GeoDyne

Geotechnical &
Environmental
Consultants

Land off Leconfield Road
Nanpantan

Phase II Exploratory Investigation Report

For

Bowbridge Homes Limited

GeoDyne Limited
Clarendon House, Clarendon Park,
Clumber Avenue, Nottingham, NG5 1AH
Tel: 0115 962 0001 email: info@geodyne.co.uk

Contents

Executive Summary **Page No**

Appendices

Project No: 40056-2		**Date: 8th September 2020**	
Issue/revision	Prepared by	Checked by	Approved by
	Nina Copson BSc (Hons) MSc FGS Geo-Environmental Engineer	**Jason Hollands BSc (Hons) MSc MIEnvSc CGeol FGS** Director	**Jason Hollands BSc (Hons) MSc MIEnvSc CGeol FGS** Director
Comments			

EXECUTIVE SUMMARY

GEOTECHNICAL CONSIDERATIONS	
Ground Conditions	Topsoil and locally Made Ground topsoil was encountered across the site to depths of between 0.20m and 0.30m begl and generally comprised silty clayey, locally slightly gravelly TOPSOIL. The Made Ground topsoil included inclusions of red brick and crystalline rock. Subsoil was locally encountered to depths of between 0.40m and 0.60m begl and generally comprised clayey SILT / silty CLAY / gravelly, locally silty SAND. In the eastern end of trial pit TP2, potential Made Ground was encountered to a depth of 1.00m begl, with brick fragments and a potential land drain. Underlying the Topsoil and Subsoil where encountered, Natural Strata considered representative of the weathered Tarporley Siltstone Formation was encountered in the southwest and northeast of the site. The strata comprised stiff to very stiff silty CLAY with pockets and bands of clayey silt / silt. With depth the Clay graded into a Mudstone. In the centre of the site and forming a ridge, strata considered representative of the weathered Swithland Formation was encountered. The strata was variable but initially comprised gravelly CLAY / clayey gravelly SAND / sandy GRAVEL on the slopes of the ridge overlying at depths of 1.40m to 1.50m highly weathered strong crystalline rock META-MUDSTONE recovered as cobbles and boulders in a sandy matrix. On the top of the ridge the Meta-Mudstone was encountered at depths of 0.30m to 0.50m begl.
Foundation Design	<u>Earthworks</u> We understand that the proposed development comprises two-storey residential dwellings and that a scheme of Earthworks will be required at the site to construct a suitably level development platform. The following recommendations are therefore preliminary and subject to confirmation once earthworks proposals, including the extent of cut and fill, have been finalised. We understand that cut locally in excess of 2m may be required. It is anticipated that the Natural Strata comprising the Tarporley Siltstone Formation and Swithland Formation will be suitable bearing strata for a typical residential dwelling. <u>Tarporley Siltstone Formation</u> Based on our findings, foundations for the proposed buildings may comprise strip or trench fill foundations which should be advanced to a minimum depth of 0.90m below existing or proposed ground level (whichever being the deeper) within cohesive soils (Tarporley Siltstone Formation). At this depth the natural strata is considered suitable to support a nett allowable ground bearing pressure of up to 120kN/m^2. <u>Swithland Formation</u> Within predominantly granular, but locally cohesive (where interfacing with the Tarporley Siltstone Formation), strata (in the centre of the site), foundations for the proposed buildings may comprise strip or trench fill foundations which should be advanced to a minimum depth of 0.90m below existing or proposed ground level (whichever being the deeper). At this depth the natural strata is considered suitable to support a nett allowable ground bearing pressure of up to 100kN/m^2. The ground is variable between exploratory holes and therefore a minimum foundation depth of 0.90m begl should be assumed unless it can be robustly demonstrated that a plot is entirely underlain by granular strata in the zone of influence of foundations, allowing a reduced foundation depth of 0.60m begl. It is noted that the central area of the site may be cut as part of an Earthworks programme to create a level development platform. The ground conditions following the cutting exercise should be re-examined to ensure the above recommendations still apply. Where earthworks remove weathered Swithland Formation to expose bedrock, a minimum foundation depth of 0.60m would typically apply and bearing pressures in the region of 200kN/m^2 would be appropriate. Care should be taken to ensure that a consistent founding stratum is achieved, and any boulders should be removed to ensure that foundation loads are evenly distributed. <u>General Comments</u> Where Made Ground, disturbed ground, boulders or soft spots are encountered at founding depth, foundations will require further deepening to encounter underlying undisturbed suitably competent Natural Strata. A watching brief for the former pond should be maintained. Any organic materials should be removed, and the resultant void infilled with geotechnically competent materials compacted in controlled layers. Should foundations straddle the interface of both granular and cohesive strata, it is recommended that foundations be deepened to encounter a single consistent stratum. Alternatively, provision should be allowed for the inclusion of suitable reinforcement within the foundations, to minimise the potential for differential settlement.

	Foundation solutions should also be designed to take account of the proposed earthworks strategy at the site. Once proposed earthworks have been confirmed the Structural Engineer should produce a foundation schedule for the site. This should take into account the final ground levels, compaction of the earthworks platform and should consider the most economical foundation solution. This may be an iterative process.
Floor Slab Design	Ground floors should be designed adopting a suspended floor slab with a clear ventilated void (i.e. beam and block) in accordance with NHBC guidance. However, where less than 600mm of geotechnically competent fill is present below floor slabs or where NHBC guidance allows it may be possible to locally adopt ground bearing floor slabs.
Coal Mining	No coal mining investigations or precautions are considered to be necessary at the site.
Building Near Trees	Where cohesive soils are encountered (northeast and southwest of the site), we would recommend that appropriate precautions are incorporated into foundations taking account of cohesive soils of a medium volume change potential in accordance with NHBC Standards Chapter 4.2.
Water	Water was not encountered in the excavations undertaken at the site. Water was locally encountered in the south-western end of the site during the ground gas monitoring programme at depths greater than 1.50m begl. Significant dewatering of shallow excavations is unlikely to be required. However, water levels may vary due to seasonal or other factors.
Excavations	Excavations in the mudstone can be anticipated to remain stable in the short term, only requiring support where necessary for health and safety reasons. Excavations using heavy site plant may encounter some localised instability and over digging in the predominantly granular Swithland Formation and therefore may require sidewall support, for constructional and health and safety reasons. The safety of excavations at the site will be the responsibility of the appointed contractor. Excavations in cohesive soils may become softened after periods of wet weather. Any softened material should be removed prior to pouring foundation concrete or placing sub-grade materials.
Sulphate Classification	The site may be classified as falling into Design Sulphate Class DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2z.
Surface Water Drainage	Typically, low permeability cohesive deposits in the southwest and northeast of the site may preclude the use of soakaways in these areas. The centre of the site comprised predominantly granular material which may be suitable for soakaways. However, this area is anticipated to be subject to a programme of Earthworks and following this, conditions may no longer be suitable. Similarly, soakaways should not be constructed in Made Ground. On this basis, it is recommended that alternative methods of surface water disposal are investigated at this stage.
CBRs & Pavements	The laboratory testing results presented a range of CBR values from 11.0% to 50.7% reflecting variable conditions encountered at the site. Please note that laboratory re-compacted CBR values represent a theoretical maximum CBR value that may be achieved where soils are compacted in optimum conditions. Lower CBR values are likely to be present in-situ. Due to the wide range of CBR values achieved and potential re-profiling of the site, it is recommended that further in-situ CBR testing should be used to confirm the design value once the site has been cleared and the formation level constructed. The road/earthworks designer should take account of the laboratory recompacted CBR values, recommended in-situ testing and earthworks proposals (for example excavation and crushing/screening of rocks). The road/earthworks designer should also take account of the plasticity index and grading testing and moisture content to allow selection of suitable equilibrium CBR values for the differing materials encountered at the site. Significant thicknesses of organic soils, i.e. topsoil, should be removed from beneath roads and pavements to avoid the potential for differential settlement. Materials encountered across parts of the site were predominantly clay grade. No frost susceptible material should be within 450mm of the ground surface in road construction.
Earthworks	Due to the change in topography across the site, re-profiling of the site is likely to be required as part of enabling works or retaining features incorporated into the design of the development. An Earthworks Method Statement and detailed cut and fill assessment should be undertaken to inform finalised designs. This will in turn inform the design of foundations and roads etc.
ENVIRONMENTAL CONSIDERATIONS	
Contamination Assessment	The Topsoil, Subsoil and near surface Natural Strata analysed may be considered to be chemically uncontaminated for a residential end-use. The concentrations of determinands detected are considered to be unlikely to present a potentially significant risk to Controlled Waters.
Remediation Proposals	No specific remedial requirements for human health are considered to be necessary at the site. Topsoil may be stripped, carefully mounded and re-used on site in gardens and soft landscaping as appropriate.
Radon	The Desk Study works undertaken by others indicate that no specific radon precautions are necessary in the development.
Ground Gas	The site may be classified as 'CS1', in accordance with Table 2 of BS8485:2015+A1:2019, therefore, no specific ground gas precautions are required for the proposed building in relation to the potential ingress of Methane and Carbon Dioxide.
GENERAL CONSIDERATIONS	
Off-Site Disposal	The results of the contamination test results should be forwarded to landfill operators to determine the potential disposal costs for surplus arisings generated from site. Waste Acceptance Criteria (WAC) testing may be required.
Unforeseen Circumstances	Should any areas of potentially contaminated soil, or anomalous features be encountered during site construction works we would recommend consultation with GeoDyne to ensure that our recommendations continue to apply.
Construction Workers	It is recommended that construction personnel involved with direct contact with the soils at the site use appropriate PPE equipment together with welfare facilities in accordance with general health and safety guidelines.

Utilities	We would recommend that this report is supplied to utility companies and their recommendations relating to appropriate supply pipes are adhered to.
Licenses etc.	The Contractor/Developer is responsible for, and must ensure that, all necessary licenses, permits, registrations, plans and approvals are in place prior to commencing with the works at the site. These will include any Mobile Treatment Licenses (MTLs), Site Waste Management Plans / Materials Management Plans (MMP) and/or Waste Management Licenses/Exemptions as necessary to enable the completion of the proposed works. The movement of soils around the site will require a U1 exemption (where only limited volumes are moved) or Materials Management Plan (with QPD and subsequent verification) where larger volumes are anticipated. Any MMP will require a Qualified Person Declaration and will require subsequent validation.
Statutory Consultation	In accordance with normal planning requirements, we would recommend that a copy of our report is issued by the Client to the Local Authority (and warranty provider) for review/comment and approval.

1.0 INTRODUCTION

1.1 Introduction

GeoDyne Ltd has been instructed by Bowbridge Homes, the Client to undertake a Phase II Exploratory Investigation on a parcel of land located off Leconfield Road, Nanpantan, Loughborough. A site location plan (Figure No. 40056-2/01) is included as Appendix I.

GeoDyne have previously prepared the following report for the site.

- GeoDyne report *'Land off Leconfield Road, Nanpantan - Phase I Geo-Environmental Desk Study Report for Bowbridge Homes'*, referenced 40056, dated 16th April 2020.

We will make reference to the foregoing report and include summarised details, as appropriate however the Phase I report should be read in conjunction with this document.

1.2 Project Understanding

It is understood that a planning application is to be submitted for the development of the site with residential dwellings with private gardens.

This understanding has formed the basis of our report. Where our understanding is incorrect, it may be necessary to review our assessment to ensure that it continues to apply.

1.3 Objectives

The scope of works detailed herein have been designed to investigate the key geotechnical and environmental issues for the proposed area of the development based on the findings and recommendations of the Phase I report.

1.4 Scope of Works

Phase II Exploratory Investigation works comprised:

- A subcontracted utility clearance scan of exploratory hole locations.
- A series of window sampling boreholes across the site.
- A programme of mechanically excavated trial pits across the site.
- Geotechnical and environmental soil testing.
- A programme of ground gas and water level monitoring.
- Revision of the CSM.

1.5 Limitations

The conclusions and recommendations made in this report are limited to those that can be made based on the findings of the investigation. Where comments are made based on information obtained from third parties, GeoDyne Limited assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third parties.

This report has been prepared in accordance with our understanding of current good practice. However changes to good practice, guidance or legislation may necessitate revision of this report after the date of issue.

GeoDyne Limited has prepared this report for the sole use and reliance of the Client, Bowbridge Homes Ltd, in accordance with our Standard Conditions and Limitations (included in Appendix IX). This report may not be used or relied upon by any unauthorised third party without the explicit written agreement of GeoDyne Limited.

1.6 Confidentiality

The risk assessment herein remains the intellectual property and trade secret of GeoDyne Limited. The information contained within this report must not be disclosed or divulged to any commercial Consultant or other third party without the prior written agreement of GeoDyne Limited.

2.0 SITE DESCRIPTION & HISTORICAL SUMMARY

2.1 Site Description

The following site description is reproduced from the GeoDyne Ltd Phase I Desk Study report (referenced in Section 1.1).

'*The site comprises an irregularly shaped parcel of land situated off the western end of Leconfield Road, Nanpantan, Leicestershire. The site may be located centred around approximate Ordnance Survey National Grid Reference 450940E 317550N and extends to an approximate area of 1.69 hectares (Ha).*

A site walkover was undertaken on 24th March 2020 by an Engineer from GeoDyne Ltd and the following description is based on observations made during our visit.

Pedestrian (and vehicular) access may be gained onto the site from its southeast corner, off Leconfield Road.

Ground levels rise into the site from the entrance towards a ridge that is present towards the centre of the site trending approximately northwest to southeast. The ridge appears to be the highest ground in the site with levels falling to the east/southeast (towards the sites entrance), north (towards the sites northern extent) and southwest (towards the sites southwestern corner).

The site is generally covered with rough grasses with occasional semi-mature trees (potentially self set). Areas of rough vegetation were noted along part of the sites northeastern boundary.

The topographically lower areas of the site were noted to be wet underfoot. This was especially apparent towards the sites far western corner.

A number of tracks/footpaths were noted crossing the site, however, it is possible that these are informal as they are not indicated on 1:25000 Ordnance Survey mapping.

Existing residential dwellings were present to the sites immediate north, east and south, with the sites entrance present towards the sites southeastern extent. A mature woodland was present to the sites immediate west.

Our site visit was relatively brief, due to the sensitive nature of the site and the proposed development and comment from local residents.'

An annotated site plan, showing the main features of the site and the immediate surrounding area, is included as Appendix II of this report (Figure No. 40056-2/02) and plans showing general views of the site are included in Appendix III (Figure Nos. 40056-2/03 to 40056-2/04).

The current site conditions were broadly unchanged from those described in the Phase I report.

2.2 Site History

Our previous report provided the following historical summary for the site.

'*The site is indicated to have comprised open field since the earliest mapping epoch viewable (1880s). Historically a track crossed the site trending north to south associated with Burleigh Farm which was historically present to the sites south, whilst also encroaching slightly onto the sites southern extent. A possible pond was historically present in the sites western extent*.'

3.0 GEOLOGY & ENVIRONMENTAL SETTING SUMMARY

The following geological information was provided in our previous report.

3.1 The following geological publications were referred to in the Phase I report:

- Landmark 1:50,000 scale Geological Maps.
- Landmark 1:10,000 scale Geological Maps.
- British Geological Survey sheet 141 *'Loughborough',* Solid and Drift Edition, 1:50,000 scale, dated 1976 & 2001.
- BGS Online Lexicon.
- Coal Authority on-line interactive map viewer.
- Landmark Envirocheck & Mining and Ground Stability Datasheet.

3.2 Geology

The reviewed geological publications indicate that the site is immediately underlain by bedrock strata comprising the Swithland Formation Mudstone dating from the Comley (Cambrian) Period. The Swithland Mudstone Formation is indicated to be aged between approximately 526 and 508 million years old and forms part of the Brand Group.

The Swithland Mudstone is described as '*Purple to grey slaty meta-mudstones and greywackes with thin conglomeratic sandstones.'*

The sites far western extent and far eastern extent are indicated to be immediately underlain by the Tarporley Siltstone Formation; Siltstone, Mudstone and Sandstone dating from the Olenekian (Triassic) Period. This geological unit is approximately 250 to 241.5 million years old.

The Tarporley Siltstone Formation is described by the BGS Lexicon as '*Heterolithic, comprising interlaminated and interbedded siltstones, mudstones and sandstones in approximately equal proportions. The siltstones are micaceous and interlaminated with mudstones or sandstones; most of the mudstones appear structureless with a blocky habit. The sandstones are mostly very fine- to fine-grained, well sorted, and micaceous. They are typically cemented by ferroan calcite or dolomite.'*

No superficial drift deposits are indicated beneath, or in the general vicinity of, the site.

Geological sheet 141 (1976) indicates the possible presence of Grit Quartzite and Conglomerate within the site or the vicinity of the site (part of the Brand Group which also includes the Swithland Formation) and also the Bradgate and Woodhouse Grits (part of the Maplewell Series). Both of these geological units, together with the Swithland Formation are indicated to date from the Pre-Cambrian, which conflicts with more recent mapping suggesting a Cambrian date. This appears to be confirmed by the BGS Earthwise website which notes that the top most unit of the Charnian Supergroup is the Brand Group that is now regarded as Cambrian in age.

We would note that sheet 141 dates from 1976 and therefore is older than more recent Landmark geological mapping, with the Landmark 1:50,000 mapping dating from a 2000 edition of sheet 141 and Landmark 1:10,000 geological mapping based on geological sheets SK51NW (2006) and SK41NE (1997). The 2001 edition of BGS sheet 141 confirms the presence of Swithland Formation beneath the site.

We would note that recent research appears to have reclassified the Swithland Formation Mudstone from the Pre-Cambrian to the Cambrian, based on fossil evidence.

Paper OR/10/041 obtained from the BGS Earthwise website provides discussion on the age of the Swithland Formation notes the following:

'The Swithland Formation is equivalent to rocks formerly known as the 'Swithland and Groby Slates'. It forms the uppermost unit of the Brand Group, the age of which has been the subject of recent controversy. Originally, it was thought to be part of the Precambrian succession – and therefore was placed at the top of the Charnian Supergroup. A Cambrian age for Brand Group is now more likely, however, due to the discovery of the Phanerozoic trace fossil Teichichnus in local headstones that had been cut from the Swithland Formation (Bland and Goldring, 1995). These traces can be seen, for example, in the churchyard at Ratby (SK 5129 0593). The contact with the underlying Hanging Rocks Formation is nowhere exposed, although in the Hangingstone Hills section, north of Woodhouse Eaves, the two units appear to be gradational and structurally conformable. An intervening unconformity was nevertheless favoured by McIlroy et al. (1998).

In Swithland Wood, the Swithland Formation largely consists of cleaved silty mudrocks, with detrital constituents of quartz, feldspar and fine-sand grade lithic fragments in a matrix of white mica and chlorite (Worssam and Old, 1988). Bedding and lamination are expressed by variations in these constituents, with white mica preferentially developed along the sub-mm spaced Charnwood cleavage.

