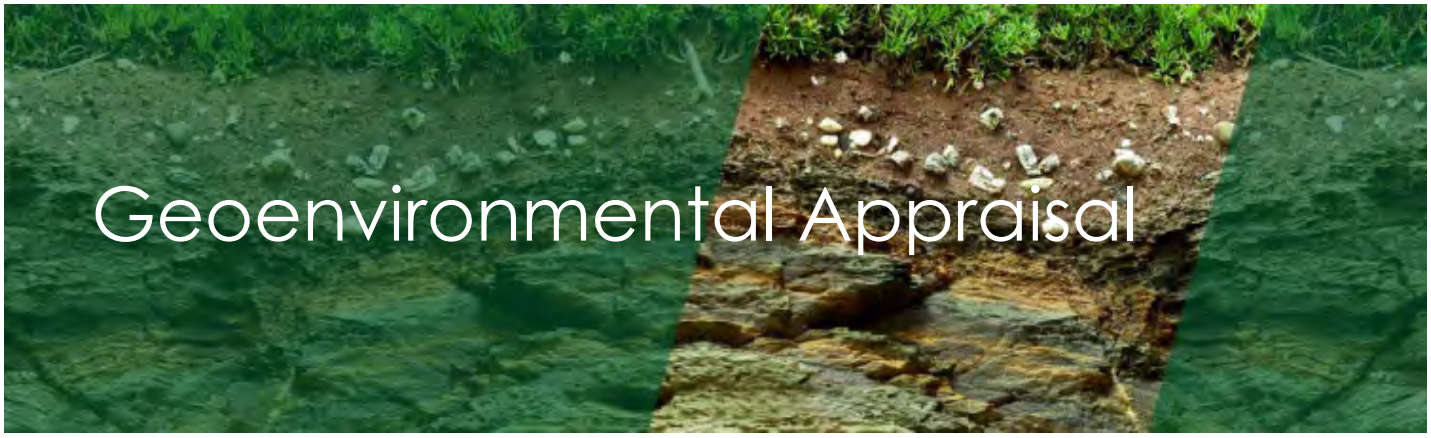


Land at Royal Victoria Court, Mendalgief Rd, Newport, south Wales

For LNT Care Developments

Report no: 5088/1

Date: January 2025

Tel: 01937 545330 • info@lithos.co.uk • www.lithos.co.uk

SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	5088	**Site area/ha**	0.7ha (1.7 acres)
Client:	LNT Care Developments	**NGR:**	ST 309 869
Site:	Royal Victoria Court, Mendalgief Rd, Newport, south Wales	**Nearest postcode:**	NP20 2NT

The site is located off Mendalgief Road, approximately 1km south of Newport town centre, and currently comprises a single parcel of land, most recently used as a storage compound for the adjacent residential development.

The site (and wider area) was historically associated with the Courtybella Steelworks. Former structures within the red line boundary included two framing bays, a gas furnace and the main office block. The steelworks were demolished to ground level in 2008 and subsequently subject to remediation works between February 2016 and January 2017. Remediation works included removal of obstructions, treatment of contaminant hotspots, treatment of Japanese Knotweed and turnover and compaction of made ground to 2m depth across the site and wider area (now undergoing redevelopment with housing).

Lithos were commissioned by LNT to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with a 66 bed 3- storey 'C' shaped care home with associated POS, landscaping and parking. Lithos' investigation included a review of 3rd party reports, the site's history and environmental setting, and a ground investigation comprising 9 trial pits and 3 cable percussive boreholes.

A summary of salient geoenvironmental issues is provided in the table below.

