	NONE	-	-	-	< 10	-
Phosphamidon (Sum)	µg/kg	10	NONE	-	-	-	< 10	-
Pirimiphos-ethyl	µg/kg	10	NONE	-	-	-	< 10	-
Pirimiphos-methyl	µg/kg	10	NONE	-	-	-	< 10	-
Propetamphos	µg/kg	10	NONE	-	-	-	< 10	-
Propyzamide	µg/kg	10	NONE	-	-	-	< 10	-
Tecnazene	µg/kg	10	NONE	-	-	-	< 10	-
Tetrachlorobenzene, 1,2,4,5-	µg/kg	10	NONE	-	-	-	< 10	-
Trichlorobenzene, 1,2,3-	µg/kg	10	NONE	-	-	-	< 10	-
Trichlorobenzene, 1,3,5-	µg/kg	10	NONE	-	-	-	< 10	-
Trifluralin	µg/kg	10	NONE	-	-	-	< 10	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-97287
Project / Site name: Hallington Mill
Your Order No: G1217

Lab Sample Number				1998762	1998763	1998764
Sample Reference				WS3 ES2 MG	WS5 ES1 TS	WS5 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.05	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021
Time Taken				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
Moisture Content	%	0.01	NONE	11	16	14
Total mass of sample received	kg	0.001	NONE	0.30	0.40	0.30
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	7.8	-
Organic Matter	%	0.1	MCERTS	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	-	-	-

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	-	1.6	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	1.1	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	0.87	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.54	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	0.90	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1.1	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.60	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.48	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.40	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.56	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	8.19	< 0.80

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	15	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	150	180	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.87	0.45	-
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	1.0	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	1.2	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16	10	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	15	16	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29	30	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	37	36	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21	13	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	280	-

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Project / Site name: Hallington Mill
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Lab Sample Number				1998762	1998763	1998764
Sample Reference				WS3 ES2 MG	WS5 ES1 TS	WS5 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.05	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021
Time Taken				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	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	-

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Project / Site name: Hallington Mill
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Lab Sample Number				1998762	1998763	1998764
Sample Reference				WS3 ES2 MG	WS5 ES1 TS	WS5 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.05	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Pesticides						
Alachlor	µg/kg	10	NONE	-	-	-
Aldrin	µg/kg	10	NONE	-	-	-
Azinphos-ethyl	µg/kg	10	NONE	-	-	-
Azinphos-methyl	µg/kg	10	NONE	-	-	-
BHC-alpha (benzene hexachloride)	µg/kg	10	NONE	-	-	-
BHC-beta	µg/kg	10	NONE	-	-	-
BHC-delta	µg/kg	10	NONE	-	-	-
BHC-gamma (Lindane, gamma HCH)	µg/kg	10	NONE	-	-	-
Bifenthrin	µg/kg	10	NONE	-	-	-
Carbophenothion	µg/kg	10	NONE	-	-	-
Chlordane-cis	µg/kg	10	NONE	-	-	-
Chlordane-trans	µg/kg	10	NONE	-	-	-
Chlorfenvinphos	µg/kg	10	NONE	-	-	-
Chlorothalonil	µg/kg	20	NONE	-	-	-
Chlorpyrifos	µg/kg	10	NONE	-	-	-
Cyfluthrin (Sum)	µg/kg	10	NONE	-	-	-
Cyhalothrin (Lambda)	µg/kg	10	NONE	-	-	-
Cypermethrin (Sum)	µg/kg	10	NONE	-	-	-
DDD-o,p'	µg/kg	10	NONE	-	-	-
DDD-p,p'	µg/kg	10	NONE	-	-	-
DDE-o,p'	µg/kg	10	NONE	-	-	-
DDE-p,p'	µg/kg	10	NONE	-	-	-
DDT-o,p'	µg/kg	10	NONE	-	-	-
DDT-p,p'	µg/kg	10	NONE	-	-	-
Deltamethrin	µg/kg	10	NONE	-	-	-
Demeton-O	µg/kg	10	NONE	-	-	-
Demeton-S	µg/kg	10	NONE	-	-	-
Diazinon	µg/kg	10	NONE	-	-	-
Dichlorobenzonitrile, 2,6-	µg/kg	10	NONE	-	-	-
Dichlorvos	µg/kg	10	NONE	-	-	-
Dieldrin	µg/kg	10	NONE	-	-	-
Dimethoate	µg/kg	10	NONE	-	-	-
Dimethylvinphos	µg/kg	10	NONE	-	-	-
Endosulfan I (alpha isomer)	µg/kg	10	NONE	-	-	-
Endosulfan II (beta isomer)	µg/kg	10	NONE	-	-	-
Endosulfan sulfate	µg/kg	10	NONE	-	-	-
Endrin	µg/kg	20	NONE	-	-	-
Endrin aldehyde	µg/kg	10	NONE	-	-	-
Endrin ketone	µg/kg	10	NONE	-	-	-
Ethion	µg/kg	10	NONE	-	-	-
Etrimfos	µg/kg	10	NONE	-	-	-
Fenitrothion	µg/kg	10	NONE	-	-	-
Fenthion	µg/kg	10	NONE	-	-	-
Fenvalerate (Sum)	µg/kg	10	NONE	-	-	-
Heptachlor	µg/kg	10	NONE	-	-	-
Heptachlor exo-epoxide	µg/kg	10	NONE	-	-	-
Hexachlorobenzene	µg/kg	10	NONE	-	-	-
Hexachlorobutadiene	µg/kg	10	NONE	-	-	-
Isodrin	µg/kg	20	NONE	-	-	-
Malathion	µg/kg	10	NONE	-	-	-
Methacrifos	µg/kg	10	NONE	-	-	-
Methoxychlor, p,p'-	µg/kg	20	NONE	-	-	-