Interpretation: The slates originated as silts and muds that accumulated in quiescent, offshore environments on the floor of a sea (the Iapetus Ocean) that had transgressed across the eroded Charnian rocks early in Cambrian times. Because they are so fine-grained, they responded to mountain-building pressures during the end-Silurian orogeny (p. 5) by developing a regular, very closely spaced cleavage. This enabled the rocks to be split and to be used as roofing slates for many of the buildings in Charnwood Forest. Swithland slates have had a number of specialised uses, for roofing, wall stone and, most famously, for headstones. They are characteristically purple, dark grey or green-grey in colour and are well displayed on the roofs of houses in Woodhouse Eaves, Newtown Linford and in surrounding villages. Swithland slate debris has also been found at Roman sites in Leicester and at East Bridgford, Nottinghamshire (Margidunum). The rather coarsely developed cleavage made these rocks difficult to split and dress and they are, therefore, thicker and rougher than Welsh slates, which had largely replaced them by the late nineteenth century. Interest in quarrying these rocks had ceased by 1908 (Ramsey, 2007); however, intricately lettered and carved Swithland headstones survive in many local church graveyards and can be distinguished from the Welsh slate imports, some of which can be similar in colour, by the presence of characteristic natural undulations on the commonly unpolished back surface of the roughly cleaved slabs. One of the principal slate quarries was here, at the 'Great Pit', which was worked to a depth of 180 ft.(55 m) - the stone blocks had to be raised to ground level before being split, sawed and polished.'

As part of our work, we have viewed a report prepared by The Wildlife Trusts dated March 2009 *'Charnwood Forest: A Living Landscape'.* The report provides the following comments with respect to the Brand Group.

'The Brand Group (including the Swithland Greywacke Formations (colloquially the Swithland Shale). This group is traditionally and most conveniently included within the Charnian Supergroup, but rather than being Precambrian, it is now thought to be early Cambrian (c. 543 mya – the earliest part of the Phanerozoic era that extends to the present day) on the basis of distinctive and significant trace fossils. [Features of national perhaps international significance. Relatively rarely do we see a sequence such as this that demonstrates this major transition in the history of life – from the Proterozoic (Precambrian) to Phanerozoic.]'

This report includes reference to Regionally Important Geological Sites (RIGS). Whilst the report does not appear to reference the subject site, we would note Figure 5 in the report includes reference to Buck Hill, Nanpantan (SK5017) located to the south of the site, which is identified as a RIG.

We would note that housing developments constructed to the sites south and northeast appear to have been constructed on the Swithland Formation.

3.3 Faults

No faults are indicated beneath the site on the reviewed geological map publications or within 250m of the site location.

3.4 Man-Made Deposits

Made Ground is not indicated associated with the site. However, we would note the indicated presence of a possible pond towards the site's western extent. This feature may potentially have been infilled historically and may correspond to the wet ground encountered on site. The Envirocheck Report Mining and Ground Stability Datasheet indicates the presence of potentially infilled land (water) approximately 2m to the sites west. This entry may relate to the pond formerly indicated on the site.

3.5 Coal Mining Report

The site does not lie within a coal mining reporting area based on the online interactive map viewer. A coal mining report is therefore not required for the site.

3.6 Environmental Report

The Phase I report contained a review of a commissioned Envirocheck report for the site, which may be summarised as follows.

- The Landmark report indicates that the bedrock aquifer designation for the site is Secondary B Aquifer. There is no Superficial Aquifer designation as there are no superficial deposits indicated on site.
- The site is not located in a SPZ.
- The site is located in an area indicated not to be at risk from flooding from rivers or sea or groundwater.
- The far western extent of the site (approximately located in the area of the pond indicated on historical plans) is designated as an area with a high risk of flooding from surface water (30 year return).
- There are no Agency entries relating to environmental permits or incidents.
- There are no waste or hazardous substance entries within the report within 250m of the site.
- There are no landfill or waste treatment sites within 250m of the site location.
- There are no significant geological issues that may significantly affect the proposed redevelopment.
- There are no industrial entries in the report that may significantly affect the proposed redevelopment.
- An area of Ancient and Semi-Natural Woodland (presumed Burleigh Wood) is indicated to be present along the sites north-western boundary and extend to the sites northwest.
- A nitrate vulnerable zone (NVZ) is indicated a distance of 0m from the site. The NVZ is indicated to be associated with the River Soar NVZ – Surface Water.
- The nearest surface water feature is indicated 221m to the sites west which relates to a surface water stream.
- The site is not located within an area requiring radon precautions.

3.7 Land Use Assessment

As part of the land use assessment provided in the previous Phase I report, reference was made to the '*Desk Reference Guide to Potentially Contaminative Land Uses*' produced by Mr P Syms and published jointly by the ISVA (The Professional Society for Valuers and Auctioneers) in association with The Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Environmental Health (CIEH).

Reference was also made to the Department for Environment, Food and Rural Affairs and the Environment Agency Contaminated Land Report CLR8 '*Potential Contaminants for the Assessment of Land*' (March 2002). Although now formally withdrawn, this document identifies key contaminants which may potentially be present at a site as a result of a given historical land use and is considered useful as a ready reference.

The following assessment is reproduced from the GeoDyne Ltd Phase I Desk Study report (referenced in Section 1.1).

'*The site is indicated to have comprised open field since the earliest mapping epoch viewable (1880s). Historically a track crossed the site trending north to south associated with Burleigh Farm which was historically present to the sites south, whilst also encroaching slightly onto the sites southern extent.*

A possible pond was historically present in the sites western extent. The location of the former pond is indicated to comprise possibly infilled ground.

The site is indicated to be underlain by the Swithland Formation Mudstone and Tarporley Formation Siltstone, Mudstone and Sandstone. The geological units underlying the site are classified as a Secondary B Aquifer by the Environment Agency. The site does not lie within a SPZ.

With reference to the publications listed in Section 3.7, the site does not fall within any of the land use categories detailed within the documents.

However, based on the information obtained from the desk study, observations made during our site visit and our experience of similar sites, potential contamination that may be present could include:

- *Metals and metalloids associated with any Made Ground (possible infilled former pond etc.) or Natural Metal Enrichment (NME) in Natural Strata.*
- *Pesticides associated with any historical arable farming practices on the site.*
- *Polycyclic Aromatic Hydrocarbons (PAHs) derived from any carbonaceous or ashy inclusions in the near surface soils.*
- *Acid/Sulphate contaminated soils.*
- *Asbestos associated with former structures on the sites western extent.*
- *Potentially hazardous ground gases (i.e. methane and carbon dioxide) associated with any deep Made Ground or associated with the pond (if backfilled).*

The site lies in a predominantly rural environ with no significant sources of potential chemical contamination identified from off-site commercial or industrial sources.

Several areas of possible infilled land are indicated in the sites environs, potentially associated with infilling of the former excavation and former quarry to the sites southeast.'

3.8 Recommended Phase II Exploratory Investigation Works

The following assessment is reproduced from the GeoDyne Ltd Phase I Desk Study report (referenced in Section 1.1).

'*The desk study works have identified potential on-site pollutant linkages of risk levels ranging between Negligible to Moderate/Low risk. Based on our CSM, there are considered to be no significant geo-environmental barriers to the development of the site, with the key risk drivers with respect to on-site pollutant linkages identified as the presence of any near surface soil contamination that may be encountered by future residential dwellings together with the risk of ground gases associated with on-site and off-site sources of ground gases affecting the building envelope.*

Proposed Phase II Exploratory Works should be sufficient to investigate the possible issues raised in the Phase I Desk Study and should be undertaken in general accordance with current industry good practice.

At this stage, the following is recommended:

- *A programme of intrusive investigation works at the site, to comprise trial pits to investigate near surface ground conditions and the ease of excavation of solid strata together with a programme of window sample boreholes to facilitate the installation of ground gas monitoring points.*
- *Collection of soil samples across the site (both topsoil and underlying subsoil/natural strata and any Made Ground) for a suitable suite of laboratory chemical analysis.*
- *Undertake a programme of ground gas monitoring at the site.*
- *Revision of the pCSM following receipt of the laboratory analysis and completion of the programme of ground gas monitoring.*

Dependent on the findings of the foregoing works or the requirements of the Client / design team or regulatory authorities, further investigation, risk assessment or remediation works may ultimately be necessary.'

4.0 GROUND INVESTIGATION

4.1 Introduction

Sub-Surface Utility Avoidance Scan

Prior to the commencement of our intrusive works at the site a sub-contracted sub-surface utility scan of proposed exploratory hole locations was undertaken to attempt to avoid buried services. Based on the results of the service scan, the exploratory holes were positioned in accessible areas of the site in order to maximise the amount of information obtained during our site works, whilst avoiding known utilities and footpaths.

Window Sampling Borehole Works

Window sampling borehole works were undertaken on 7th July 2020 and comprised the advancement of 8No. window sampling boreholes (designated WS1 to WS8). The boreholes were advanced to a depth of 0.7m to 2.00m below existing ground level (begl).

Standard Penetration Tests (SPTs) were undertaken at nominal 1m centres in the boreholes in order to provide initial strength data for the near surface soils.

Following completion, five of the boreholes (WS1, WS2, WS3, WS6 and WS7) were constructed with combined ground gas and groundwater monitoring wells in order to facilitate a programme of ground gas and water level monitoring.

Trial Pits

A series of 8No. mechanically excavated trial pits (designated TP1 to TP8) were undertaken at the site to depths ranging between 1.80m and 2.90m begl on the 8th July 2020. Selected trial pits were observed by an earthwork's contractor at the request of Bowbridge Homes Ltd.

Exploratory Hole Locations

The approximate locations of the exploratory holes are shown on the plan presented in Appendix IV (Figure No. 40056-2/05).

Exploratory holes were advanced to target specific areas and features identified in the Desk Study information and site walkover and also to provide general site coverage.

Table 1 summarises the reasoning behind the exploratory hole positions.

TABLE 1 – REASONING FOR EXPLORATORY HOLE LOCATION

Exploratory Hole Reference	Reasoning Behind Location
WS1	Targeted to the area of the historic pond in the west of the site
TP2	Targeted to the area of the historic farm buildings in the south of the site
TP1, TP3 TP5 & WS8	Targeted to the top of the ridge.
WS2, WS4, WS7 & TP8	Targeted to the slopes of the ridge.
WS3, WS5, WS6, TP4, TP6 & TP7	General site coverage.

Key
TP – Trial Pit
WS – Window Sampling Borehole

During the site work, all exploratory hole locations were surveyed using GPS method by the sub-contracted utility clearance scanner. The co-ordinates and elevations are shown in Table 2.

TABLE 2 – SUMMARY OF EXPLORATORY HOLE LOCATION DATA			
Exploratory Hole Location	Easting	Northing	Elevation (m AOD)
TP1	450952.10	317511.15	87.525
TP2	450895.14	317514.62	84.236
TP3	450937.71	317542.61	86.931
TP4	450890.02	317555.96	84.330
TP5	450940.98	317505.97	87.650
TP6	450961.00	317575.02	82.294
TP7	451000.64	317542.72	79.607
TP8	450972.02	317523.96	83.949
WS1	450880.25	317517.60	83.808
WS2	450919.22	317537.04	85.591
WS3	450984.52	317497.80	82.773
WS4	450919.01	317571.98	85.468
WS5	450954.99	317596.97	82.497
WS6	451006.02	317578.00	78.281
WS7	450959.95	317548.00	83.934
WS8	450942.70	317532.80	87.153

Exploratory Hole Logs/Plates

The exploratory hole logs are presented in Appendix V of this report. Selected photographs of the exploratory hole arisings are presented in the Plates included in Appendix VI of this report.

4.2 Ground Conditions

The ground conditions encountered in the exploratory holes may be summarised as follows.

Topsoil

Topsoil was encountered in all exploratory holes (except TP2) to depths of between 0.20m and 0.30m begl and generally comprised brown and dark brown silty clayey, locally slightly gravelly TOPSOIL.

In TP2 Made Ground topsoil was encountered to a depth of 0.30m begl and was compositionally the same as the natural Topsoil but contained anthropogenic inclusions of red brick and crystalline rock.

Subsoil

Subsoil was locally encountered beneath the Topsoil in exploratory holes WS3, WS6, TP4, TP6 and TP7 to depths of between 0.40m and 0.60m begl. The subsoil generally comprised light brown to brown clayey SILT / silty CLAY / gravelly, locally silty SAND.

Possible Made Ground

In the eastern end of trial pit TP2, potential Made Ground was encountered to a depth of 1.00m begl, with brick fragments and a potential land drain. This Made Ground may relate to the historic farm building shown on the historical maps in the south of the site.

Tarporley Siltstone Formation

Underlying the Topsoil and Subsoil where encountered, Natural Strata considered representative of the weathered Tarporley Siltstone Formation was encountered in exploratory holes WS1, TP2 and TP4 in the southwest of the site and in WS6 and TP7 in the northeast of the site. The base of the strata was not penetrated.

The strata comprised stiff to very stiff red-brown silty CLAY with pockets and bands of green-grey clayey silt / silt. With depth the Clay graded into a Mudstone.

Swithland Formation

Underlying the Topsoil and Subsoil where encountered, in the centre of the site and forming a ridge, Natural Strata considered representative of the weathered Swithland Formation was encountered in exploratory holes WS2 to WS5, WS7, WS8, TP1, TP3, TP5, TP6 and TP8. The coarse granular (cobbles and boulders) nature of the soils caused the termination of the majority of the window sample boreholes at shallow depth and the arisings may not be representative of the strata. The base of the strata was not penetrated.

The strata was variable but initially comprised gravelly CLAY / clayey gravelly SAND / sandy GRAVEL on the slopes of the ridge overlying at depths of 1.40m to 1.50m highly weathered dark grey and green-grey strong crystalline rock META-MUDSTONE recovered as cobbles and boulders in a sandy matrix. On the top of the ridge the Meta-Mudstone was encountered at depths of 0.30m to 0.50m begl.

4.3 Water

Water was not encountered in any of the exploratory holes undertaken at the site.

4.4 Stability and Excavations

Excavations in the predominantly Clay strata of the Tarporley Siltstone Formation encountered in the southwest and northeast of the site generally remained stable during advancement of the exploratory holes.

Excavations where the weathered meta-mudstone of the Swithland Formation was encountered were generally stable, with hard-to-dig conditions encountered. However, where the strata was typically recovered as boulders and cobbles, the removal of the boulders caused instability and overdigging of the pit, widening the top significantly.

4.5 Shear Vane Values

In-situ shear vane testing was undertaken (using a suitable extension rod) on visually cohesive soils encountered within the trial pits TP2, TP4 and TP7 where the Tarporley Siltstone was encountered.

The results revealed in-situ soil shear strength values in the cohesive soils varied across the site between 53kN/m^2 and 114kN/m^2, at depths of between 0.65m and 1.00m begl, but generally increased with depth.

The shear vane values are graphically displayed on Chart 40056/01 included on page 13 and are detailed on the trial pit logs presented in Appendix V.

4.6 Standard Penetration Test (SPT) Data

In order to establish a strength/depth profile of the natural soils beneath the site, in-situ Standard Penetration Testing (SPT) was undertaken at one-metre nominal centres in boreholes WS1 to WS8.

The testing within the exploratory holes comprising predominantly cohesive soils (WS1 and WS6) revealed SPT 'N' Values of 15 and 18 at a depth of 1.00m begl, indicating a stiff to very stiff consistency. At a depth of 2.00m begl both boreholes achieved SPT 'N' refusal (i.e. ≥50 blows) indicating the strength increased with depth.

The SPT findings in the granular materials of the Swithland formation encountered in WS2 indicated an SPT 'N' value of 15 at a depth of 1.00m begl indicating a stiff to very stiff consistency. At a depth of 2.00m begl, SPT 'N' refusal (i.e. ≥50 blows) was achieved indicating the strength increased with depth.

Within boreholes WS3 to WS5, WS7 and WS8 SPT 'N' refusal (i.e. ≥50 blows) was achieved at depths of 0.70m to 1.00m begl. It is likely these boreholes refused on boulders of the meta-mudstone, which were encountered at shallow depth in the trial pits.

Chart 40056/02 showing the SPT results with depth is provided on page 14, with SPT results for each of the boreholes provided on the logs included in Appendix V.

Chart 40056/01
Leconfield Road, Nanpantan
Shear Vane Values Vs Depth (m begl)