Issue	Remarks
Made ground	Made ground is present across the site to depths of between 1.6m and 2.9m (average depth to base of 2.3m and typically comprises Cohesive Made Ground underlain by Granular Made Ground. Macadam hardstand was encountered in TP06 to 0.05m depth and is likely associated with the site's temporary use as an overflow hospital car park. Brickfill was also encountered in TP01 between 0.2m and 0.3m depth.
Natural ground	Natural ground comprises Cohesive Tidal Flat Deposits: a soft to firm, slightly sandy Clay to depths of between 3.4m and 5.3m. Typically, Peat was encountered beneath this clay and was typically 0.6m to 0.8m thick. This was underlain by soft Clays to depths of between 9.5m and 12.7m. Granular Tidal Flat Deposits were encountered in BH03 between 9.5m and 12.2m as a Sand underlain by Gravel of mixed lithologies. Mudstone bedrock (St Maughans Formation) was encountered from between 12.2m and 12.7m depth.
Previous remediation works	Records suggest remediation works were undertaken and supervised by Walters UK Ltd and Celtic enGlobe between February 2016 and January 2017. Excavation and treatment of the two identified on-site contamination hotspots to clean-up criteria derived for a commercial end use with a 600mm clean soil cover (underlain by a marker barrier) was undertaken and validated by Celtic. In addition, a site wide turnover and remediation of soils to a minimum 2.0m depth across the site was also undertaken and validated by Celtic. Perched groundwaters encountered during excavation of turnover soils were pumped to a treatment system prior to discharge to the foul water sewer network. Verification samples recovered from the turnover and backfilled cells were taken on a 25m x 25m grid across the site. Results confirmed that the backfilled materials met the site remediation requirements. Celtic confirmed that remediation works had been successfully carried out in accordance with the approved Remediation Strategy and subsequent agreements with Newport City Council and Natural Resources Wales. The works are said to have removed all identified contamination sources and all areas of contamination encountered during the remediation works were successfully removed. Some structures may remain in the ground at depths below 2.0m. Celtic concluded that following completion of the remediation works, the site is suitable for use, subject to any conditions and restrictions imposed by planning or regulatory authorities and the specific requirements of future development works.
Contamination	Asbestos impacted made ground was deliberately placed in defined layers as part of the remediation, based on the amount of asbestos within the soils. • 0.0m – 0.2m – soil containing <0.001% asbestos • 0.2m – 1.0m – soil containing <0.01% asbestos • >1.0m – soil containing <0.1% asbestos Asbestos was recorded in 8 samples of made ground sent for analysis by Lithos. The results of the Lithos asbestos quantification analysis are broadly in line with the above strategy. No other contamination has been identified by Lithos to date.

SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	5088	**Site area/ha**	0.7ha (1.7 acres)
Client:	LNT Care Developments	**NGR:**	ST 309 869
Site:	Royal Victoria Court, Mendalgief Rd, Newport, south Wales	**Nearest postcode:**	NP20 2NT

Issue	Remarks
Mining & quarrying	The site is located beyond the Mining Remediation Authority's (CA) defined coalfields. There are no quarries located within 250m of the site's boundary
Hazardous gas	The site lies in an area where <1% of homes are estimated to be above the radon action level and therefore no protection measures are required. Due to the presence of a landfill within 250m, deep made ground and peat, the site may be affected by sources of hazardous gas. Gas monitoring is ongoing, with a hazardous gas risk assessment due to be issued in March 2025.
Preparatory works	Site clearance. Demolition of the remaining security building with subsequent removal of foundations.
Foundations	Piled foundations will be the most suitable foundation solution for the proposed three storey care home. Piled foundations should be end bearing in bedrock.
Groundwater & excavations	Groundwater was encountered at shallow depth across the site from 0.9m depth. Groundwater monitoring has confirmed a shallow groundwater table with fast recharge. Shallow excavations are unlikely to remain stable during the construction phase in the short term due to the presence of perched water within the made ground.
Flooding & drainage	The site is located within a Flood Zone 1 where risk of flooding from rivers or the sea is classed as low. Soakaways will not provide a suitable means of surface water disposal at the site. Consequently, there is likely to be a need for surface water balancing.
Car Park	Validation testing undertaken by Integral Geotechnique suggests CBR values are likely to be around 5%. This should be verified prior to or during construction.