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Project / Site name: Hallington Mill
Your Order No: G1217

Lab Sample Number				1998762	1998763	1998764
Sample Reference				WS3 ES2 MG	WS5 ES1 TS	WS5 ES2 MG
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.05	0.30
Date Sampled				02/09/2021	02/09/2021	02/09/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Mevinphos, E+Z	µg/kg	10	NONE	-	-	-
Omethoate	µg/kg	20	NONE	-	-	-
Parathion	µg/kg	10	NONE	-	-	-
Parathion-methyl	µg/kg	10	NONE	-	-	-
Pendimethalin	µg/kg	10	NONE	-	-	-
Pentachlorobenzene	µg/kg	10	NONE	-	-	-
Permethrin, Cis-	µg/kg	10	NONE	-	-	-
Permethrin, Trans-	µg/kg	10	NONE	-	-	-
Phorate	µg/kg	10	NONE	-	-	-
Phosalone	µg/kg	10	NONE	-	-	-
Phosphamidon (Sum)	µg/kg	10	NONE	-	-	-
Pirimiphos-ethyl	µg/kg	10	NONE	-	-	-
Pirimiphos-methyl	µg/kg	10	NONE	-	-	-
Propetamphos	µg/kg	10	NONE	-	-	-
Propyzamide	µg/kg	10	NONE	-	-	-
Tecnazene	µg/kg	10	NONE	-	-	-
Tetrachlorobenzene, 1,2,4,5-	µg/kg	10	NONE	-	-	-
Trichlorobenzene, 1,2,3-	µg/kg	10	NONE	-	-	-
Trichlorobenzene, 1,3,5-	µg/kg	10	NONE	-	-	-
Trifluralin	µg/kg	10	NONE	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 21-97287
Project / Site name: Hallington Mill

* 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 *
1998757	WS1 ES1 TS	None Supplied	0.1	Brown sandy loam with gravel and vegetation.
1998758	WS1 ES2 MG	None Supplied	0.25	Brown loam and clay with gravel.
1998759	WS1 ES3 MG	None Supplied	0.5	Brown loam and clay with gravel and vegetation.
1998760	WS2 ES1 TS	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
1998761	WS2 ES2 MG	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
1998762	WS3 ES2 MG	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
1998763	WS5 ES1 TS	None Supplied	0.05	Brown loam and clay with gravel and vegetation.
1998764	WS5 ES2 MG	None Supplied	0.3	Brown loam and clay with gravel and vegetation.

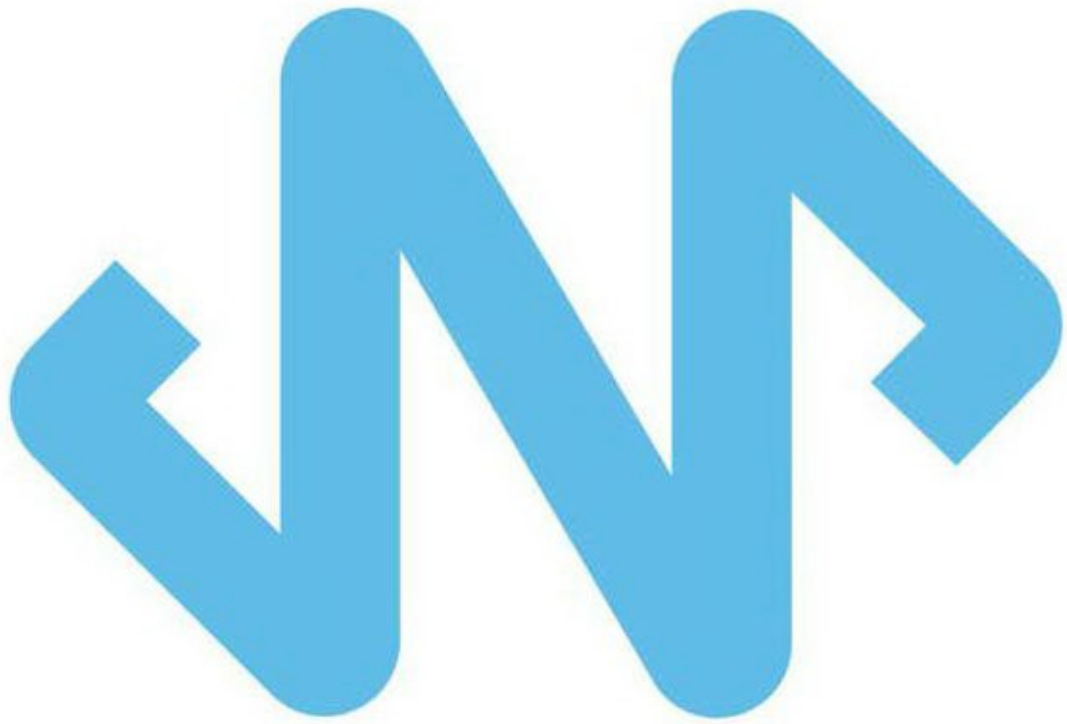
Analytical Report Number : 21-97287
Project / Site name: Hallington Mill

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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
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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-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
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-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
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
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
Pesticides by GC-MS/MS	Detemination of Pesticides in soil by GC MS/MS	In-house method	L055B-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS

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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



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