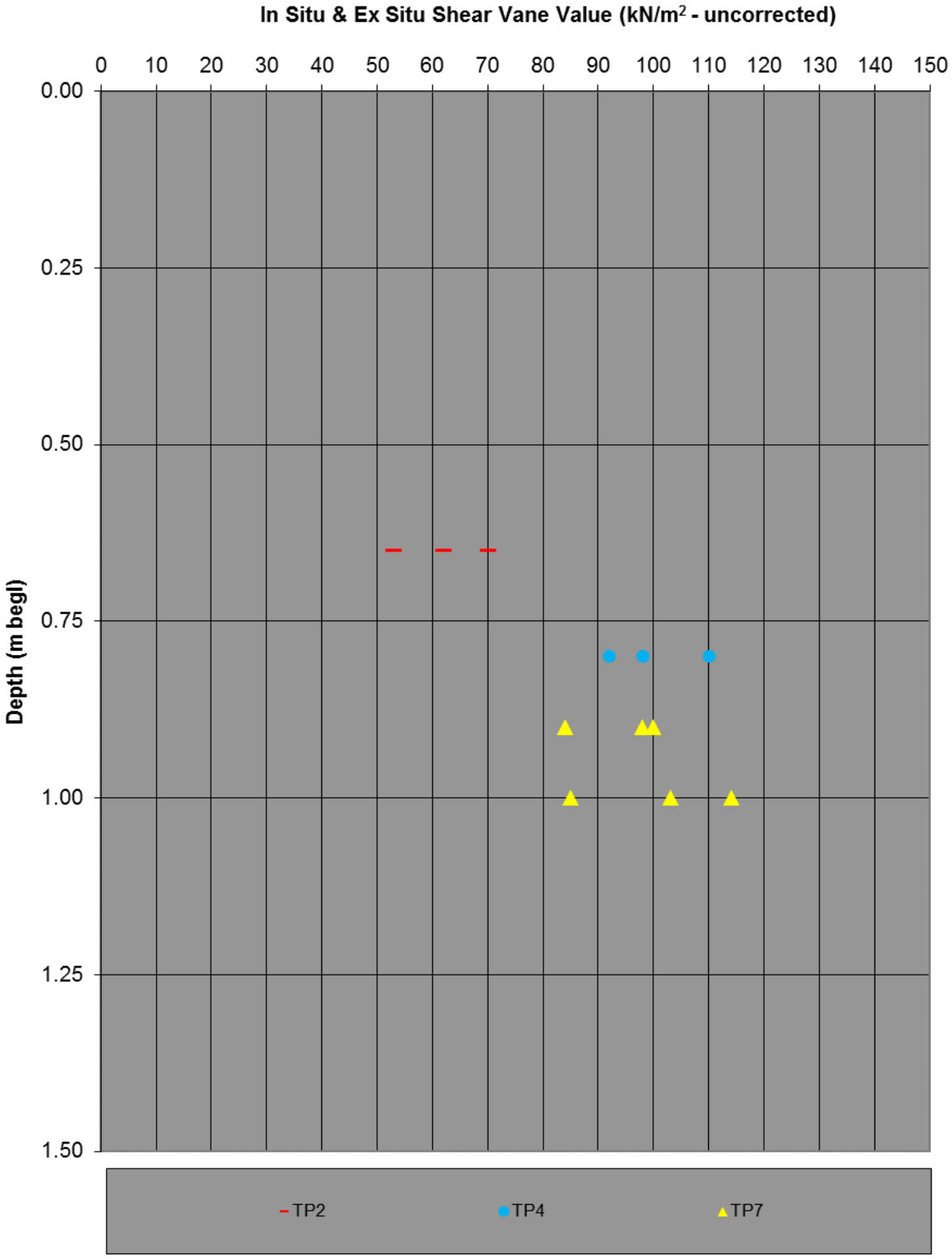
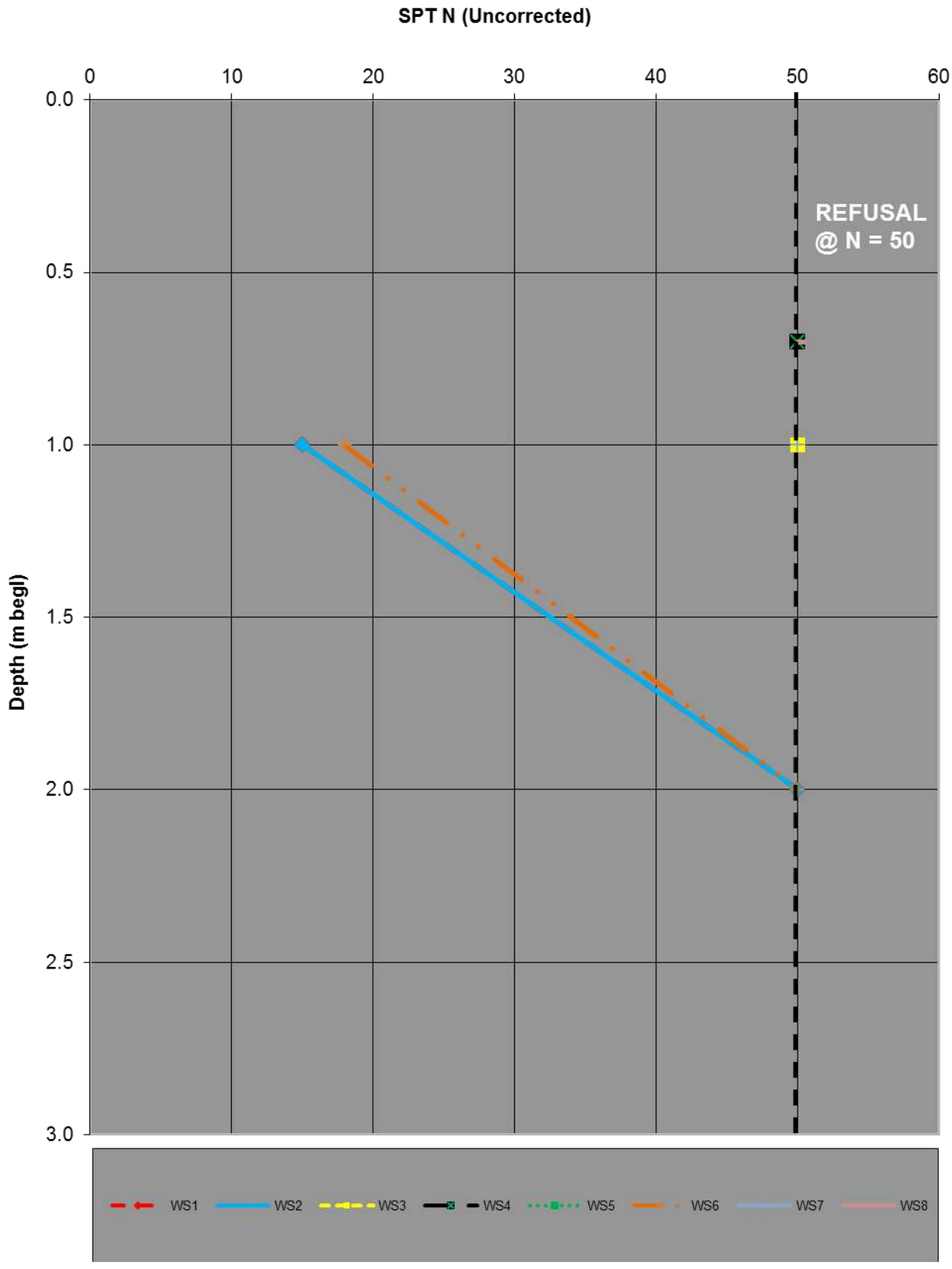


Chart 40056/02
Leconfield Road, Nanpantan
SPT N Values Vs Depth (m begl)



5.0 LABORATORY TESTING & CONTAMINATION ASSESSMENT

5.1 Introduction

Geotechnical soil testing was undertaken on selected samples and comprised the following:

- 5No. Water soluble sulphate tests.
- 12No. pH tests.
- 5No. Plasticity Index (PI) tests.
- 1No. Particle Size Distribution (PSD) test.
- 3No. Laboratory Recompacted California Bearing Ratio (CBR) test.

The following environmental soil testing was carried out on visually representative samples recovered from the exploratory holes, broadly based on the summary of environmental risk for the site in the Phase I Desk Study referenced in Section 1.1:

- 9No. Standard contamination suites (including speciated PAH and TOC).
- 5No. Asbestos Screens.
- 5No. Pesticide Screens.

The geotechnical and environmental laboratory soil test results are presented in Appendix VII of this report.

5.2 Geotechnical Soil Test Results

Water Soluble Sulphate/pH

Water soluble sulphate testing was undertaken on five samples of Natural Strata revealing concentrations ranging between <0.01g/l and 0.04g/l. The pH values of the 10No. Natural Strata (excluding topsoil) soils tested ranged between 5.46 and 8.30.

Adopting the highest water soluble sulphate concentration (0.04g/l), and the average of the lowest two pH values (5.50), in accordance with the Building Research Establishment publication Special Digest 1 '*Concrete in Aggressive Ground*' (2005) the site falls into Design Sulphate Class DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2z.

The foregoing designation assumes a natural ground location with potentially mobile groundwater.

Plasticity Index Testing

Plasticity Index (PI) testing was undertaken on 4No. samples of visually cohesive Strata and 1No. sample of granular strata to determine the volume change potential of the samples.

In accordance with the NHBC Guidance Chapter 4.2 and the BRE Digest 240 '*Low-rise buildings on shrinkable clay soils: Part 1*' (1993), the reported PI value may be modified based on the portion of the sample retained on the 425μm sieve.

The results of the PI analysis are summarised in Table 3.

TABLE 3 – SUMMARY OF PLASTICITY INDEX (PI) DATA				
Sample Ref., Depth (begl) & Strata	Reported PI Value (%)	Portion Passing 425μm Sieve (%)	Modified PI Value (%)	Volume Change Potential
WS1, 1.00m, Clay	21	100	21	Medium
WS1, 2.00m, Clay	22	100	22	Medium
WS6, 1.80m, Clay	17	100	17	Low
TP1, 1.70m, Meta-Mudstone	-	-	-	Non-Plastic
TP6, 1.40m, clayey Sand	17	91	19	Low

In accordance with the NHBC guidance and BRE Digest 240, the adjusted PI values reveal that the visually cohesive samples may be classified as having a low to medium volume change potential. A medium volume change potential should be assumed for the clay soils at the site.

Particle Size Distribution (PSD) Tests

Particle Size Distribution (PSD) testing was undertaken on 1No. sample of visually granular Natural Strata.

The results of the PSD analysis are summarised in Table 4.

TABLE 4 – SUMMARY OF PARTICLE SIZE DISTRIBUTION (PSD) DATA	
Sample Reference and Depth (begl)	Typical Description
TP1, 1.70m	Brown sandy silty GRAVEL with cobbles

The PSD testing has generally confirmed the visual description of the soils noted during the course of the intrusive investigation works. We would also note that boulders, which were too large to sample, were encountered at the site.

Recompacted California Bearing Ratio (CBR) Testing

Recompacted California Bearing Ratio testing was undertaken on 3No. samples of shallow Natural Strata from across the site. The results of the recompacted CBR testing are summarised in Table 5 below. CBR values for the top and bottom of the recompacted sample are recorded.

TABLE 5 – SUMMARY OF LABORATORY CBR TEST RESULTS				
Sample Ref.	Depth (m begl)	Initial Moisture Content (%)	CBR Value Sample Top (%)	CBR Value Sample Bottom (%)
TP5 (Meta-Mudstone)	0.50-1.00	10	50.7	38.8
TP6 (Sand)	0.60-0.80	14	28.6	20.7
TP7 (Clay)	1.00	19	11.1	11.0

5.3 Contamination Assessment Rationale

It is understood that it is proposed to construct residential dwellings with gardens and associated infrastructure. The land use category of residential with plant uptake end use is considered to be the most relevant in this instance.

5.3.1 Assessment Methodology

In order to undertake a Generic Quantitative Risk Assessment (GQRA) we have adopted the Suitable for Use Levels (S4ULs) published by LQM/CIEH in their publication referenced: Nathanail, C.P., McCaffrey, C. Gillett, A.G., Ogden, R.C. and Nathanail, J.F, 2015. '*The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. All rights reserved.*' In the absence of an S4UL screening value, we have made reference to the Category 4 Screening Levels (C4SLs) published by DEFRA.

In consideration of the available generic land uses utilised in the derivation of the adopted screening criteria, we have adopted a residential with plant uptake end-use scenario for the purposes of our assessments.

For assessment purposes, we have adopted a policy whereby determinands within the dataset are individually compared to the relevant screening value (i.e. individual S4ULs). Where determinands within the dataset are less than the appropriate screening value, the determinand is considered to be present at an acceptable concentration and no further assessment is required. Additional comment, statistical assessment or further Detailed Quantitative Risk Assessment (DQRA) may be provided where elevated values are revealed.

5.3.2 Selection of Soil Organic Matter (SOM) Content

The SOM content and soil type are used to provide an assessment of the applicability of the screening values adopted (the S4UL values are typically based upon SOM of 1%, 2.5% and 6%, as applicable).

Determinands have in the first instance, been compared to screening values adopting a conservative SOM of 1%.

Where the determinand exceeds the relevant screening value at 1% SOM, a site specific SOM may be adopted as appropriate to derive more site-specific screening values and the dataset reassessed.

5.4 Sampling Strategy

The sampling strategy for the site was primarily to retrieve visually representative soil samples from a selection of locations that provide coverage across the entire site area.

The sampling strategy was initially based on a review of the historical, geological and environmental information obtained as part of the previous Phase I Desk Study report, together with the current and proposed site setting.

The ground conditions encountered during our Phase II works revealed the presence of three distinct types of material i) Topsoil/Made Ground Topsoil, ii) Subsoil and iii) Natural Strata.

Representative samples were obtained during our Phase II works and subjected to chemical analysis for a suite of contaminants deemed appropriate based on the land use assessment.

5.5 Contamination Soil Test Results

The contamination assessment for the soils at the site is summarised in Table 6. The dataset comprises samples of Topsoil, Subsoil, Made Ground Topsoil and Natural Strata. The dataset has been combined for initial assessment purposes.

Please note that screening values have only been used for determinands where they are present at concentrations in excess of the Limit of Detection (LOD) of the method of analysis employed by the laboratory on at least one occasion.

TABLE 6 – SUMMARY OF TIER 1 GAC ASSESSMENT RESIDENTIAL WITH PLANT UPTAKE END-USE				
Contaminants – Potentially Harmful to Human Health	No. of Samples Tested	Concentration Range (mg/kg)	Tier 1 GAC (mg/kg)	Tier 1 GAC Exceeded (Yes/No)
Metals				
Arsenic	9	<1 – 9	37 S4UL	No
Cadmium	9	<0.5 – 0.6	11 S4UL	No
Copper	9	15 – 78	2400 S4UL	No
Chromium III	9	5 – 44	910 S4UL	No
Lead	9	5 – 44	200 C4SL	No
Nickel	9	4 – 30	180 S4UL	No
Zinc	9	22 – 81	3700 S4UL	No
Key S4UL – CIEH/LQM Suitable 4 Use Levels (2015). Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3026. All rights reserved. C4SL –value for Lead taken from DEFRA publication SP1010 and based on a residential with plant uptake end-use.				

All of the determinands were revealed to be below the appropriate Tier 1 GAC for a residential with plant uptake end use or Limit of Detection of the method of analysis employed.

5.6 Pesticide Testing

Three samples of Topsoil and one sample of Subsoil obtained from exploratory holes WS1, WS3, WS5, WS6 and TP5 were tested for a suite of pesticides.

All of the determinands were revealed to be below the Limit of Detection of the method of analysis employed within the samples screened.

5.7 Asbestos Testing

Five samples including Topsoil, Subsoil and Made Ground Topsoil obtained from exploratory holes WS1, WS3, WS4, WS6 and TP2 were tested for the presence of Asbestos.

No asbestos fibres were detected by the laboratory within the samples screened.

We would note that no visual evidence of any suspected Asbestos Containing Materials (ACMs) was noted during the site works in the exploratory holes.

5.8 Contamination Assessment Summary

The samples of Topsoil, Subsoil, Made Ground Topsoil and Natural Strata tested did not reveal elevated concentrations of the determinands tested, when compared to Tier 1 GAC for a residential with plant uptake end use.

The Topsoil and near surface Natural Strata analysed may be considered to be chemically uncontaminated for a residential end-use, and may be re-used as required within the proposed development (subject to geotechnical suitability and all necessary permits and plans being in place).

The concentrations of determinands detected are considered to be unlikely to present a potentially significant risk to Controlled Waters.

6.0 GROUND GAS & GROUNDWATER MONITORING

6.1 Introduction

The Phase I Desk Study information has revealed the presence of a potentially backfilled pond on site and several areas of possible infilled land are indicated in the sites environs. These features are considered to represent potential sources of hazardous ground gases (i.e. Methane and Carbon Dioxide) that may affect the proposed development.

Based on the foregoing a programme of ground gas monitoring has been undertaken to determine the sites ground gas regime and possible requirement for ground gas protection measures for the proposed buildings.

6.2 Monitoring Installations

Upon completion, 5No. window sample boreholes (WS1 to WS3, WS6 and WS7) were installed with combined ground gas and water monitoring wells to facilitate a programme of monitoring.

The full set of ground gas and water monitoring data is presented in Appendix VIII of this report.

6.3 Results of the Ground Gas Monitoring

A total of six monitoring visits generally over a six-week period have been undertaken at the site as part of our works. The ground gas monitoring results are summarised in Table 7 below.

TABLE 7 – SUMMARY OF GROUND GAS MONITORING DATA

Parameter	Minimum % by volume (v/v)	Maximum % by volume (v/v)
Methane	0.0	0.0
Carbon Dioxide	0.4	3.5
Oxygen	17.4	22.3
Flow (l/h)	0.0	0.1

Atmospheric pressure ranged between 1001mb and 1010mb during the monitoring programme. Due to undertaking the monitoring during the summer months high pressure predominated, therefore, no monitoring visit was undertaken below 1000mb (typically regarded as being low pressure).

Water was encountered in 2No. wells (WS1 and WS2), located in the southwest of the site during the monitoring programme, at depths ranging between 1.50m and 1.90m begl.

6.4 Appropriate Guidance

6.4.1 British Standard & CIRIA

The results of the ground gas monitoring have been reviewed with reference to the following documentation:

- CIRIA Report C665 '*Assessing risks posed by hazardous ground gases to buildings*' (2007).
- NHBC & RSK Group publication '*Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present*' (March 2007).
- British Standard BS 8485 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*' (2015+A1:2019).

- CIRIA Report C735 '*Good practice on the testing and verification of protection systems for buildings against hazardous ground gases*' (2011).

6.4.2 Gas Screening Value Calculation

BS 8485:2015+A1:2019 and CIRIA Report C665 recommend a risk-based methodology to ground gas assessment, the first step of which includes the calculation of a site-specific Gas Screening Value (GSV). The GSV of a particular ground gas regime equates to:

- GSV (l/h) = maximum borehole flow rate (l/h) x (maximum gas concentration/100).

The GSV should be calculated for both Methane and Carbon Dioxide (where appropriate) to determine a site-specific Characteristic Situation for each gas. The higher the calculated GSV, the greater the risk posed by the presence of ground gas. The CIRIA guidance document notes that '*…the GSV is a guideline value and not an absolute threshold*'.

6.4.3 Site Classification

The next step in the assessment process is determining the sites classification. Table 2 of BS 8485:2015+A1:2019 (reproduced below) presents six Characteristic Situations (CS) to assist in the classification of the site, based on the calculated GSV for Methane and Carbon Dioxide.

Table 2 — *CS by site characteristic GSV*

CS	Hazard potential	Site characteristic GSV [A] L/h	Additional factors
CS1	Very low	<0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	0.07 to <0.7	Typical measured flow rate <70 L/h (otherwise consider an increase to CS3)
CS3	Moderate	0.7 to <3.5	–
CS4	Moderate to high	3.5 to <15	–
CS5	High	15 to <70	–
CS6	Very high	>70	–

[A] The figures used in this column are empirical.

NOTE The CS is equivalent to the characteristic GSV in CIRIA C665 [6].

6.4.4 Proposed Building Type

In accordance with BS 8485:2015+A1:2019, the CS classification for the site should be considered in conjunction with the proposed Building Type to determine the appropriate level of ground gas protection measures that should be installed to mitigate the risk posed by ground gases.

BS 8485:2015+A1:2019 notes '*The Building Type is determined based the proposed construction and use of the building, together with the control of future structural changes to the building and its maintenance (the building's management) should be assessed, since potential risks posed by ground gases are strongly influenced by these factors*'.

Subject to the development proposals, each building may be categorised as a whole, or for each different part of the building.

The Building Types presented in Table 3 of BS 8485:2015+A1:2019, are reproduced below.

Table 3 — *Building types*

	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ public, possible multiple	Commercial/ public	Commercial/ industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small/ medium	Small to large	Large industrial/ retail park style

- **Type A building**: private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.
- **Type B building**: private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.
- **Type C building**: commercial building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building, including the gas protection measures. Single occupancy of ground floor and basement areas. Small to large size rooms with active ventilation or good passive ventilation of all rooms and other internal spaces throughout ground floor and basement areas. Probably civil engineering construction. Examples include offices, some retail premises, and parts of some public buildings (such as schools, hospitals, leisure centres and parts of hotels).
- **Type D building**: industrial style building having large volume internal space(s) that are well ventilated. Corporate ownership with building management controls on alterations to the ground floor and basement areas of the building and on maintenance of ground gas protective measures. Probably civil engineering construction. Examples are retail park sales buildings, factory shop floor areas, warehouses. (Small rooms within these style buildings should be separately categorized as Type B or Type C).

6.4.5 Gas Protection Score (Number of Points to be Achieved)

Table 4 of BS 8485:2015+A1:2019, reproduced below, should be used to derive the minimum level of gas protection applicable to the Building Type, based on the CS determined from the calculated GSV. The Gas protection Score in Table 4 below is used to determine the level and type of protection measures used.

Table 4 — *Gas protection score by CS and type of building*

CS	Minimum gas protection score (points)			
	High risk		Medium risk	Low risk
	Type A building	Type B building	Type C building	Type D building
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 [A)]	5.5 [A)]	4.5	3.5
5	— [B)]	A1 6 A1 [A)]	5.5	4.5
6	— [B)]	— [B)]	A1 — [B)] A1	A1 6 A1

[A)] Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.