Significant developer abnormals relating to geoenvironmental issues at the site are:

- Due to the compressible nature of the Cohesive Tidal Flat Deposit, any increase in ground levels greater than 1m above existing, could result in additional consolidation settlement of the ground around the care home, which could cause issues for level access and service entries.
- Made Ground has been found to contain low levels of asbestos fibres and ACMs, which has been placed in designated layers depending on the amount (%) of asbestos identified within the soils. These materials should be controlled in accordance with the Control of Asbestos Regulations 2012 and risks must be mitigated by appropriate measures including but not limited to:
    - Damping down of soils
    - Appropriate PPE/RPE based on the contractors risk assessment
    - General site controls (i.e. speed limits, controlled stockpiling) to reduce dust generation
    - Precautionary airborne fibre monitoring to ensure that airborne fibre concentrations do not exceed the clearance limit of 0.01 fibres/millilitre (cm^3)

CONTENTS

APPENDICES

Appendix A – General notes

01	Environmental setting
02	Ground investigation fieldwork
03	Geotechnical testing
04	Contamination laboratory analysis & interpretation
05	Hazardous gas

Appendix B – Drawings

Drawing	Revision	Title
5088/1	-	Site Location Plan
5088/2	-	Proposed Site Layout
5088/3	-	Site Features
5088/3A	-	Historical Site Features
5088/4	-	Site Photographs
5088/5	-	Preliminary Conceptual Site Model
5088/6	-	Exploratory Hole Locations
5088/6A	-	Arup 2014 Exploratory Hole Location
5088/7	-	Revised Conceptual Site Model

Appendix C – Commission

Appendix D – Historical OS plans#

Appendix E – Search responses#

From	Date	Content
Landmark	11 11 2024	Environmental search data
British Geological Survey	11 11 2024	Radon report

Appendix F to G – Exploratory records

Appendix F	TP01 to TP09
Appendix G	BH01 to BH03

Appendix H – Chemical test results

Appendix I – Geotechnical test results

Appendix J – Gas monitoring results

Appendix K – Site investigation photographs

Some of this data is not included within the paper or PDF copies of this report but can be provided on request.

FOREWORD (GEOENVIRONMENTAL APPRAISAL REPORT)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Lithos Consulting Limited (Lithos); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

This report has been reviewed by a Competent Person, as defined in the National Planning Policy Framework. We ensure that all projects are managed by individuals with necessary experience, relevant qualifications, and current membership of a relevant professional organisation. Records of engineers, project managers and reviewers involved in this project are maintained by us. Lithos QA/QC procedures for all our work forms an integral part of our ISO9001 accreditation and as such is regularly audited.

The report presents observations and factual data obtained during our site investigation and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Lithos prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of pages to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is not included in the PDF; by request it can be provided.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from a variety of sources as detailed within this report, and which Lithos believes are reliable. Reasonable care and skill has been applied in examining the information obtained. Nevertheless, Lithos cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Lithos, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy.

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

Lithos cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

The report represents the findings and opinions of experienced geoenvironmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

GEOENVIRONMENTAL APPRAISAL
of land at
ROYAL VICTORIA COURT, MENDALGIEF RD, NEWPORT, SOUTH WALES

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting Limited were commissioned by LNT Care Developments to carry out a geoenvironmental appraisal of land at Royal Victoria Court, Mendalgief Road, Newport, South Wales.

1.1.2 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:

- A review of third party reports
- A site walkover and inspection
- An assessment of the land use history
- Determination of the site's environmental setting
- An intrusive ground investigation comprising 9 trial pits and 3 boreholes
- Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
- A qualitative assessment of contamination risks
- Recommendations for the necessary site preparatory and remediation works

1.1.3 This report is **not** intended to validate remediation works undertaken in 2016/2017 by Walters UK Limited on behalf of the Tirion Group Ltd. All remediation works undertaken were supervised by Walters UK Ltd and Celtic enGlobe between February 2016 and January 2017. Post remediation investigation and validation was undertaken by Integral Geotechnique and Celtic and the site was deemed suitable for the proposed mixed-use development (including a school, residential and commercial).

1.1.4 Primary aims of this phase of investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable LNT to obtain budget costs for: foundations; gas protection measures; and site preparatory and any additional remediation works.

1.2 The proposed development

1.2.1 It is understood that consideration is being given to redevelopment of the site with a 66 bed, 3 storey 'C' shaped care home with associated landscaping, parking and area of public open space (POS).

1.2.2 A site layout has been provided by LNT Construction (Drawing reference NP20 2NW-F-01, dated March 2024) which is reproduced as Drawing 5088/2 in Appendix B to this report.

1.3 Report format and limitations

1.3.1 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

1.3.2 In accordance with the agreed scope of works, the ground investigation reported here is not fully compliant with Eurocode 7 (EC7) and this report does not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. The ground appraisal, parametric assessment and preliminary design guidance presented are intended to assist others as they prepare the design of the proposed works.