[B)] The gas hazard is too high for this empirical method to be used to define the gas protection measures.

6.4.6 Methods of Achieving Gas Protection Scores

The appropriate level of precautions, to be designed in accordance with the point scoring system of BS 8485:2015+A1:2019, should therefore be determined for the specific type of developments based on the GSV and CS of the site. These may include a combination of two or more of the following three types of protection measures, which could be used to achieve the required score:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- Ventilation measures; and
- Gas resistant membrane which may include an element of verification and potentially integrity testing.

Verification and integrity testing should be undertaken in accordance with CIRIA report C735 '*Good practice on the testing and verification of protection systems for buildings against hazardous ground gases*' (2014) and would be detailed in a Remediation Method Statement report in advance of construction which should be agreed with the Local Planning Authority.

The points achieved for each element of the ground gas precautions are summarised in Tables 5, 6 and 7 of the British Standard. These tables are reproduced below.

Table 5 — *Gas protection scores for the structural barrier*

Floor and substructure design (see Annex A)	Score [A])
Precast suspended segmental subfloor (i.e. beam and block)	0
Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)	0.5
Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations	1 or 1.5 [B]
Basement floor and walls conforming to BS 8102:2009, Grade 2 waterproofing [C] [A1] [D] [A1]	2
Basement floor and walls conforming to BS 8102:2009, Grade 3 waterproofing [C] [A1] [D] [A1]	2.5

[A] The scores are conditional on breaches of floor slabs, etc., being effectively sealed.

[B] To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see **A.2.2.2**).

[C] The score is conditional on the waterproofing [A1] being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall). [A1]

[D] [A1] If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas resistant membrane in that table. [A1]

Table 6 — *Gas protection scores for ventilation protection measures*

Protection element/system	Score	Comments
(a) Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building)	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/ or is not terminated in a venting trench (or similar), then the score is zero.

(b) Passive sub floor dispersal layer: Very good performance: Good performance: Media used to provide the dispersal layer are: • Clear void • Polystyrene void former blanket • Geocomposite void former blanket • No-fines gravel layer with gas drains • No-fines gravel layer	2.5 1.5	Performance criteria for methane and carbon dioxide are shown in Figure B.6 and Figure B.7, respectively. The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B. Passive ventilation should be designed to meet at least "good performance", see Annex B.
(c) Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers	1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least "good performance", as described in Annex B.
(d) Active positive pressurization by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket	1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient "coverage" of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least "good performance".
(e) Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park)	4	Assumes that the car park is vented to deal with car exhaust fumes, designed to *Buildings Regulations 2000, Approved Document F* [9].

Table 7 — *Gas protection score for the gas resistant membrane*

Protection element/system	Score	Comments
Gas resistant membrane meeting all of the following criteria: • sufficiently impervious A1, both in the sheet material A) and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and/or carbon dioxide through the membrane; A1 • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • A1 *Text deleted* A1 • sufficiently strong A1 B) A1 to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); A1 and to withstand in-service stresses (e.g. settlement if placed below a floor slab); A1 • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735 [N1].	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. A1 *Text deleted* A1 If a membrane is installed that does not meet all the criteria in column 1 then the score is zero.

A) A1 A membrane with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1:2007 manometric method) is regarded as sufficiently impervious.

B) For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m² and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also **C.3**). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs. A1

6.5 Ground Gas Analysis

6.5.1 Gas Screening Value

The ground gas monitoring undertaken has not revealed the presence of measurable concentrations of Methane. A maximum Carbon Dioxide concentration of 3.5% by volume (v/v) was revealed by the monitoring undertaken. A positive gas flow was detected in the monitoring wells, with a maximum flow rate of 0.1 l/hr on one occasion.

The GSV for Carbon Dioxide at the site may be calculated as follows:

- 0.1 x (3.5/100) = 0.0035 l/h

On the basis of the assessment, the site may be classified as **'CS1**', in accordance with Table 2 of BS 8485:2015+A1:2019.

6.5.2 Building Type

We understand that it is proposed to construct low-rise residential properties at the site. In accordance with Table 3 of BS 8485, **Building Type A** is considered to be the most appropriate classification.

6.5.3 Gas Protection Score

On the basis of a Characteristic Situation 1 (CS1) and the development proposals with buildings that may be designated as Building Type A and in accordance with Table 4 of BS 8485:2015+A1:2019, the minimum gas protection score for the site is **0 points**.

6.5.4 Recommended Level of Precaution

The site has been characterised as Characteristic Situation 1 (**CS1**) based on the gas data recorded. In accordance with Table 3 of BS 8485:2015+A1:2019, **Building Type A** is considered to be the most appropriate classification for the proposed structures and in accordance with Table 4 of BS 8485:2015+A1:2019, the minimum gas protection score for the site is **0 points**.

Therefore, specific ground gas protection measures for the ingress of Methane and Carbon Dioxide into buildings are considered not to be required for the site.

7.0 REVISED CONCEPTUAL SITE MODEL

7.1 Introduction

In accordance with the approach detailed within Section 4.0 of our previous Phase I report, the preliminary Conceptual Site Model (pCSM) for the site should be refined following acquisition and collection of additional data following completion of the site investigation works.

Based on the findings of the preliminary CSM (pCSM) detailed in Section 7.6 below, Bedrock has been removed from the assessment as a potential source as the findings of the Phase I Desk Study pCSM Risk Classification were '*Negligible*' and the findings of the Phase II investigation have confirmed this.

As a result of the findings of the Phase I Desk Study and site investigation, and given the distance to any surface watercourses, we have removed this potential receptor from the CSM table, and have therefore also excluded the surface run-off and base flow pathways into surface watercourses from our assessment. The remaining potential contaminant linkages have been re-assessed to reflect the findings of the investigations and risk assessments completed.

Our revised assessment following the acquisition and collection of information from the site investigation works is provided in Table 12 below.

7.2 Classification of Consequences

In order to apply a consequence classification to a particular potential pollutant linkage, it is first necessary to define the terminology used within the classification system. The following terminology and definitions detailed in Table 8 have been adopted within our assessment, based on current guidance.

TABLE 8 – CLASSIFICATION OF CONSEQUENCES

Classification	Definition
Severe	• Acute risks to human health. • Short-term risk of pollution of controlled waters or significant impact on controlled waters; e.g. large-scale pollution or very high levels of contamination. • Catastrophic damage to buildings or property (such as building explosion causing collapse). • Ecological system effects – immediate risks of major damage which is likely to result in irreversible substantial adverse changes in the functioning of the ecosystem or harm to a species of special interest that endangers the long-term maintenance of the population.
Medium	• Chronic risks to human health. • Pollution of sensitive water resources (such as leaching of contaminants into controlled waters) causing a significant effect on water quality. • Ecological system effects – Immediate risks of significant damage which may result in substantial adverse changes to the ecosystems functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. • Significant damage to buildings, structures and services (for example foundation damage or rendering the building unsuitable for habitation).
Mild	• Non-permanent health effects to human health (i.e. exposure is unlikely to lead to 'significant harm' in the context of Part 2A of the Environmental Protection Act 1990). • Pollution of controlled waters or non-sensitive water resources (for example non-classified groundwater) that results in a short-lived effect to water quality or a marginal effect on amenity value, agriculture or commerce. • Minor damage to buildings, structures and services. • Ecological system effects – Minor or short-term damage which is unlikely to result in substantial adverse changes to the ecosystems functioning or harm to a species of special interest. • Substantial damage to non-sensitive environments (such as arable farmland for example).

TABLE 8 – CLASSIFICATION OF CONSEQUENCES	
Classification	Definition
Minor	• No measurable effects on human health including non-permanent health effects to human health that are easily preventable by appropriate use of PPE/RPE. • Minor pollution of controlled waters including non-sensitive water resources with no discernible effects on water quality or ecosystems. • Minor damage to non-sensitive environments (including arable farmland for example). • Easily repairable effects of damage to buildings, structures, services or the environment (for example discolouration of concrete, loss of plants in a landscaping scheme etc.).

7.3 Classification of Probability

Once the possibility of a pollutant linkage has been established (noting that probability classification does not apply when there is no possibility of a linkage being present), the probability should be classified in accordance with Table 9.

TABLE 9 – CLASSIFICATION OF PROBABILITY		
Classification	Definition	
High Likelihood	There is a pollutant linkage and an event is highly likely to occur in the short-term, and is almost inevitable over the long-term OR there is evidence at the receptor of harm or pollution occurring.	>95% likelihood of Consequence Occurring
Likely	There is a pollutant linkage and it is probable that an event will occur. It is not inevitable, but possible in the short-term and likely over the long-term.	50 – 95% likelihood of Consequence Occurring
Low Likelihood	There is a pollutant linkage and circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place, and less likely in the short-term.	5 – 49% Likelihood of Consequence Occurring
Unlikely	There is a pollutant linkage and it is improbable that an event would occur even in the very long-term.	<5% likelihood of Consequence Occurring

7.4 Classification of Risk

In order to establish the relevant risk term applicable to the identified pollutant linkage, one of the risk phrases identified within Table 10 must be adopted, with the definitions of each risk term detailed within Table 11.

TABLE 10 - RISK CLASSIFICATION MATRIX (BASED ON C552 CIRIA, 2001)					
		Consequence of Risk			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Negligible
	Unlikely	Moderate/Low	Low	Negligible	Negligible or No Potential Risk

TABLE 11 - RISK CLASSIFICATION DEFINITIONS (BASED ON C552 CIRIA, 2001; MODIFIED BY GEODYNE)	
Very High	There is a high probability that severe harm will arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, there is a low likelihood that such harm would be severe, or if any harm were to occur it is more likely that the harm would be mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate/Low	It is possible that harm could arise to a receptor. However, a combination of likelihood and consequence results in a risk that is above low but is not of sufficient concern to be classified as moderate. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely. Such harm would at worse normally be mild. The risk is unlikely to present a substantial liability. Some limited further investigation may be required to clarify the risk and any associated liability. If subsequent remediation works are necessary, they are likely to be limited in extent.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Negligible	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is unlikely to be any worse than mild. No liability would be associated with such risks.
No Potential Risk	There is no potential risk or liability where no pollutant linkage has been established.

7.5 Contaminant [C] - Pathway [P] - Receptor [R] Considerations

The following CPR assessment has been undertaken based on the assumption that the site will be redeveloped with residential dwellings with gardens.

7.6 Consideration of Potential Sources of Contamination [C]

Based on the findings of our works, the potential key sources of contamination at the site (reproduced from the Phase I Desk Study report) that would require consideration for the derivation of an updated CSM would be the following:

SUMMARY OF POTENTIAL CONTAMINANT SOURCES	
Potential Contaminant Source	Potential Associated Contaminants
Made Ground (from infilling of former pond)	▪ Metals and metalloids ▪ Polycyclic Aromatic Hydrocarbons ▪ Ground gases (i.e. carbon dioxide and methane); where deep Made Ground or buried organic soils are encountered
Agricultural Topsoil	▪ Pesticides ▪ Metals and metalloids
Bedrock Strata	▪ Metals (from Natural Metal Enrichment) ▪ Radon
Off-site Made Ground sources	▪ Ground Gases (i.e. methane and carbon dioxide)

7.7 Consideration of Potential Pathways [P]

The potential pathways at the site are primarily:

- Direct ingestion of soil.
- Inhalation of dust.
- Direct skin contact with the ground.

- Ingestion of home-grown produce.
- Vertical and lateral migration of contamination.
- Vertical and lateral migration of ground gases.

7.8 Consideration of Potential Receptors [R]

The potential receptors at the site are:

- The final end users (residents - typically long term (chronic) exposure and site visitors – typically short term (acute) exposure).
- Neighbouring properties (i.e. off-site receptors and adjacent ecological receptors).
- Controlled Waters (i.e. underlying groundwater or nearby surface waters).
- Buildings and construction materials.

In preparing this CSM, it has been assumed that construction personnel involved with the development of the site (typically short term (acute) exposure) will adopt all necessary personal protective equipment (PPE and RPE etc.) and conform to health and safety requirements of their site-specific Risk Assessments and Method Statements (RAMS). Site workers have therefore not been included within the following table, as the adoption of these appropriate mitigation measures will result in an overall low risk of exposure to the C-P-R linkages identified.

7.9 Revised Risk Assessment / Conceptual Site Model

Our revised conceptual model of possible pollutant linkages, applicable to the proposed site usage and based on our current understanding, is summarised in Table 12.

TABLE 12 – REVISED RISK ASSESSMENT SUMMARY TABLE

Potential Contaminant Source [C]	Potential Pathway(s) [P]	Potential Receptor [R]	Probability of CPR Linkage	Consequence of CPR Linkage	Risk Level	Comments / Justification
Made Ground or Agricultural Topsoil	Direct contact, ingestion or inhalation of soil	End users	Unlikely	Medium	Low	The site is proposed for a residential end-use with garden areas. No elevated contaminant concentrations in the samples tested have been revealed by the Phase II investigation works.
	Ingestion of home-grown produce	End Users	Unlikely	Mild	Negligible	The site is proposed for a residential end use with garden areas. The growing of vegetables for consumption is possible. No elevated contaminant concentrations in the samples tested have been revealed by the Phase II investigation works.
	Leaching of Contaminants through unsaturated zone	Groundwater	Unlikely	Medium	Low	The site has historically comprised open field. The site is classified as a Secondary B Aquifer and is not located in an SPZ. No elevated contaminant concentrations in the soil have been revealed which could impact on Controlled Waters.
	Inhalation of fugitive dust	Neighbouring users	Unlikely	Mild	Negligible	No elevated contaminant concentrations in the samples tested have been revealed by the Phase II investigation works.
	Vertical and lateral migration of ground gases	End Users	Unlikely	Medium	Low	A former pond, potentially backfilled, is present in the sites western extent.
	Vertical and lateral migration of contaminants	Adjacent Ecological Receptors	Unlikely	Medium	Low	A local wildlife site and ancient woodland is present adjacent to the site corresponding to Burleigh Wood. No elevated contaminant concentrations in the samples tested have been revealed by the Phase II investigation works that could impact on the adjacent woodland.
Off-site Made Ground Sources	Vertical and lateral migration of ground gases	End Users	Unlikely	Medium	Low	Off site areas of potentially infilled land are indicated in excess of 100m to the sites southeast.

8.0 CONCLUSIONS & RECOMMENDATIONS

The following assessment has been prepared in advance of preparation of a detailed earthworks strategy (by others) including consideration of cut and fill etc. Consequently, our assessment should be considered preliminary and subject to revision once the earthworks strategy has been completed.

8.1 Site Summary

- The site comprises a vacant grass covered parcel off land located to the west of Leconfield Road
- Topographically the site has a ridge present towards the sites centre trending northwest to southeast. Ground levels fall to the southwest, north and east/southeast.
- The site is indicated to be underlain by the Swithland Formation Mudstone and Tarporley Formation Siltstone, Mudstone and Sandstone. The geological units underlying the site are classified as a Secondary B Aquifer by the Environment Agency.

8.2 Geotechnical Information

8.2.1 Ground Conditions

Topsoil and locally Made Ground topsoil was encountered across the site to depths of between 0.20m and 0.30m begl and generally comprised silty clayey, locally slightly gravelly TOPSOIL. The Made Ground topsoil included inclusions of red brick and crystalline rock.

Subsoil was locally encountered across the site to depths of between 0.40m and 0.60m begl and generally comprised clayey SILT / silty CLAY / gravelly, locally silty SAND.

In the eastern end of trial pit TP2, potential Made Ground was encountered to a depth of 1.00m begl, with brick fragments and a potential land drain. This Made Ground may relate to the historic farm building shown on the historical maps in south of the site.

Underlying the Topsoil and Subsoil where encountered, Natural Strata considered representative of the weathered Tarporley Siltstone Formation was encountered in the southwest and northeast of the site. The strata comprised stiff to very stiff silty CLAY with pockets and bands of clayey silt / silt. With depth the Clay graded into a Mudstone.

In the centre of the site and forming a ridge, Natural Strata considered representative of the weathered Swithland Formation was encountered. The strata was variable but initially comprised gravelly CLAY / clayey gravelly SAND / sandy GRAVEL on the slopes of the ridge overlying at depths of 1.40m to 1.50m highly weathered strong crystalline rock META-MUDSTONE recovered as cobbles and boulders in a sandy matrix. On the top of the ridge the Meta-Mudstone was encountered at depths of 0.30m to 0.50m begl.

8.2.2 Preliminary Foundation Design

<u>Earthworks</u>

We understand that the proposed development comprises two-storey residential dwellings and that a scheme of Earthworks will be required at the site to construct a suitably level development platform. The following recommendations are therefore preliminary and subject to confirmation once earthworks proposals, including the extent of cut and fill, have been finalised. We understand that cut locally in excess of 2m may be required.

It is anticipated that the Natural Strata comprising the Tarporley Siltstone Formation and Swithland Formation will be suitable bearing strata for a typical residential dwelling.

Tarporley Siltstone Formation

Based on our findings, foundations for the proposed buildings may comprise strip or trench fill foundations which should be advanced to a minimum depth of 0.90m below existing or proposed ground level (whichever being the deeper) within cohesive soils (Tarporley Siltstone Formation). At this depth the natural strata is considered suitable to support a nett allowable ground bearing pressure of up to 120kN/m^2.

Swithland Formation

Within predominantly granular, but locally cohesive (where interfacing with the Tarporley Siltstone Formation), strata (Swithland Formation in the centre of the site), foundations for the proposed buildings may comprise strip or trench fill foundations which should be advanced to a minimum depth of 0.90m below existing or proposed ground level (whichever being the deeper). At this depth the natural strata is considered suitable to support a nett allowable ground bearing pressure of up to 100kN/m^2.

The ground is variable between exploratory holes and therefore a minimum foundation depth of 0.90m begl should be assumed unless it can be robustly demonstrated that a plot is entirely underlain by granular strata in the zone of influence of foundations, allowing a reduced foundation depth of 0.60m begl.

It is noted that the central area of the site may be cut as part of an Earthworks programme to create a level development platform. The ground conditions following the cutting exercise should be re-examined to ensure the above recommendations still apply. Where earthworks remove weathered Swithland Formation to expose bedrock, a minimum foundation depth of 0.60m would typically apply and bearing pressures in the region of 200kN/m^2 would be appropriate. Care should be taken to ensure that a consistent founding stratum is achieved, and any boulders should be removed to ensure that foundation loads are evenly distributed.

General Comments

Where Made Ground, disturbed ground, boulders or soft spots are encountered at founding depth, foundations will require further deepening to encounter underlying undisturbed suitably competent Natural Strata.

A watching brief for the former pond should be maintained. Any organic materials should be removed, and the resultant void infilled with geotechnically competent materials compacted in controlled layers.

Should foundations straddle the interface of both granular and cohesive strata, it is recommended that foundations be deepened to encounter a single consistent stratum. Alternatively, provision should be allowed for the inclusion of suitable reinforcement within the foundations, to minimise the potential for differential settlement.

Foundation solutions should also be designed to take account of the proposed earthworks strategy at the site. Once proposed earthworks have been confirmed the Structural Engineer should produce a foundation schedule for the site. This should take into account the final ground levels, compaction of the earthworks platform and should consider the most economical foundation solution. This may be an iterative process.

8.2.3 Floor Slab Design

We consider that in the first instance, ground floors should be designed adopting a suspended floor slab with a clear ventilated void (i.e. beam and block) in accordance with NHBC guidance.

However, where less than 600mm of geotechnically competent fill is present below floor slabs or where NHBC guidance allows (for example where foundations are not required to be deepened below 1.5m begl due to trees or where the ground is not desiccated etc.) it may be possible to locally adopt ground bearing floor slabs.

Localised Possible Made Ground was encountered to a depth of 1m in the south of the site. Topsoil was encountered to a depth of 0.30m begl and should be removed prior to slab formation together with any disturbed ground.

8.2.4 Building Near Trees

The geotechnical laboratory test results have also revealed that the cohesive soils encountered across the site have Medium volume change potential characteristics. It is recommended that a Medium volume change potential should be assumed for design purposes where cohesive soils are encountered.

Foundation designs will require adjusting in accordance with NHBC Guidance Chapter 4.2 when building near existing, recently removed or proposed trees due to the presence of cohesive soils at the site.

8.2.5 Water

Water was not encountered in any of the exploratory holes undertaken at the site during the site work. Water was encountered in the southwest of the site (WS1 and WS2) during the ground gas monitoring at depths of between 1.50m and 1.90m begl. This confirmed our observations during our walkover where locally wet ground was revealed.

Based on the findings from the investigation works, significant dewatering of shallow excavations is unlikely to be required. However, water levels may vary due to seasonal or other effects.

8.2.6 Excavations

Excavations in Clay strata generally remained stable during advancement. Excavations within the Swithland Formation in the centre of the site were wider due to over-digging caused by removal of large boulders.

Excavations to depths of less than approximately 2.0-2.5m should be achievable using conventional heavy site plant, locally using a mechanical breaker. Excavations in the mudstone can be anticipated to remain stable in the short term, only requiring support where necessary for health and safety reasons. However, instability should be anticipated in the Swithland Formation due to its granular nature and presence of boulders. The safety of excavations at the site will be the responsibility of the appointed contractor.

Selected excavations were viewed by an earthworks contractor to assist their assessment.

Clay soils are liable to deterioration and softening if left exposed to wet weather conditions. Therefore, formation soils should not be exposed to wet weather conditions for any prolonged period of time to avoid the risk of deterioration in strength.

8.2.7 Sulphate Classification

On the basis of current works undertaken, the site may be classified as falling into Design Sulphate Class DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2z. The foregoing designation assumes a natural ground location with mobile groundwater conditions.

8.2.8 Surface Water Drainage

The ground conditions encountered during our works comprised typically low permeability cohesive deposits in the southwest and northeast of the site, which may preclude the use of soakaways in these areas. The centre of the site comprised predominantly granular material which may be suitable for soakaways. However, this area is anticipated to be subject to a programme of Earthworks and following this, conditions may no longer be suitable. Similarly, soakaways should not be constructed in Made Ground.

On this basis, it is recommended that alternative methods of surface water disposal are investigated at this stage.

8.2.9 CBRs and Pavements

The laboratory testing results presented a range of CBR values from 11.0% to 50.7% reflecting variable conditions encountered at the site. Please note that laboratory re-compacted CBR values represent a theoretical maximum CBR value that may be achieved where soils are compacted in optimum conditions. Lower CBR values are likely to be present in-situ.

Due to the wide range of CBR values achieved and potential re-profiling of the site, it is recommended that further in-situ CBR testing should be used to confirm the design value once the site has been cleared and the formation level constructed.

The road/earthworks designer should take account of the laboratory recompacted CBR values, recommended in-situ testing and earthworks proposals (for example excavation and crushing/screening of rocks). The road/earthworks designer should also take account of the plasticity index and grading testing and moisture content to allow selection of suitable equilibrium CBR values for the differing materials encountered at the site.

Significant thicknesses of organic soils, i.e. topsoil, should be removed from beneath roads and pavements to avoid the potential for differential settlement.

Materials encountered across parts of the site were predominantly clay grade. No frost susceptible material should be within 450mm of the ground surface in road construction.

8.2.10 Earthworks

Due to the change in topography across the site, re-profiling of the site is likely to be required as part of enabling works or retaining features incorporated into the design of the development. An Earthworks Method Statement and detailed cut and fill assessment should be undertaken to inform finalised designs. This will in turn inform the design of foundations and roads etc.

8.3 Environmental Considerations

8.3.1 Soil Contamination Assessment

The samples of Topsoil, Subsoil, Made Ground Topsoil and Natural Strata tested did not reveal elevated concentrations of the determinands tested, when compared to Tier 1 GAC for a residential with plant uptake end use.

The Topsoil and near surface Natural Strata analysed may be considered to be chemically uncontaminated for a residential end-use, and may be re-used as required within the proposed development (subject to geotechnical suitability and all necessary permits and plans being in place).

The concentrations of determinands detected are considered to be unlikely to present a potentially significant risk to Controlled Waters.

8.3.2 Radon

The Desk Study works undertaken previously indicate that no specific radon precautions are necessary in the development.

8.3.3 Ground Gas

Based on existing information, the site may be classified as 'CS1', in accordance with Table 2 of BS8485:2015+A1:2019.

On this basis, no specific ground gas precautions are required for the proposed building in relation to the potential ingress of Methane and Carbon Dioxide.

8.3.4 Remediation Proposals

No specific remedial requirements for human health are considered to be necessary at the site. Topsoil may be stripped, carefully mounded and re-used on site in gardens and soft landscaping as appropriate. A minimum growing thickness of topsoil of 0.15m should be adopted in garden areas.

Any visually anomalous topsoil should be segregated from general topsoil, inspected and subject to chemical contamination testing prior to final decisions regarding its re-use or disposal.

8.4 General Considerations

8.4.1 Off-site Disposal

Should off-site disposal be required of excess natural strata, the chemical testing regime can be different to the chemical testing required to assess the suitability of the soils for retention on site and the risks to Human Health and Controlled Waters.

Therefore, Waste Acceptance Criteria (WAC) testing may be required to confirm disposal costs, although in the first instance, the test results from this investigation should be supplied to landfill operators to determine likely disposal costs before any further testing is carried out.

8.4.2 Unforeseen Circumstances

Should any areas of potentially contaminated soil, or anomalous features be encountered during site construction works we would recommend consultation with GeoDyne to ensure that our recommendations continue to apply.

Any potentially contaminated soils should be left in-situ and subjected to further assessment, to potentially include further chemical testing and risk assessment.

The following procedure should be adhered to if any areas of previously unidentified suspected contamination are encountered during the development of the site:

i. Suspected contaminated material will remain in-situ.
ii. GeoDyne to be notified and will inform the Local Authority Environmental Health Department and warranty provider (if appropriate).
iii. GeoDyne will undertake a visual assessment of the possible contamination, followed by appropriate sampling/testing (as necessary).
iv. If necessary, an appropriate strategy to remove/remediate the contamination will be submitted to the Local Authority and warranty provider.

8.4.3 Construction Workers

It is recommended that construction personnel involved with direct contact with the soils at the site use appropriate PPE equipment (i.e. boots, gloves and overalls) together with hygiene facilities in accordance with general health and safety guidelines.

The chosen Contractor should undertake the necessary Risk Assessments and Method Statements (RAMS) to determine the most appropriate protection required for safe working practices at the site.

A copy of this report should be included in the site health and safety file, and site workers should be made fully aware of the sites setting.

8.4.4 Utilities

We would recommend that this report is supplied to utility companies (including water supply), and that their recommendations relating to appropriate supply pipes are adhered to.

8.4.5 Licenses, Permits, Registrations and Approvals

The Contractor/Developer is responsible for, and must ensure that, all necessary licenses, permits, registrations, plans and approvals are in place prior to commencing with the works at the site. These will include any Mobile Treatment Licenses (MTLs), Site Waste Management Plans / Materials Management Plans (MMP) and/or Waste Management Licenses/Exemptions as necessary to enable the completion of the proposed works.

The movement of soils around the site will require a U1 exemption (where only limited volumes are moved) or Materials Management Plan (with QPD and subsequent verification) where larger volumes are anticipated.

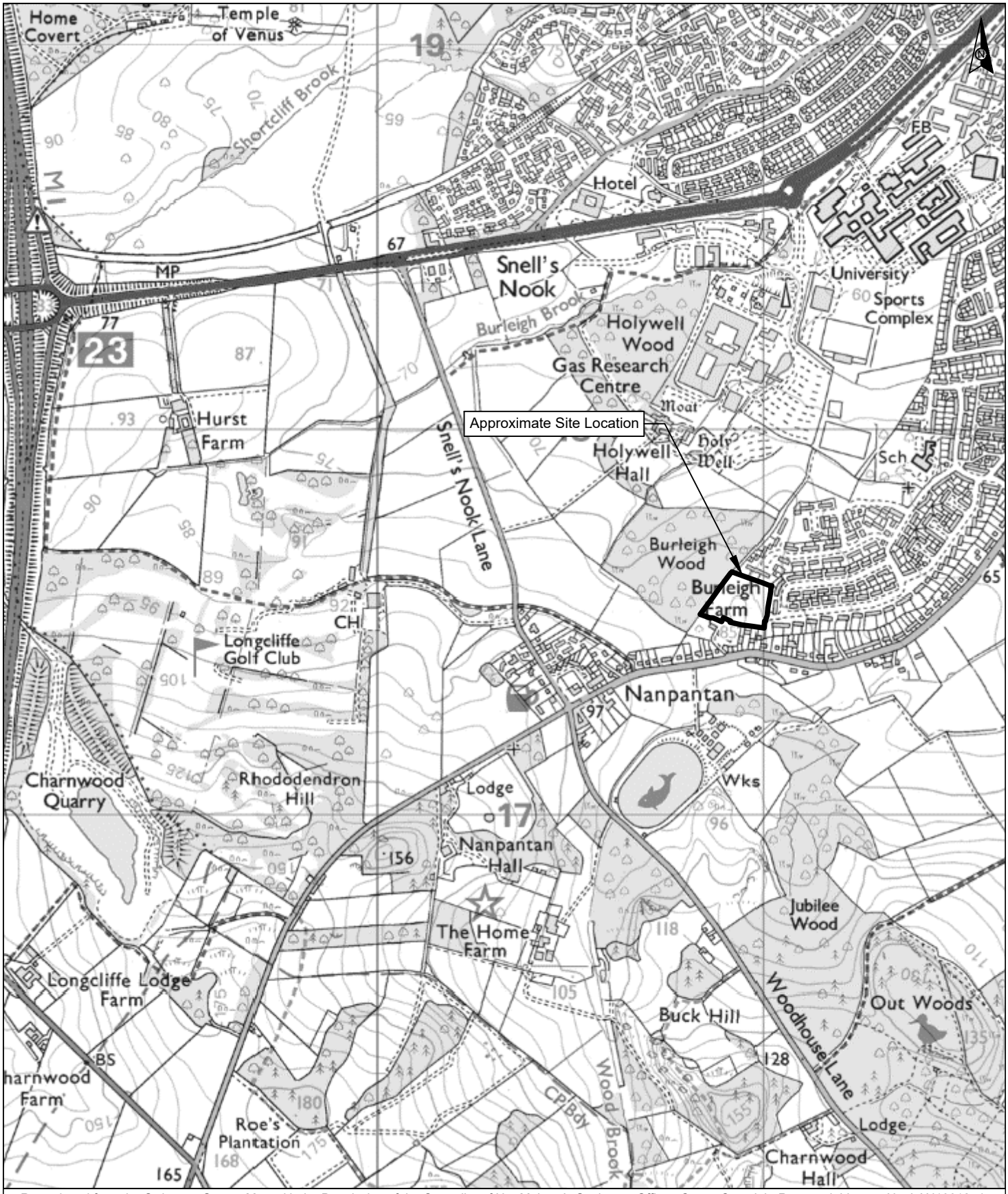
Any MMP will require a Qualified Person Declaration and will require subsequent validation.

8.4.6 Statutory Consultation

In accordance with normal planning requirements, we would recommend that a copy of our report is issued by the Client to the Local Authority (and warranty provider) for review/comment and approval prior to commencing with the redevelopment of the site.

APPENDIX I

Site Location Plan
(Figure No. 40056-2/01)

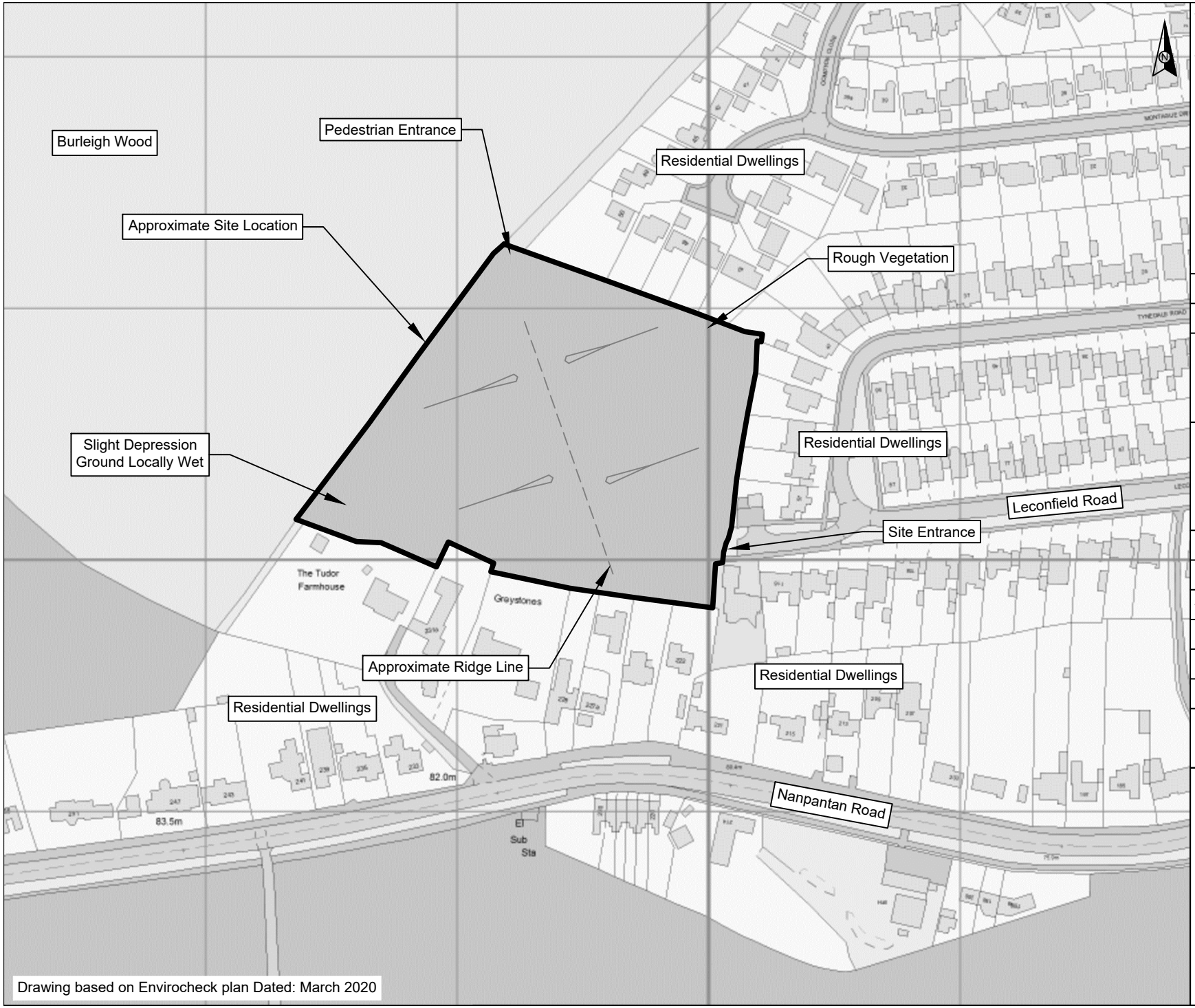


Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	DH
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Site Location Plan	Revision	
		Figure No.	40056-2/01

GeoDyne
Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

APPENDIX II

Annotated Site Plan
(Figure No. 40056-2/02)



Project No.	40056-2
Client	Bowbridge Homes Ltd
Project	Leconfield Road, Nanpantan
Title	Annotated Site Plan
Drawn By	ACH
Checked By	DH
Approved By	JPH
Scale	NTS
Date Drawn	28/07/2020
Revision	
Figure No.	40056-2/02

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

APPENDIX III

Site Plan and General Views of Site
(Figure No. 40056-2/03 and 04)

Project No.	40056-2
Client	Bowbridge Homes Ltd
Project	Leconfield Road, Nanpantan
Title	Site Plan and General Views of Site
Drawn By	ACH
Checked By	DH
Approved By	JPH
Scale	NTS
Date Drawn	28/07/2020
Revision	
Figure No.	40056-2/03

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Drawing based on Envirocheck plan Dated: March 2020

Project No.	40056-2
Client	Bowbridge Homes Ltd
Project	Leconfield Road, Nanpantan
Title	Site Plan and General Views of Site
Drawn By	ACH
Checked By	DH
Approved By	JPH
Scale	NTS
Date Drawn	28/07/2020
Revision	
Figure No.	40056-2/04

Drawing based on Envirocheck plan Dated: March 2020

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

GeoDyne

APPENDIX IV

Exploratory Hole Location Plan
(Figure No. 40056-2/05)

Drawing based on Envirocheck plan Dated: March 2020

Project No.	40056-2
Client	Bowbridge Homes Ltd
Project	Leconfield Road, Nanpantan
Title	Exploratory Hole Location plan
Drawn By	ACH
Checked By	NC
Approved By	JPH
Scale	NTS
Date Drawn	28/07/2020
Revision	
Figure No.	40056-2/05

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

GeoDyne

APPENDIX V

Exploratory Hole Logs

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS1

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.15	D	D1		Rough grass over dark brown root-bound slightly gravelly silty clayey TOPSOIL. Gravel is fine to coarse meta-mudstone (TOPSOIL)		(0.30)			
						0.30			
				Stiff red-brown mottled black silty CLAY (TARPORLEY SILTSTONE FORMATION)					
0.50	D	D2							
1.00	B	B1							
1.00 - 1.45	C		15			(1.70)			
1.50	D	D3							
2.00	B	B2							
2.00 - 2.45	C		50/245mm	End of Borehole at 2.00m		2.00			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 2.00m.
4.Borehole fitted with plain pipe and bentonite seal from ground level to 1.00m and with slotted pipe in a gravel surround from 1.00m to 2.00m.
5.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample

S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:**	Competitor Rig	**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:**	1:20	WS1