1.3.3 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:

- Assessment of the site's environmental setting
- Ground investigation fieldwork
- Geotechnical testing
- Contamination testing
- Hazardous gas

2 SITE DESCRIPTION

2.1 General

2.1.1 The site's location is shown on Drawing 5088/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	1 km south of Newport town centre
NGR	ST 309 869
Approximate area	0.7ha (1.7 acres)
Known services	None

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on the 9th December 2024.

2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 5088/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current access	Off Mendalgief Road
Topography	Relatively flat
Approximate areas	7,000m² un-made ground (ground which does not have a formal surface covering)
Nature of boundaries	North – palisade fencing East & south – wooden fencing panels West – no formal boundary, adjacent residential construction site
Surrounding land uses	North – Former railway embankment with Cardiff Road & Bell Vue Park beyond East – Mendalgief Road with housing beyond South & West – New residential dwellings/construction site

2.2.3 The site is accessed via the adjacent construction site to the west, off Cape Yelcho Road and comprises a roughly L-shaped parcel of land.

2.2.4 Currently, the majority of the site is being used as a storage area for the adjacent residential development construction works.

2.2.5 The southern area of the site comprises an open area of un-made ground (ground with no formal surface covering), which is understood to have recently contained a stockpile of soil (unknown type) that has been used in the adjacent construction works.

2.2.6 The central section of the site contained multiple skips which were being filled with construction waste (timber, foam, bricks etc). Timber roof trusses were also stored in this area.

2.2.7 The north of site was used for the storage of construction materials and contained pallets of bricks, tiles, timber, insulation etc. The surface of this area of site was 'littered' with construction materials and plastic which had either been dropped or windblown.

2.2.8 Whilst all of the steelworks buildings were demolished during the turnover works, the security building is still present in the east of site and comprises a single storey dilapidated brick building. Further inspection of the building was not possible due to the presence of construction materials, however, it is understood to be no longer in use.

2.2.9 Large ponded areas were present across the site, most notably in the centre-south and north of site, where levels were slightly lower due to high traffic areas (in front of the skips and roadways towards the construction materials).

2.2.10 The Lithos engineer was made aware by the site manager that the site walkover was undertaken 24 hours after a storm, which had placed the site in a 'red alert' area, and therefore high amounts of rainfall and strong winds had occurred, which may account for the ponded areas and high amount of litter on the surface.

2.2.11 The sites topography is relatively flat, however, there is a raised bund c. 0.5m max. around the southern/southwestern perimeter of the site, where levels meet the existing development. Site levels in the centre and north are level with the adjacent construction site.

2.2.12 A selection of site photographs is included on Drawing 5088/4.

3 SITE HISTORY

3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1884 have been examined. Some of these plans are presented in Appendix D to this report.

3.2 The table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding land
1884	Open fields. Trees and drainage ditch NE-SW in northwest of site. **Mendalgief Road** along eastern boundary.	'Spring Gardens' houses c. 15m east. **Great Western Railway line** c. 35m north.
1902	**Allotment gardens** in the far southwest of site, extending off site to the south.	Houses (terraced) constructed c. 70m southeast.
1937	**Railway** extended to abut the northern boundary of site. **Unnamed road** through centre of site.	'**Courtybella Steelworks** located c. 50m southwest. Includes two tanks c. 150m west. Spring Gardens c. 15m east replaced with terraced houses. Sports ground c. 80m south.
1957	**Building** constructed to the southwest of site which now extends on to site. Likely associated with the Courtybella Steel Works.	Sports ground replaced with larger building associated with Courtybella Steel Works.

Date	Site	Surrounding land
1978	No significant changes. Railway line no longer present.	**Tank** c. 15m south.
2006	**Steelworks** site appears to be disused.	No significant changes
2009	**Steelwork buildings** demolished to slab level.	
2016	Wider steelworks site has been cleared and turned over. Area within the site boundary appears to be used as a **car park**.	
2023	Site contains **stockpiles** and other construction materials associated with surrounding development.	Houses constructed to the south and west of site.
October 2024	No significant changes.	Surrounding housing development complete.