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS2

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.05	D	D1		Rough grass over dark brown root-bound silty clayey TOPSOIL (TOPSOIL)		(0.30)			
				...with cobble of meta-mudstone between 0.25m and 0.30m		0.30			
0.50	D	D2		Firm brown dry silty slightly gravelly CLAY. Gravel is green-grey tabular angular fine to medium meta-mudstone (SWITHLAND FORMATION)		0.45			
1.00 - 1.45	C		15	Loose to medium dense brown gravelly SAND. Gravel is green-grey fine to medium meta-mudstone (SWITHLAND FORMATION)		(1.05)			
				Stiff brown slightly gravelly silty CLAY. Gravel is green-grey fine to medium meta-mudstone (SWITHLAND FORMATION)		1.50 (0.30)			
1.80 - 2.25	C		50/265mm	End of Borehole at 1.80m		1.80			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 1.80m.
4.Borehole fitted with plain pipe and bentonite seal from ground level to 0.50m and with slotted pipe in a gravel surround from 0.50m to 1.50m.
5.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:**	Competitor Rig	**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:**	1:20	WS2

GeoDyne
Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS3

Project No. 40056

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.15	D	D1		Brambles over dark brown root-bound silty clayey TOPSOIL (TOPSOIL)		0.25			
				Stiff dry brown silty CLAY (SUBSOIL)		0.50			
0.80	B	B1		Loose to medium dense becoming dense dark grey mottled orange-brown sandy fine to medium GRAVEL. Gravel is green-grey angular meta-mudstone (SWITHLAND FORMATION)		(0.50)			
0.80	D	D2							
1.00 - 1.45	C		50/275mm	End of Borehole at 1.00m		1.00			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 1.00m.
4.Borehole fitted with plain pipe and bentonite seal from ground level to 0.50m and with slotted pipe in a gravel surround from 0.50m to 1.00m.
5.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:** Competitor Rig		**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:** 1:20		WS3

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS4

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.10	D	D1		Rough grass over dark brown root-bound silty clayey slightly gravelly TOPSOIL (TOPSOIL)		0.20			
				Dense brown very gravelly fine grained SAND. Gravel is green-grey fine to coarse meta-mudstone with frequent fine roots (SWITHLAND FORMATION)		(0.50)			
0.60	D	D2							
0.70 - 1.15	C		50/115mm	End of Borehole at 0.70m		0.70			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 0.70m.
4.Borehole backfilled with arisings upon completion.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:** Competitor Rig		**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:** 1:20		WS4

GeoDyne
Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS5

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.15	D	D1		Rough grass over dark brown root-bound silty clayey TOPSOIL (TOPSOIL)		(0.30)			
						0.30			
				Dense dark brown slightly clayey gravelly fine to medium grained SAND. Gravel is green-grey tabular angular fine to coarse meta-mudstone (SWITHLAND FORMATION)		(0.50)			
0.70	D	D2		...becoming very gravelly below 0.65m					
0.80 - 1.25	C		50/230mm	End of Borehole at 0.80m		0.80			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 0.80m.
4.Borehole backfilled with arisings upon completion.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:** Competitor Rig		**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:** 1:20		WS5

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS6

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Rough grass over brown root-bound slightly gravelly silty clayey TOPSOIL. Gravel is fine (TOPSOIL)					
				...with coarse gravel at 0.25m		0.25			
0.30	D	D1		Firm to stiff light brown clayey SILT (SUBSOIL)					
						0.45			
				Stiff red-brown mottled silty CLAY (TARPORLEY SILTSTONE FORMATION)					
0.80	D	D2							
1.00 - 1.45	C		18						
1.20	B	B1				(1.55)			
				...with thin green-grey siltstone bands at 1.40m, 1.50m and 1.60m (skerry bands)					
1.50	D	D3							
1.80	B	B2							
				...with green-grey siltstone band at 1.90m (skerry band)					
2.00 - 2.45	C		50/285mm	End of Borehole at 2.00m		2.00			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 2.00m.
4.Borehole fitted with plain pipe and bentonite seal from ground level to 1.00m and with slotted pipe in a gravel surround from 1.00m to 2.00m.
5.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:**	Competitor Rig	**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:**	1:20	WS6

GeoDyne
Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS7

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Rough grass over root-bound brown silty clayey TOPSOIL (TOPSOIL)		0.20			
				Medium dense brown gravelly fine to medium grained SAND. Gravel is green-grey fine meta-mudstone (SWITHLAND FORMATION)		(0.30)			
				Strong grey META-MUDSTONE recovered as angular medium to coarse gravel with cobbles (SWITHLAND FORMATION)		0.50			
0.70	D	D1		...with cobbles at 0.50m		(0.50)			
1.00 - 1.45	C		50/105mm	End of Borehole at 1.00m		1.00			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 1.00m.
4.Borehole fitted with plain pipe and bentonite seal from ground level to 0.40m and with slotted pipe in a gravel surround from 0.40m to 0.90m.
5.Bung, valve and lockable cover installed.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:**	Competitor Rig	**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:**	1:20	WS7

GeoDyne
Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

WS8

Project No. 40056

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Rough grass over brown root-bound silty clayey TOPSOIL (TOPSOIL)		0.25			
				Dense dark brown very gravelly fine to medium grained SAND. Gravel is green-grey subangular crystalline meta-mudstone (SWITHLAND FORMATION)		(0.55)			
0.70	D	D1							
0.80 - 1.25	C		50/135mm	End of Borehole at 0.80m		0.80			

Remarks

1.Borehole sides generally stable.
2.No water encountered.
3.Borehole terminated due to SPT refusal at 0.80m.
4.Borehole backfilled with arisings upon completion.

Key

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
W = Water Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
= Water Strike (m)
= Steady Water Level (m)

Project:	Land off Leconfield Road, Nanpantan, Loughborough			**Client:**	Bowbridge Homes Ltd		
Logged:	NC	**Checked:**	JPH	**Field Book Ref:**	**Plant:** Competitor Rig		**Drawing Ref:**
Date:	07/07/2020	**Approved:**	JPH	NC19/03	**Scale:** 1:20		WS8

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP1

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over root-bound slightly gravelly silty clayey TOPSOIL. Gravel is fine meta-mudstone (TOPSOIL)							
		0.30					
Highly weathered strong dark pinkish grey and green-grey crystalline rock META-MUDSTONE recovered as brown very gravelly fine to medium grained sand with frequent cobbles and boulders of tabular subrounded pinkish grey and green-grey fine crystalline rock (SWITHLAND FORMATION)							
...boulders becoming more tabular below 1.10m							
		1.70	B1 D1	B D			
End of Trial Pit at 2.10m		2.10					

Remarks:

1.Trial pit sides stable. Boulders causing overdigging of pit.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP1
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP2

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over root-bound dark brown cobbly clayey topsoil with much coarse roots. Cobbles of red brick and crystalline rocks (MADE GROUND - TOPSOIL)		0.25	D1	D			
Firm to stiff red-brown silty CLAY (TARPORLEY SILTSTONE FORMATION) ...with potential Made Ground in eastern end of pit to 1m including possible land drain		0.30					
		0.60	D2	D	In-Situ SV	53	
		0.65	B1	B		62	
		0.70				70	
...with pockets of green-grey silt below 1.20m							
...recovered as tabular cobbles of highly weathered mudstone below 1.70m							
...becoming increasing harder to dig from 2.00m with frequent tabular gravel and cobbles to 2.60m							
End of Trial Pit at 2.60m		2.60	D3	D			

Remarks:

1.Trial pit sides stable.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP2
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP3

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over root-bound dark brown silty clayey slightly gravelly TOPSOIL (TOPSOIL)							
		0.30					
Strong dark grey and green-grey crystalline rock META-MUDSTONE recovered as cobbles and boulders in a medium grained sand matrix (SWITHLAND FORMATION)							
End of Trial Pit at 2.50m		2.50					

Remarks:

1.Trial pit sides stable. Boulders causing overdigging of pit.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP3
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP4

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over brown root-bound silty clayey slightly gravelly TOPSOIL with frequent fine roots (TOPSOIL)							
		0.30					
Brown silty gravelly SAND. Gravel is dark grey coarse meta-mudstone (SUBSOIL)							
		0.50	D1	D			
		0.60					
Stiff to very stiff red-brown silty CLAY becoming MUDSTONE (TARPORLEY SILTSTONE FORMATION)							
		0.80			In-Situ SV	110 92 98	
...with pockets of green-grey silt below 1.90m							
...with light grey siltstone band at 2.90m		2.90					
End of Trial Pit at 2.90m							

Remarks:

1.Trial pit sides stable.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP4
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP5

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over brown root-bound silty clayey slightly gravelly TOPSOIL (TOPSOIL)		0.15	D1	D			
Strong dark grey and green-grey crystalline rock META-MUDSTONE recovered as cobbles and boulders in a brown gravelly fine to coarse grained sandy matrix (SWITHLAND FORMATION)		0.30 0.50	B1 D2	B D			
...with a boulder of 1.1m x 0.7m x 0.25m at 1.40m							
End of Trial Pit at 2.10m		2.10					

Remarks:

1.Trial pit sides stable. Boulders causing overdigging of pit.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP5
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP6

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over brown root-bound silty clayey slightly gravelly TOPSOIL (TOPSOIL)		0.10	D1	D			
Brown gravelly SAND (SUBSOIL)		0.30					
Dense pinkish grey clayey gravelly SAND (SWITHLAND FORMATION) ...becoming very clayey with depth		0.40					
		0.60	B1	B			
		1.40	B2	B			
			D2	D			
Strong green-grey crystalline rock META-MUDSTONE recovered as gravel and boulders in a sandy matrix (SWITHLAND FORMATION)		1.50					
End of Trial Pit at 2.10m		2.10					

Remarks:

1.Trial pit sides stable. Boulders causing overdigging of pit.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP6
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP7

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over dark brown root-bound silty clayey TOPSOIL (TOPSOIL)		0.10	D1	D			
Firm to stiff light brown clayey SILT (SUBSOIL)		0.20					
Stiff to very stiff red-brown silty CLAY (highly weathered mudstone) (TARPORLEY SILTSTONE FORMATION)		0.50					
		0.90			In-Situ SV	100	
		1.00	B1	B	In-Situ SV	84 98 103 114 85	
...with green-grey clayey silt band between 1.90m and 2.60m							
End of Trial Pit at 2.60m		2.60					

Remarks:

1.Trial pit sides stable.
2.No water encountered.
3.Trial pit backfilled with arisings upon completion.
4.Hard to dig at bottom of pit.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP7
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

GeoDyne

Unit 2.2 Clarendon House
Clarendon Park, Clumber Avenue
Nottingham NG5 1AH
Tel: 0115 962 0001
email: info@geodyne.co.uk

TP8

Project No: 40056

Sheet 1 of 1

Description of Strata	Legend	Depth (m)	Sample Ref	Sample Type	Field Test Type	Field Test Result	Ground-water
Rough grass over brown root-bound slightly gravelly silty clayey TOPSOIL (TOPSOIL)		0.10	D1	D			
Medium dense brown gravelly fine to medium grained SAND with cobbles of dark grey crystalline rocks (SWITHLAND FORMATION)		0.30					
		0.80	B1 D2	B D			
Strong dark grey crystalline rock META-MUDSTONE recovered as fine to coarse gravel and cobbles in a sandy matrix with rare rounded boulders (SWITHLAND FORMATION) ...with boulder of 0.85m x 0.70m x 0.40m		1.40					
End of Trial Pit at 1.80m		1.80	B2 D3	B D			

Remarks:

1.Trial pit sides stable. Boulders causing overdigging of pit.
2.No water encountered.
3.Trial pit terminated due to boulder at base of pit.
4.Trial pit backfilled with arisings upon completion.

Key: B = Bulk Sample D = Disturbed Sample W = Water Sample SV = Shear Vane (kN/m2) P = Penetrometer (kN/m2)
J = Jar Sample V = Vial Sample ▽ = Water Strike (m) ▼ = Steady Water Level (m)

Project: Land off Leconfield Road, Nanpantan, Loughborough			**Client:** Bowbridge Homes Ltd	
Logged: NC	**Checked:** JPH	**Field Book Ref:** NC19/03	**Plant:** 8t Tracked Excavator	**Drawing No.** TP8
Date: 08/07/2020	**Approved:** JPH		**Scale:** 1:20	

APPENDIX VI

Plates

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Arisings from Exploratory Holes WS1 and WS2	Revision	
		Figure No.	40056-2/P1

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Arisings from Exploratory Holes WS3 and WS4	Revision	
		Figure No.	40056-2/P2

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Arisings from Exploratory Holes WS5 and WS6	Revision	
		Figure No.	40056-2/P3

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Arisings from Exploratory Holes WS7 and WS8	Revision	
		Figure No.	40056-2/P4

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP1 and Arisings	Revision	
		Figure No.	40056-2/P5

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP2 and Arisings	Revision	
		Figure No.	40056-2/P6

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP3 and Arisings	Revision	
		Figure No.	40056-2/P7

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP4 and Arisings	Revision	
		Figure No.	40056-2/P8

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP5 and Arisings	Revision	
		Figure No.	40056-2/P9

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP6 and Arisings	Revision	
		Figure No.	40056-2/P10

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP7 and Arisings	Revision	
		Figure No.	40056-2/P11

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

Project No.	40056-2	Drawn By	ACH
Client	Bowbridge Homes Ltd	Checked By	NC
		Approved By	JPH
Project	Leconfield Road, Nanpantan	Scale	NTS
		Date Drawn	28/07/2020
Title	Views of Exploratory Hole TP8 and Arisings	Revision	
		Figure No.	40056-2/P12

GeoDyne

Nottingham 0115 962 0001
Derby 01332 290 798
Warrington 01925 661739
info@geodyne.co.uk
www.geodyne.co.uk

GeoDyne

APPENDIX VII

Laboratory Soil Test Results

LABORATORY REPORT

4043

Contract Number: PSL20/3512

Report Date: 24 July 2020

Client's Reference: 40056

Client Name: Geodyne Notts
Unit 2.2 Clarendon House
Clarendon Park
Clumber Avenue
Nottingham
NG5 1AH

For the attention of: Jason Hollands

Contract Title: Land off Leconfield Road, Nanpantan

Date Received: 14/7/2020
Date Commenced: 14/7/2020
Date Completed: 24/7/2020

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	S Royle (Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS1		D	1.00		Reddish brown sandy silty CLAY.
WS1		D	2.00		Reddish brown sandy silty CLAY.
WS6		D	1.80		Reddish brown sandy very silty CLAY.
TP1		D	1.70		Brown sandy silty GRAVEL with cobbles.
TP5		B	0.50	1.00	Brown very sandy clayey GRAVEL.
TP6		B	0.60	0.80	Brown gravelly very sandy CLAY.
TP6		D	1.40		Brown slightly gravelly very sandy CLAY.
TP7		B	1.00		Brown sandy CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS1		D	1.00		19			42	21	21	100	Intermediate plasticity CI.
WS1		D	2.00		14			40	18	22	100	Intermediate plasticity CI.
WS6		D	1.80		16			37	20	17	100	Intermediate plasticity CI.
TP1		D	1.70		5.4				NP			
TP6		D	1.40		14			33	16	17	91	Low plasticity CL.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Land off Leconfield Road, Nanpantan

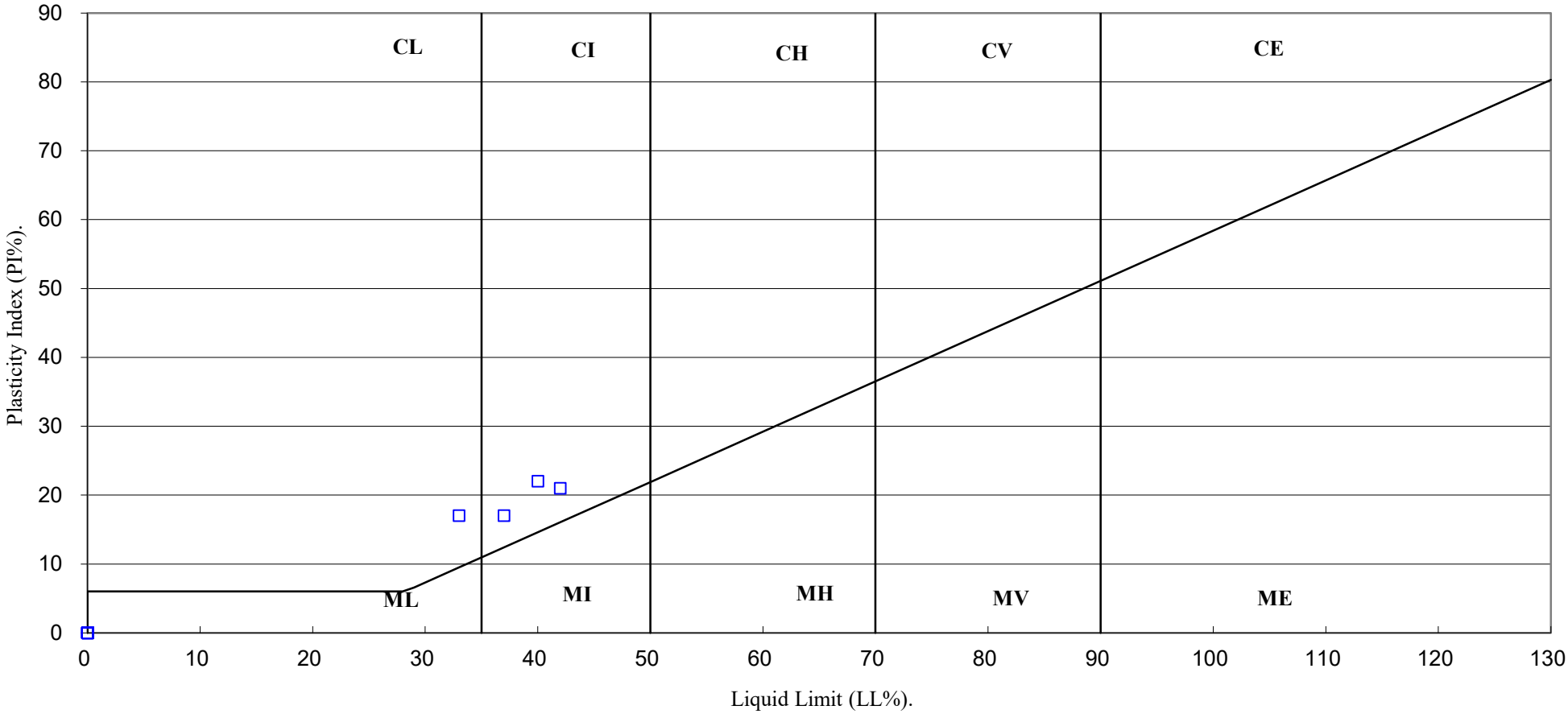
Contract No:

PSL20/3512

Client Ref:

40056

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Land off Leconfield Road, Nanpantan	**Contract No:** PSL20/3512 **Client Ref:** 40056

PARTICLE SIZE DISTRIBUTION TEST

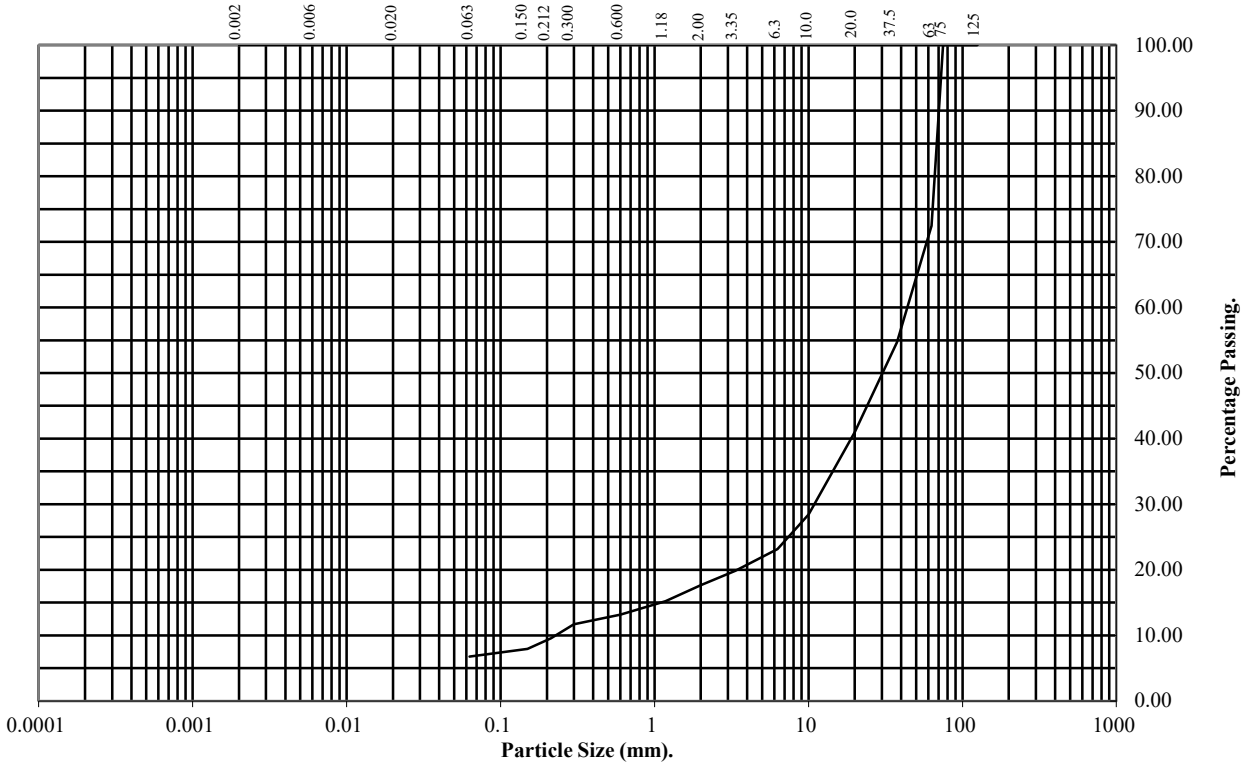
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP1 **Top Depth (m):** 1.70

Sample Number: **Base Depth(m):**

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	72
37.5	55
20	41
10	28
6.3	23
3.35	20
2	18
1.18	15
0.6	13
0.3	12
0.212	10
0.15	8
0.063	7

Soil Fraction	Total Percentage
Cobbles	28
Gravel	54
Sand	11
Silt/Clay	7

Remarks:

See Summary of Soil Descriptions

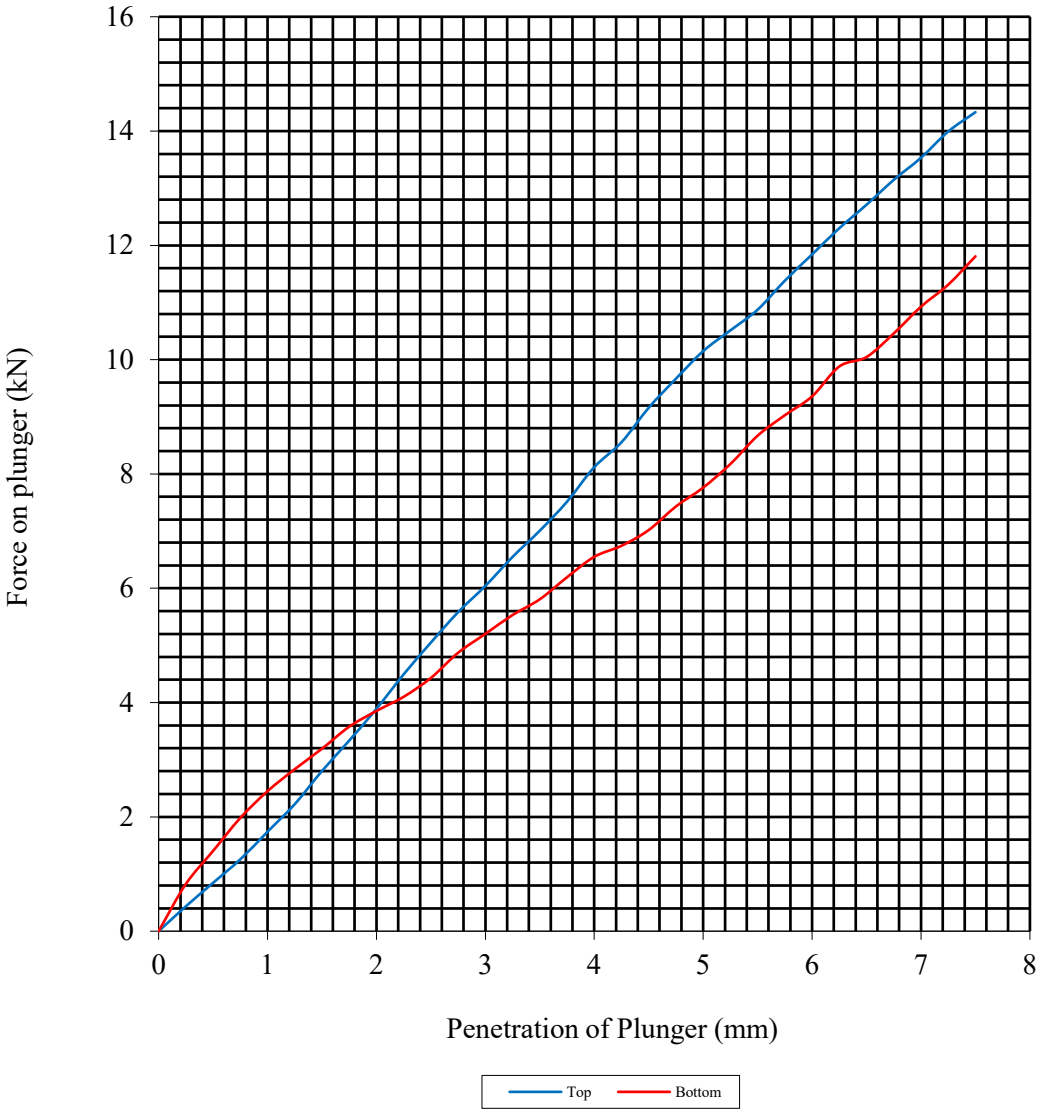
CALIFORNIA BEARING RATIO TEST

Non compliance with BS 1377 : Part 4 : 1990

Hole Number: TP5 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):** 1.00

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	10	Surcharge Kg:	4.20	Sample Top	10	Sample Top	50.7
Bulk Density Mg/m3:	2.09	Soaking Time hrs	0	Sample Bottom	10	Sample Bottom	38.8
Dry Density Mg/m3:	1.90	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			56				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Land off Leconfield Road, Nanpantan

Contract No: PSL20/3512

Client Ref: 40056

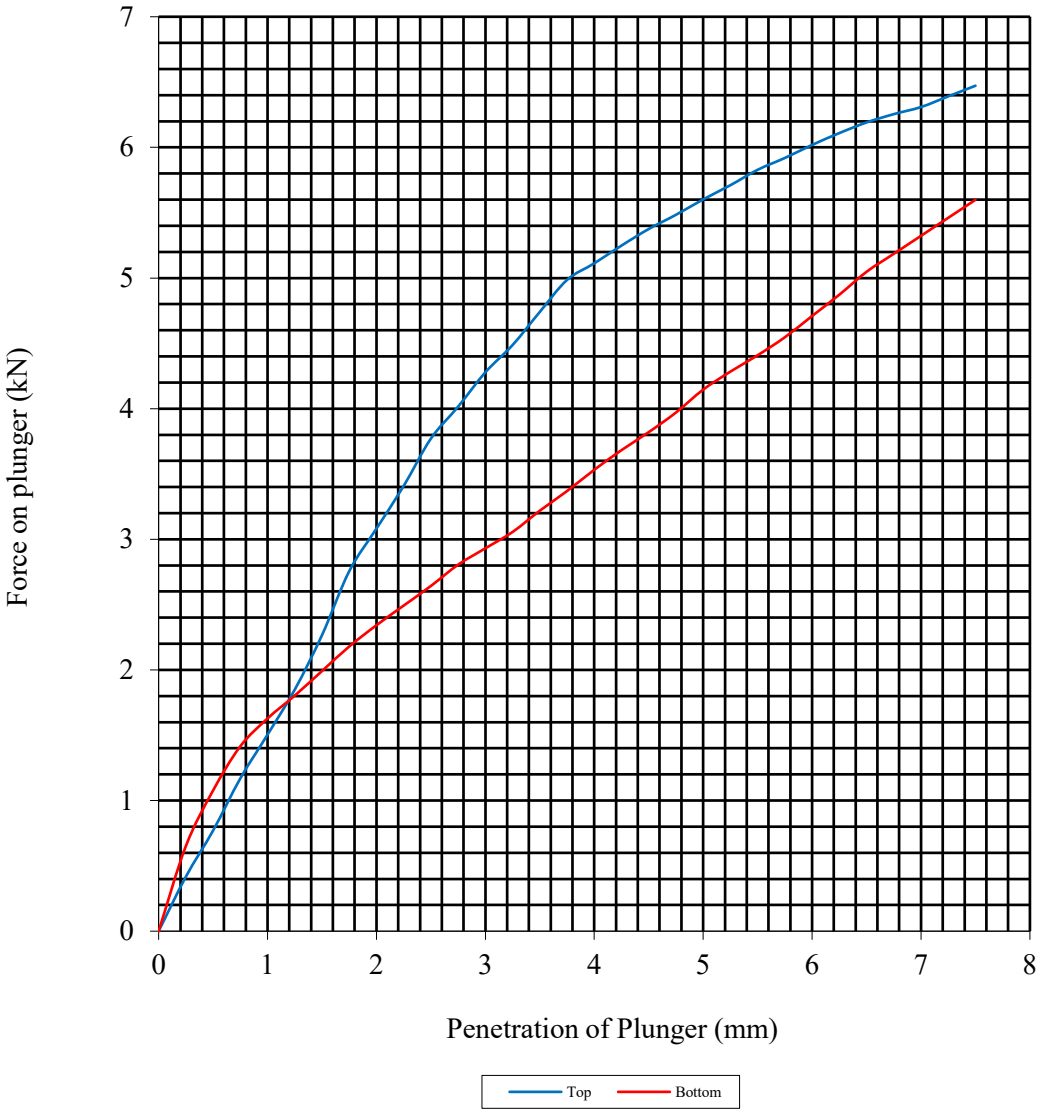
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP6 **Top Depth (m):** 0.60

Sample Number: **Base Depth (m):** 0.80

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	14	Surcharge Kg:	4.20	Sample Top	14	Sample Top	28.6
Bulk Density Mg/m3:	2.06	Soaking Time hrs	0	Sample Bottom	14	Sample Bottom	20.7
Dry Density Mg/m3:	1.80	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			9				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Land off Leconfield Road, Nanpantan

Contract No: PSL20/3512

Client Ref: 40056

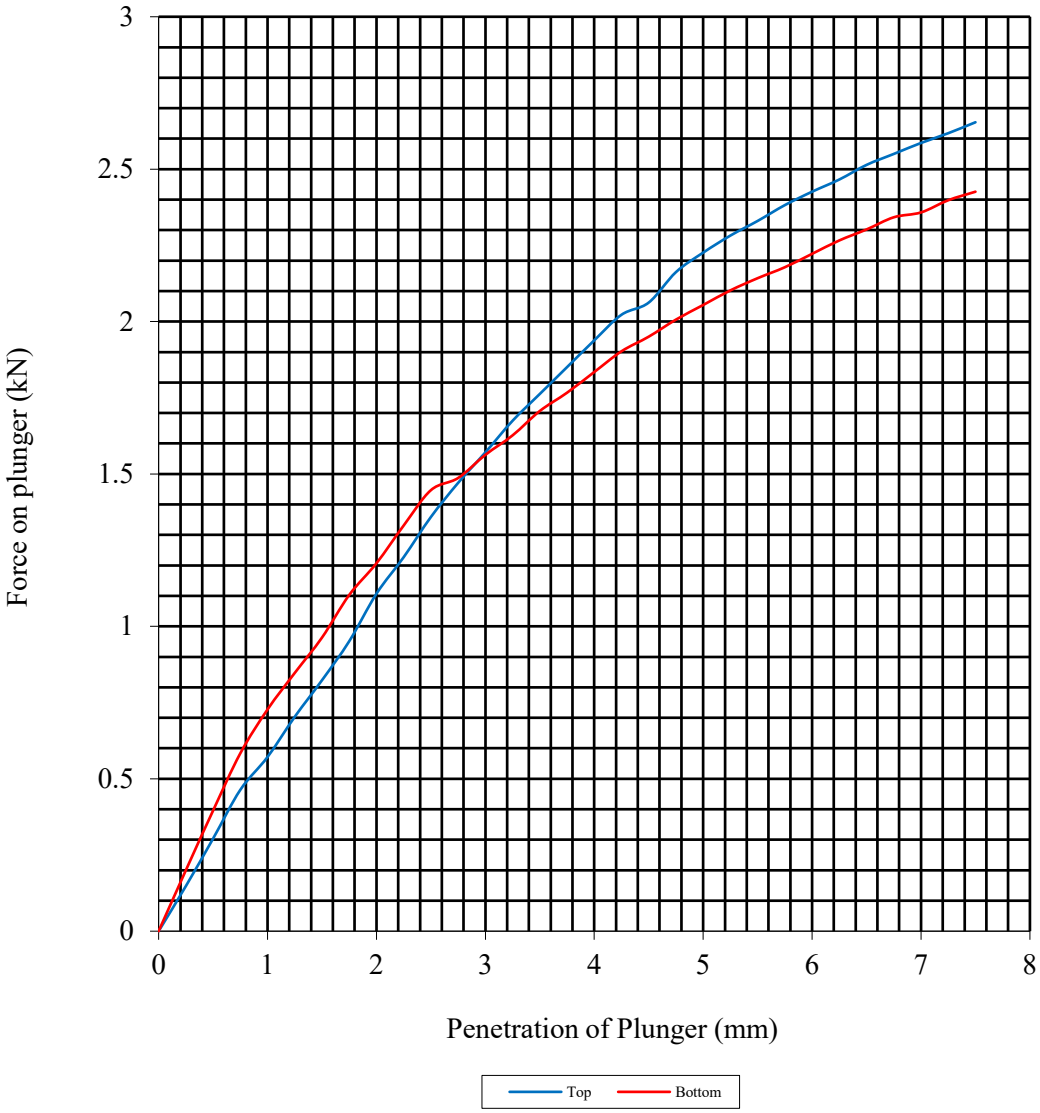
CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

Hole Number: TP7 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	19	Surcharge Kg:	4.20	Sample Top	19	Sample Top	11.1
Bulk Density Mg/m3:	2.09	Soaking Time hrs	0	Sample Bottom	19	Sample Bottom	11.0
Dry Density Mg/m3:	1.76	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL Professional Soils Laboratory

Land off Leconfield Road, Nanpantan

Contract No: PSL20/3512

Client Ref: 40056

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/05682
Issue Number: 1 **Date:** 21 July, 2020

Client:
GeoDyne (Nottingham)
Unit 2.2 Clarendon House
Clarendon Park
Clumber Avenue
Nottingham
Nottinghamshire
UK
NG5 1AH

Project Manager: Nina Copson
Project Name: Land off Leconfield Road, Nanpantan
Project Ref: 40056
Order No: 40056/NC
Date Samples Received: 10/07/20
Date Instructions Received: 14/07/20
Date Analysis Completed: 21/07/20

Prepared by:

Sophie France
Client Service Manager

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/1	20/05682/2	20/05682/3	20/05682/5	20/05682/6	20/05682/7	20/05682/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS1	WS2	WS3	WS3	WS4			
Depth to Top	0.15	0.50	1.50	0.50	0.15	0.80	0.10			
Depth To Bottom										
Date Sampled	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	5A	4A	6AE	6A	6AE			
% Stones >10mm$_A$	6.9	<0.1	<0.1	14.6	16.5	40.9	0.9	% w/w	0.1	A-T-044
pH$_D$[M#]	-	7.92	8.30	7.33	-	5.54	-	pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D$[M#]	-	-	0.04	-	-	0.02	-	g/l	0.01	A-T-026s
Total Organic Carbon$_D$[M#]	-	0.14	-	0.08	-	-	-	% w/w	0.03	A-T-032s
Arsenic$_D$[M#]	-	3	-	6	-	-	-	mg/kg	1	A-T-024s
Cadmium$_D$[M#]	-	0.6	-	<0.5	-	-	-	mg/kg	0.5	A-T-024s
Copper$_D$[M#]	-	32	-	78	-	-	-	mg/kg	1	A-T-024s
Chromium$_D$[M#]	-	44	-	15	-	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	-	<1	-	<1	-	-	-	mg/kg	1	A-T-040s
Chromium (trivalent)	-	44	-	15	-	-	-	mg/kg	1	Calc
Lead$_D$[M#]	-	26	-	13	-	-	-	mg/kg	1	A-T-024s
Mercury$_D$	-	<0.17	-	<0.17	-	-	-	mg/kg	0.17	A-T-024s
Nickel$_D$[M#]	-	28	-	13	-	-	-	mg/kg	1	A-T-024s
Selenium$_D$[M#]	-	<1	-	<1	-	-	-	mg/kg	1	A-T-024s
Zinc$_D$[M#]	-	79	-	68	-	-	-	mg/kg	5	A-T-024s

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/1	20/05682/2	20/05682/3	20/05682/5	20/05682/6	20/05682/7	20/05682/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS1	WS2	WS3	WS3	WS4			
Depth to Top	0.15	0.50	1.50	0.50	0.15	0.80	0.10			
Depth To Bottom										
Date Sampled	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	5A	4A	6AE	6A	6AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_{D}^{\#}$	NAD	-	-	-	NAD	-	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_{D}$	N/A	-	-	-	N/A	-	N/A			A-T-045
OCP+OPP Combined Pest Suite (incl. Atrazine and Simazine)										
Dichlobenil$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Tecnazene$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Trifluralin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
alpha-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Hexachlorobenzene (HCB)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Simazine$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Atrazine$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
beta-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Quintozene (PCNB)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Chlorothalonil$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
delta-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Triallate$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Heptachlor$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Aldrin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Triadimefon$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Telodrin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Isodrin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Pendimethalin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Heptachlor epoxide$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
trans-Chlordane (Gamma)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
o,p-DDE (2,4)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Endosulphan I (Alpha)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
cis-Chlordane (Alpha)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
p,p-DDE (4,4)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Dieldrin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
o,p-DDD (2,4)$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Endrin$_{A}$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056