3.3 The site was located within the north east of the wider steel works site.

3.4 **Courtybella Steel Works** (which was later known as **Whiteheads**) operated from the 1930s and included hot and cold rolling mills, pickling lines, travelling cranes, welding shops and ancillary structures such as substations, stores and workshops.

3.5 Details of the wider **steel works** history given in Arup's Report (Ref. 234989/4.50) suggests the site historically contained the main **office block** and **Bays 7 & 8**.

3.6 It was noted by Arup that Bay 8 contained a motor house, **coal gas plant** and framing works. Bay 7 was noted to contain a backfilled **waste pit**/ chamber approximately 10m x 30m in size. The pit was tipped with an assortment of waste from plant processes which was subsequently capped with cement, which was sagging and cracking.

3.7 Arup created a drawing detailing observations from a site walkover carried out whilst the site was active; it shows the waste pit of Bay 7 to only slightly encroach into the far western boundary. In addition, the motor room in Bay 8 is located c.8m south. The gas furnace is however recorded in the centre of site.

3.8 Historical features are shown on **Drawing 5088/3A**.

3.9 Records show the wider steel works site (including the site) was **reclaimed** by Walters UK Limited and their contaminated land remediation sub-contractor Celtic between February 2016 and January 2017. Details of the work undertaken are given in section 5.

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. Reference has been made to publicly available Government held digital data via QGIS (an Open Source Geographic Information System). Extracts from the response received from Landmark are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet 249) 1:10,000 BGS map (Sheet ST38NW)	Drift soils – Tidal Flat Deposits - clay and slit. Solid (bedrock) – St Maughans Formation (argillaceous rocks and sandstone). Strata dip - unknown. Faults – None recorded.
Mining	Mining Remediation Authority	This site is located beyond the Mining Remediation Authority's defined coalfields.
Quarrying	Historical OS plans	None recorded within 250m.
Radon	UK Health Security Agency	The site lies in an area where 10-30% of homes are estimated to be above the radon action level. Further details in Section 12.5.
Hydrogeology	Environment Agency electronic open data via QGIS	Groundwater Source Protection Zone? None. Aquifer: Unproductive (Drift); Secondary A Aquifer (Solid). Groundwater abstractions? None. Soil leaching potential - High. Pollution incidents? None of significance.
Hydrology	Defra Catchment data explorer Envirocheck Report	Nearest watercourse(s) – Nearest is 119m west, inland river (Twenty Acres Reen) within the Ebbw Sirhowy catchment. It is understood this watercourse was used as a discharge point for the historical steelworks. Water quality – moderate. Pollution incidents? None of significance. Abstractions? None. Discharge consents? Nearest is 280m south, Trade discharge into the 20 Acre Reen. None of significance
Flood risk	Environment Agency electronic open data via QGIS	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. In accordance with Chapter 14 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency);
UXO	Zetica website	Low Risk

4.2 Landfills

4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Land at Newport Sidings	ST 306 867 (237m southwest)	Historical landfill. Licence held by Network Rail Infrastructure Ltd No date of input. No record of waste types. Ref. EAHLD35574	Natural Resources Wales Envirocheck report.

* QGIS is an Open Source Geographic Information System.

4.2.2 Information held regarding the land at Newport Sidings is limited, the historical landfill is now overlain by houses.

4.2.3 In addition to the recorded landfill, there is possibly an infilled drainage ditch in the northwest of site, running NE-SW. Depending on the nature of the backfill gas may be being produced.

5 PREVIOUS INVESTIGATION FINDINGS

5.1 General

5.1.1 LNT have provided Lithos with a copy of the following reports:

- **Report 1** - Ground Investigation & Risk Assessment Report (Ref. 234989/4.50), issued by Arup in October 2014.
- **Report 2** - Reclamation Works: Revised Dec 2015 (Ref. 234989/4.60), issued by Arup in December 2015
- **Report 3** - Factual Engineering Report (Ref. 11734/AF/17/FER/Rev A) issued by Integral Geotechnique (Wales) in February 2017.
- **Report 4** - Post Reclamation Geotechnical Investigation Report (Ref. 11734/JJ/18/SI/Rev B) issued by Integral Geotechnique (Wales) in August 2018.

5.1.2 These reports include a desk study, site investigation, remediation strategy and remediation verification report (**geotechnical only** – i.e. compaction testing, CBRs, plate load tests) undertaken across the wider Courtybella Steelworks to enable redevelopment.

5.1.3 In addition to the above, Lithos have obtained the following reports from the Newport City Council Planning Portal:

- **Report 5** – Remediation Strategy, Implementation and Verification Plan (Ref. C1664/15/4635) issued by Celtic enGlobe in November 2015.
- **Report 6** – Factual Remediation Verification Report Version 2 (Ref. R1664/17/4768) issued by Celtic enGlobe in June 2017.

5.1.4 These reports include detail of the remediation works undertaken across the wider site (including the current area of interest) and focus on the environmental remediation (i.e. soil and groundwater remediation) rather than the geotechnical remediation which is included in Reports 3 & 4 above.

5.2 Summary of Report 1's findings

5.2.1 **Report 1** includes the findings of a **ground investigation** undertaken by Arup in July 2014 across the wider site (including the current red line boundary). The aims of the investigation were to supplement results of previous ground investigation undertaken in 2004.

5.2.2 Arup's ground investigation works comprised:

- 25 trial pits excavated to a maximum depth of 3.1m
- 23 cable percussion boreholes to a maximum depth of 13m
- Rising and falling head tests in 7 standpipes
- Two periods of groundwater sampling
- Two periods of surface water sampling from the Twenty Acre Reen
- Geotechnical classification tests (Atterberg Limits, pH, soluble sulphate etc.)
- Chemical laboratory tests (including pH, metals, asbestos, speciated TPH, speciated PAH, VOCs, SVOCs and PCBs)

5.2.3 Of the 25 trial pits and 23 cable percussion boreholes undertaken across the wider site, only three trial pits (TP01B, TP02 & TP05) and two boreholes (BH07 & BH19) were undertaken within the current red line boundary.

5.2.4 Ground conditions encountered by Arup within the current red line boundary are summarised in the table below:

Hole	Final depth (m)	Depth of made ground (m)	Nature of made ground	Nature of natural ground	Location
TP01B	1.80	>1.80	Reinforced concrete (0.2m thick) underlain by Gravel and Cobbles of concrete, brick, sandstone and clinker with fragments of insulating tape, electrical wire, clay pipe and polythene. Strong hydrocarbon odour.	Not encountered	Bay 7 waste pit (far west)
TP02	1.70	1.50	Concrete (0.15m thick (underlain by Gravel of sandstone, concrete, brick and clinker with frequent ash and ceramic fragments to 1.1m. Soft gravelly Clay with a strong chemical odour to 1.5m.	Firm silty Clay	Bay 8 Framing
TP05	2.20	1.70	Tarmac (0.15m thick) underlain by gravel of sandstone, concrete, brick and clinker with rare ceramic, tile, glass, slag and metal to 1.2m. Soft slightly sandy slightly gravelly silty Clay to 1.7m.	Firm silty Clay	Gas Furnace
BH07	10.0	1.50	Concrete (0.2m thick) underlain by Cohesive Made Ground with a faint chemical odour)	Soft Clay to 10.0m depth with Peat between 4.4m and 5.5m depth	Bay 8 Framing
BH19	12.0	2.30	Tarmac (0.05m thick) underlain by Soft silt and Clay.	Soft to Firm silty/peaty Clay to 6.25m. Peat 6.25m – 7.0m. Firm Clay 7.0m to 12.0m depth	Car park?

5.2.5 Groundwater was encountered at the base of made ground, within peat and silty alluvium layers and within gravelly Clay and upper weathered bedrock layers. It was considered by Arup that groundwater encountered within the made ground and shallow drift deposits are indicative of discontinuous perched groundwater bodies beneath the site. The main groundwater body was thought to be present at depth within bedrock and flows south.

5.2.6 Visual and olfactory evidence of contamination was encountered within Bay 8 (historic framing works, motor room and coal gas plant) located within the current red line boundary. Evidence of contamination was also encountered within the infilled waste pit in Bay 7, which is located directly west of site, and may encroach the far western boundary of the current red line boundary.

5.2.7 Results of 3 rounds of gas monitoring are included within the Arup Report, with a further 3 monitoring visits scheduled. Results from BH07 & BH19, located within the red line boundary recorded methane between not detected and 0.9% and carbon dioxide concentrations between not detected and 2.5%. No gas flows were recorded.