Lab Sample ID	20/05682/1	20/05682/2	20/05682/3	20/05682/5	20/05682/6	20/05682/7	20/05682/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS1	WS2	WS3	WS3	WS4			
Depth to Top	0.15	0.50	1.50	0.50	0.15	0.80	0.10			
Depth To Bottom										
Date Sampled	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	5A	4A	6AE	6A	6AE			
Endosulphan II (Beta)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
p,p-DDD (4,4)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
o,p-DDT (2,4)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Endrin Aldehyde$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Endrin Ketone$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Endosulphan Sulphate$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
p,p-DDT (4,4)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
o,p-Methoxychlor$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
p,p-Methoxychlor$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Permethrin I (cis)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Permethrin II (trans)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Dichlorvos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Mevinphos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Demeton-S$_A$	<0.50	-	-	-	<0.50	-	<0.50	mg/kg	0.5	A-T-056
Demeton-O$_A$	<0.50	-	-	-	<0.50	-	<0.50	mg/kg	0.5	A-T-056
Phorate$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Dimethoate$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Propetamphos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Diazinon (Dimpylate)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Disulfoton$_A$	<0.10	-	-	-	<0.10	-	<0.10	mg/kg	0.1	A-T-056
Etrimphos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Chlorpyrifos-methyl$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Parathion (Ethyl Parathion)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Methyl Parathion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Pirimiphos-methyl$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Fenitrothion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Fensulphothion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Fenthion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Malathion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Chlorfenvinphos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Chlorpyrifos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Trichloronate$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Prothiofos (Tokuthion)$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/1	20/05682/2	20/05682/3	20/05682/5	20/05682/6	20/05682/7	20/05682/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS1	WS2	WS3	WS3	WS4			
Depth to Top	0.15	0.50	1.50	0.50	0.15	0.80	0.10			
Depth To Bottom										
Date Sampled	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	5A	4A	6AE	6A	6AE			
Ethion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Triazophos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Sulprofos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Carbophenothion$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Phosalone$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Azinphos-methyl$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Azinphos-ethyl$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056
Coumaphos$_A$	<0.01	-	-	-	<0.01	-	<0.01	mg/kg	0.01	A-T-056

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/1	20/05682/2	20/05682/3	20/05682/5	20/05682/6	20/05682/7	20/05682/8	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS1	WS1	WS1	WS2	WS3	WS3	WS4			
Depth to Top	0.15	0.50	1.50	0.50	0.15	0.80	0.10			
Depth To Bottom										
Date Sampled	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20	07-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	5A	4A	6AE	6A	6AE			
PAH-16MS										
Acenaphthene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Acenaphthylene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Anthracene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Chrysene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Fluoranthene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Fluorene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Naphthalene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Phenanthrene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Pyrene$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s
Total PAH-16MS$_A^{M\#}$	-	<0.1	-	<0.1	-	-	-	mg/kg	0.1	A-T-019s

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/12	20/05682/13	20/05682/17	20/05682/18	20/05682/19	20/05682/22	20/05682/23	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS6	WS6	TP1	TP2	TP2	TP5	TP5			
Depth to Top	0.30	0.80	1.70	0.25	0.60	0.15	0.50			
Depth To Bottom							1.00			
Date Sampled	07-Jul-20	07-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	6AE	6AE	5A	6AE	6AE			
% Stones >10mm$_A$	1.8	0.2	62.1	-	6.7	24.9	59.5	% w/w	0.1	A-T-044
pH$_D$$^{M\#}$	-	5.84	5.74	-	7.38	4.88	5.61	pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D$$^{M\#}$	-	-	0.03	-	-	-	-	g/l	0.01	A-T-026s
Total Organic Carbon$_D$$^{M\#}$	-	0.18	0.07	-	0.18	2.51	0.35	% w/w	0.03	A-T-032s
Arsenic$_D$$^{M\#}$	-	9	1	-	<1	2	1	mg/kg	1	A-T-024s
Cadmium$_D$$^{M\#}$	-	0.6	<0.5	-	<0.5	<0.5	<0.5	mg/kg	0.5	A-T-024s
Copper$_D$$^{M\#}$	-	35	15	-	31	19	15	mg/kg	1	A-T-024s
Chromium$_D$$^{M\#}$	-	40	5	-	26	11	5	mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	-	<1	<1	-	<1	<1	<1	mg/kg	1	A-T-040s
Chromium (trivalent)	-	40	5	-	26	11	5	mg/kg	1	Calc
Lead$_D$$^{M\#}$	-	23	5	-	17	44	10	mg/kg	1	A-T-024s
Mercury$_D$	-	<0.17	<0.17	-	<0.17	<0.17	<0.17	mg/kg	0.17	A-T-024s
Nickel$_D$$^{M\#}$	-	30	4	-	18	6	4	mg/kg	1	A-T-024s
Selenium$_D$$^{M\#}$	-	<1	<1	-	<1	<1	<1	mg/kg	1	A-T-024s
Zinc$_D$$^{M\#}$	-	81	22	-	62	66	31	mg/kg	5	A-T-024s

Lab Sample ID	20/05682/12	20/05682/13	20/05682/17	20/05682/18	20/05682/19	20/05682/22	20/05682/23	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS6	WS6	TP1	TP2	TP2	TP5	TP5			
Depth to Top	0.30	0.80	1.70	0.25	0.60	0.15	0.50			
Depth To Bottom							1.00			
Date Sampled	07-Jul-20	07-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	6AE	6AE	5A	6AE	6AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_{D}^{\#}$	NAD	-	-	NAD	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_{D}$	N/A	-	-	N/A	-	-	-			A-T-045
OCP+OPP Combined Pest Suite (incl. Atrazine and Simazine)										
Dichlobenil$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Tecnazene$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Trifluralin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
alpha-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Hexachlorobenzene (HCB)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Simazine$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Atrazine$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
beta-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Quintozene (PCNB)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Chlorothalonil$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
delta-Hexachlorocyclohexane (HCH)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Triallate$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Heptachlor$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Aldrin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Triadimefon$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Telodrin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Isodrin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Pendimethalin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Heptachlor epoxide$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
trans-Chlordane (Gamma)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
o,p-DDE (2,4)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Endosulphan I (Alpha)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
cis-Chlordane (Alpha)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
p,p-DDE (4,4)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Dieldrin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
o,p-DDD (2,4)$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Endrin$_{A}$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056

Lab Sample ID	20/05682/12	20/05682/13	20/05682/17	20/05682/18	20/05682/19	20/05682/22	20/05682/23	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS6	WS6	TP1	TP2	TP2	TP5	TP5			
Depth to Top	0.30	0.80	1.70	0.25	0.60	0.15	0.50			
Depth To Bottom							1.00			
Date Sampled	07-Jul-20	07-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	6AE	6AE	5A	6AE	6AE			
Endosulphan II (Beta)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
p,p-DDD (4,4)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
o,p-DDT (2,4)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Endrin Aldehyde$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Endrin Ketone$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Endosulphan Sulphate$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
p,p-DDT (4,4)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
o,p-Methoxychlor$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
p,p-Methoxychlor$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Permethrin I (cis)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Permethrin II (trans)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Dichlorvos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Mevinphos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Demeton-S$_A$	<0.50	-	-	-	-	<0.50	-	mg/kg	0.5	A-T-056
Demeton-O$_A$	<0.50	-	-	-	-	<0.50	-	mg/kg	0.5	A-T-056
Phorate$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Dimethoate$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Propetamphos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Diazinon (Dimpylate)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Disulfoton$_A$	<0.10	-	-	-	-	<0.10	-	mg/kg	0.1	A-T-056
Etrimphos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Chlorpyrifos-methyl$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Parathion (Ethyl Parathion)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Methyl Parathion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Pirimiphos-methyl$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Fenitrothion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Fensulphothion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Fenthion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Malathion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Chlorfenvinphos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Chlorpyrifos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Trichloronate$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Prothiofos (Tokuthion)$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/12	20/05682/13	20/05682/17	20/05682/18	20/05682/19	20/05682/22	20/05682/23	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS6	WS6	TP1	TP2	TP2	TP5	TP5			
Depth to Top	0.30	0.80	1.70	0.25	0.60	0.15	0.50			
Depth To Bottom							1.00			
Date Sampled	07-Jul-20	07-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	6AE	6AE	5A	6AE	6AE			
Ethion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Triazophos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Sulprofos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Carbophenothion$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Phosalone$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Azinphos-methyl$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Azinphos-ethyl$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056
Coumaphos$_A$	<0.01	-	-	-	-	<0.01	-	mg/kg	0.01	A-T-056

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/12	20/05682/13	20/05682/17	20/05682/18	20/05682/19	20/05682/22	20/05682/23	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS6	WS6	TP1	TP2	TP2	TP5	TP5			
Depth to Top	0.30	0.80	1.70	0.25	0.60	0.15	0.50			
Depth To Bottom							1.00			
Date Sampled	07-Jul-20	07-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20	08-Jul-20			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	6AE	5A	6AE	6AE	5A	6AE	6AE			
PAH-16MS										
Acenaphthene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Acenaphthylene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Anthracene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Chrysene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Fluoranthene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Fluorene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Naphthalene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Phenanthrene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Pyrene$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s
Total PAH-16MS$_A^{M\#}$	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	mg/kg	0.1	A-T-019s

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/24	20/05682/25	20/05682/28					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP6	TP7	TP8							
Depth to Top	1.40	0.10	1.80							
Depth To Bottom										
Date Sampled	08-Jul-20	08-Jul-20	08-Jul-20							
Sample Type	Soil - D	Soil - D	Soil - D							
Sample Matrix Code	6AE	6AE	6AE							
% Stones >10mm$_A$	16.1	<0.1	56.5					% w/w	0.1	A-T-044
pH$_D$$^{M\#}$	5.46	5.22	5.86					pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D$$^{M\#}$	<0.01	-	<0.01					g/l	0.01	A-T-026s
Total Organic Carbon$_D$$^{M\#}$	-	3.20	0.06					% w/w	0.03	A-T-032s
Arsenic$_D$$^{M\#}$	-	1	<1					mg/kg	1	A-T-024s
Cadmium$_D$$^{M\#}$	-	<0.5	<0.5					mg/kg	0.5	A-T-024s
Copper$_D$$^{M\#}$	-	21	27					mg/kg	1	A-T-024s
Chromium$_D$$^{M\#}$	-	17	7					mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	-	<1	<1					mg/kg	1	A-T-040s
Chromium (trivalent)	-	17	7					mg/kg	1	Calc
Lead$_D$$^{M\#}$	-	39	7					mg/kg	1	A-T-024s
Mercury$_D$	-	<0.17	<0.17					mg/kg	0.17	A-T-024s
Nickel$_D$$^{M\#}$	-	10	6					mg/kg	1	A-T-024s
Selenium$_D$$^{M\#}$	-	<1	<1					mg/kg	1	A-T-024s
Zinc$_D$$^{M\#}$	-	57	26					mg/kg	5	A-T-024s

Envirolab Job Number: 20/05682

Client Project Name: Land off Leconfield Road, Nanpantan

Client Project Ref: 40056

Lab Sample ID	20/05682/24	20/05682/25	20/05682/28					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	TP6	TP7	TP8							
Depth to Top	1.40	0.10	1.80							
Depth To Bottom										
Date Sampled	08-Jul-20	08-Jul-20	08-Jul-20							
Sample Type	Soil - D	Soil - D	Soil - D							
Sample Matrix Code	6AE	6AE	6AE							
PAH-16MS										
Acenaphthene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Acenaphthylene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Anthracene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Chrysene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Fluoranthene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Fluorene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Naphthalene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Phenanthrene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Pyrene$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s
Total PAH-16MS$_A^{M\#}$	-	<0.1	<0.1					mg/kg	0.1	A-T-019s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX VIII

Ground Gas and Water Level Monitoring Results

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	15/07/2020
Weather	Overcast with light showers
Equipment	GEO09 & Dipmeter
Operator	BP

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	NA	NA	Peak	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found
			Steady	NA	NA	NA	NA	NA	NA	NA					
WS2	10:29	1005	Peak	ND	0.0	1.4	19.6	0	0	0.0	NA	NGW	NA	40	
			Steady	ND	0.0	1.4	19.6	0	0	0.0					
WS3	09:45	1005	Peak	ND	0.0	2.8	17.4	0	0	0.0	NA	NGW	NA	40	
			Steady	ND	0.0	2.8	17.4	0	0	0.0					
WS6	09:35	1005	Peak	ND	0.0	1.3	19.8	0	0	0.0	NA	NGW	NA	55	
			Steady	ND	0.0	1.3	19.8	0	0	0.0					
Ambient		1005					20.7								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	23/07/2020
Weather	Overcast, warm & dry
Equipment	GEO20 & Dipmeter
Operator	TPA

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	09:48	1009	Peak	ND	0.0	1.8	18.9	0	0	0.0	NA	1.86	NA	60	Monitored for 300 seconds.
			Steady	ND	0.0	1.8	18.9	0	0	0.0					
WS2	10:00	1009	Peak	ND	0.0	2.0	20.2	0	0	0.0	NA	NGW	NA	120	Monitored for 300 seconds.
			Steady	ND	0.0	2.0	20.2	0	0	0.0					
WS3	10:55	1009	Peak	ND	0.0	1.3	20.8	1	0	0.0	NA	NGW	NA	60	Monitored for 300 seconds.
			Steady	ND	0.0	1.3	20.8	1	0	0.0					
WS6	10:08	1009	Peak	ND	0.0	1.4	20.7	0	0	0.0	NA	NGW	NA	30	Monitored for 300 seconds.
			Steady	ND	0.0	1.4	20.7	0	0	0.0					
WS7	10:35	1009	Peak	ND	0.0	3.0	18.4	0	0	0.0	NA	NGW	NA	210	Monitored for 300 seconds.
			Steady	ND	0.0	3.0	18.4	0	0	0.0					
Ambient		1009					22.0								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	30/07/2020
Weather	Sunny, Warm & Dry
Equipment	GEO20 & Dipmeter
Operator	TPA

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	15:25	1010	Peak	ND	0.0	1.8	18.7	0	0	0.0	NA	1.86	NA	30	Monitored for 300 seconds.
			Steady	ND	0.0	1.8	18.7	0	0	0.0					
WS2	15:42	1010	Peak	ND	0.0	1.8	19.9	0	0	0.0	NA	1.50	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	1.6	20.2	0	0	0.0					
WS3	15:15	1010	Peak	ND	0.0	1.5	20.5	1	0	0.0	NA	NGW	NA	180	Monitored for 300 seconds.
			Steady	ND	0.0	1.5	20.5	1	0	0.0					
WS6	16:07	1010	Peak	ND	0.0	3.2	17.7	0	0	0.0	NA	NGW	NA	210	Monitored for 300 seconds.
			Steady	ND	0.0	3.3	17.8	0	0	0.0					
WS7	15:55	1010	Peak	ND	0.0	1.2	20.7	0	0	0.0	NA	NGW	NA	120	Monitored for 300 seconds.
			Steady	ND	0.0	1.3	20.8	0	0	0.0					
Ambient		1010					21.5								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	06/08/2020
Weather	Overcast and warm
Equipment	GEO20 & Dipmeter
Operator	TPA

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	10:44	1010	Peak	ND	0.0	2.2	19.6	0	0	0.0	NA	1.87	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	2.0	20.0	0	0	0.0					
WS2	10:57	1010	Peak	ND	0.0	1.6	20.7	0	0	0.0	NA	1.52	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	1.4	20.9	0	0	0.0					
WS3	10:36	1010	Peak	ND	0.0	1.5	20.9	0	0	0.0	NA	NGW	NA	30	Monitored for 300 seconds.
			Steady	ND	0.0	1.5	20.9	0	0	0.0					
WS6	11:17	1010	Peak	ND	0.0	3.5	18.0	1	0	0.0	NA	NGW	NA	120	Monitored for 300 seconds.
			Steady	ND	0.0	3.5	18.1	0	0	0.0					
WS7	11:06	1010	Peak	ND	0.0	1.1	21.0	0	0	0.0	NA	NGW	NA	60	Monitored for 300 seconds.
			Steady	ND	0.0	1.0	21.0	0	0	0.0					
Ambient		1010					21.8								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	12/08/2020
Weather	Sunny, hot & dry
Equipment	GEO20 & Dipmeter
Operator	TPA

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	15:46	1007	Peak	ND	0.0	1.8	19.9	0	0	0.0	NA	1.88	NA	240	Monitored for 300 seconds.
			Steady	ND	0.0	1.4	20.5	0	0	0.0					
WS2	15:57	1007	Peak	ND	0.0	1.1	20.8	0	0	0.0	NA	1.53	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	0.9	21.1	0	0	0.0					
WS3	15:34	1007	Peak	ND	0.0	0.9	20.9	2	0	0.1	NA	NGW	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	0.8	21.1	0	0	0.1					
WS6	16:15	1007	Peak	ND	0.0	2.9	19.0	0	0	0.0	NA	NGW	NA	240	Monitored for 300 seconds.
			Steady	ND	0.0	2.9	19.2	0	0	0.0					
WS7	16:06	1007	Peak	ND	0.0	0.5	21.3	0	0	0.0	NA	NGW	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	0.4	21.5	0	0	0.0					
Ambient		1007					21.4								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

Project No.	40056
Client	Bowbridge Homes Ltd
Site Location	Leconsfield Road, Nanpantan
Date	18/08/2020
Weather	Cloudy, warm, dry
Equipment	GEO20 & Dipmeter
Operator	TPA

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665 / BS8485:2015															
Borehole No.	Time (00:00)	Ambient Pressure (mb)		VOC (ppm IEU)	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	CO (ppm)	H_2S (ppm)	Gas Flow (l/hr)	Depth to LNAPL (m begl)	Depth to groundwater (m begl)	Depth to DNAPL (m begl)	Time to steady readings (secs)	Other Issues i.e. odour, condition of installation, etc
WS1	15;05	1001	Peak	ND	0.0	1.5	21.3	0	0	0.0	NA	1.90	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	1.5	21.6	0	0	0.0					
WS2	14:53	1001	Peak	ND	0.0	0.8	21.8	0	0	0.0	NA	1.52	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	0.8	22.1	0	0	0.0					
WS3	15:16	1001	Peak	ND	0.0	0.6	22.2	0	0	0.0	NA	NGW	NA	60	Monitored for 300 seconds.
			Steady	ND	0.0	0.6	22.3	0	0	0.0					
WS6	14:34	1001	Peak	ND	0.0	2.6	19.7	0	0	0.0	NA	NGW	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	2.5	20.0	0	0	0.0					
WS7	14:44	1001	Peak	ND	0.0	0.6	22.0	0	0	0.0	NA	NGW	NA	270	Monitored for 300 seconds.
			Steady	ND	0.0	0.6	22.2	0	0	0.0					
Ambient		1001					22.1								

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)
3. Where Carbon Monoxide exceeds 30ppm (after BS8576:2013)
4. Where Hydrogen Sulphide exceeds 5ppm (after BS8576:2013)
5. Where Oxygen is below 16% v/v (Coal Authority guidance)

Where cell is highlighted further consideration of the recorded value is required in accordance with the specified guidance documents

NA - Not Applicable/ Not Available

BOH - Bottom of Hole

ND - Not Determined

NGW - No groundwater encountered

NR - None Recorded

GeoDyne

APPENDIX IX

Conditions & Limitations

Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.

3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.

2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.

3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.

4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.

5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.

6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create ‘soft spots’, therefore, should the Client wish to designate ‘no dig’ zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.

7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.

8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1 Payment terms are strictly 28 days from the invoice date.

2 Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.

3 Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.