5.2.8 Chrysotile asbestos (0.001%) was identified within TP1B at 1.6m depth. In addition, Chrysotile cement was also encountered within TP5 at 0.3m.

5.2.9 Contamination 'hotspots' were identified within soils in the vicinity of TP5 and included elevated concentrations of zinc, polycyclic aromatic hydrocarbons (PAHs), Trichloroethene, Cis-1,2-dichloroethene and Vinyl Chloride.

5.2.10 Groundwater from BH05 contained elevated concentrations of zinc and Cis-1,2-dichloroethene. Groundwater from BH19 contained elevated concentrations of Cis-1,2-dichloroethene, Trichloromethane and Bromodichloromethane.

5.2.11 Arup recommended:

- Breaking out of hardstand and removal of obstructions to 2.0m depth
- Removal, treatment and disposal of contaminated perched water
- Decommissioning of tanks
- Excavation of ACM and cement products

5.2.12 Due to the presence of widespread elevated concentrations of metals and PAHs within the made ground (and some natural materials), it was recommended that post-earthworks, gardens and landscaped areas would require a 1.0m thick, clean capping layer.

5.2.13 Arup also referred to contamination identified within a 2004 investigation (Figure 4 in Report 1), which shows elevated concentrations of PAHs, Total Petroleum Hydrocarbons (TPHs), Chlorinated Solvents and Semi Volatile Organic Compounds (sVOCs) in both soil and groundwater.

5.3 Summary of Report 2's findings

5.3.1 Report 2 includes a **scope** for proposed reclamation works which was due to be completed as a separate contract across the wider site, in advance of subsequent development.

5.3.2 The scope of remediation works (across the wider site) included:

- Development of a remediation strategy, detailed design and discharge planning conditions prior to commencement of site works in Spring 2015
- Spraying of Japanese Knotweed in-situ
- Site clearance
- Stripping of topsoil and tarmac with subsequent stockpiling for re-use
- Testing of existing demolition stockpiles and classification for incorporation as fill on site
- Breaking out of concrete, crush and grade to Class 1B and stockpile on site for re-use
- Excavation of existing material to up to 2.0m depth, breaking out obstructions and infill any voids
- Removal of bulk waste/refuse materials (namely the waste pit from Bay 7) with subsequent backfill
- Exposure of contamination for treatment, process and recompact to earthworks profile
- Remediation of soil and groundwater, including installation of new groundwater monitoring wells for long term monitoring, soil and groundwater validation testing
- Validation of the remediation
- Construction of a retention pond and associated works for future drainage provision
- Provision of new bat roost facilities

5.4 Summary of Report 3's findings

5.4.1 This **factual engineering report** produced by Integral Geotechnique issued in February 2017 includes details of remediation works undertaken and validation testing of earthworks.

5.4.2 Made ground or reworked natural ground to depths of 2.0m below the finished plateau was excavated and reprocess for re-use. Foundations, buried walls, drainage runs, disused services, buried tanks and manholes were removed and processed to a minimum depth of 2.0m below finished ground levels.

5.4.3 Locally, excavations were extended below 2.0m where deeper obstructions were encountered.

5.4.4 Geotechnical testing was undertaken across the site and comprised:

- 21 Atterberg limits were undertaken on samples from 10 trial pits across the site, with PI's between 6% and 18% (low shrinkability).
- 21 compaction tests (4.5kg rammer). OMC results of 7.3% - 13% and MDD of between 1.73 – 2.12Mg/m^3
- CBR tests at 32 locations, with results of between 4.9% and 13.9%.

5.4.5 Shallow groundwater was encountered at depths of between 0.3m and 2.3m in 6 of 10 trial pits excavated across the site. The water was typically encountered near the base of the engineered fill.

5.4.6 No **chemical testing** was undertaken.

5.5 Summary of Report 4's findings

5.5.1 This report was produced in August 2018 post-reclamation of the wider site and contains details of a post reclamation **geotechnical investigation**. This report does not cover the current area of interest due to its ongoing use as a hospital car park, however, it provides details of land adjacent to the current red line boundary.

5.5.2 Integral Geotechnique's investigation included:

- 7 cable percussion boreholes (BH1 to BH7) to depths of between 6.9m and 14.8m
- 24 CPT tests (CPT1 to CPT3 and CPT6 to CPT25) to depths of between 3.0m and 13.8m
- 16 plate load tests (P1 to P16)

5.5.3 Engineered fill comprising compact Gravel and Cobbles with occasional boulders of brick, concrete, sandstone, mudstone, clinker and slag was encountered across the site to depths of between 0.9m and 2.8m. This was underlain by Drift soils to depths of up to 14.0m. A weak mudstone was encountered from >6.9m to 14.0m depth.

5.5.4 A desiccated crust comprising a firm silty clay was encountered immediately beneath the made ground across the majority of the site. CPT testing suggests this material has an undrained shear strength of 35 to 58kPa and an Mv value of 0.06 to 0.1m^2/MN. Below the desiccated crust, shear strength dropped to between 18 and 26kPa and compressibility (Mv values) increased to 0.17 to 0.39m^2/MN.

5.5.5 Plate load tests indicated a consistent performance of engineered fill across the site, with settlement values ranging from between 0.84mm 50kN/m^2 loading to 8.22mm settlement with a 150kN/m^2 load.

5.5.6 Foundation recommendations included raft foundations for 2/3 storey houses and piled foundations for apartment blocks and terraced houses where alluvium is present (in the centre and south of site. Shallow strip/trench fill foundations were recommended where alluvium was not encountered (far north of site).

5.5.7 Given this report was a geotechnical investigation, no **chemical testing** was undertaken.

5.6 Summary of Report 5's findings

5.6.1 The report includes details of the **strategy** for implementing and verifying the remediation works at the site.

5.6.2 Remediation works of significance to the area of site of current interest include:

- Site clearance
- Strip topsoil and tarmac with stockpile on site for re-use
- Testing of existing demolition stockpiles and classification for incorporation as fill on site
- Breaking out of concrete with crushing and grading ready for re-use on site
- Excavation of existing material up to 2.0m depth, breaking out of obstructions (including basements) and infill any voids
- Excavation of contaminated soil hotspots as described by Arup (this includes the former gas plant (BH05), footprint of Bay 8, and the excavation of soils within the waste pit in Bay 7 which are located within the current red line boundary).
- Validation testing of all excavations
- Design and construct a fully contained temporary ex-situ bioremediation soil windrow treatment facility with a capacity to treat approximately 8,000m^2, including a contingency to treat a further volume if necessary
- Ex-situ bioremediation of soils to meet required re-use specification
- Design and construct a suitable water treatment system to treat shallow groundwater (perched water) contamination
- Soil stabilisation and/or off-site disposal of untreatable or difficult to treat soils
- Production of a verification report detailing works undertaken

5.6.3 The site was to be remediated to 'Final Remediation Level' (FRL) above which a minimum of 600mm clean imported cap underlain by a marker barrier will be placed above the final development. S4UL values for a **commercial scenario** were used as the proposed human health criteria.

5.6.4 As the excavation turnover proceeded, the presence and extent of **asbestos** was to be assessed visually and results recorded. Re-use criteria for asbestos comprised the following:

- 0.0m to 0.2m below final remediation level
  - Material will meet 0.001% w/w asbestos, however rare ACM fragments may still remain within, consisting of hand-size or smaller fragments.
- 0.2m to 1.0m below final remediation level
  - The material will meet 0.01% w/w by gravimetric test, however ACM fragments may still remain within the material, which will typically be hand sized or smaller.
- Greater than 1.0m below final remediation level
  - This material will meet 0.1% w/w by gravimetric test, however ACM fragments may remain within the material which will typically be hand sized of smaller.

5.6.5 The above recommendations assume a minimum of 600mm clean soil cover underlain by a marker barrier will be placed above the final remediation level.

5.6.6 Proposed groundwater remediation target concentrations were developed by Celtic as park of a Detailed Controlled Waters Risk Assessment.

5.6.7 Perched groundwater originating from within excavations across the site was to be pumped into a temporary lined retention lagoon. The proposed temporary water treatment system included the following:

- Oil/water separator
- Sediment settlement/capture system
- Totalising volumetric flow meter
- Sand filtration
- Activated carbon adsorption system; and
- Effluent sample tap

5.6.8 Contamination hotspots were to be excavated, stockpiled, characterised and treated via ex-situ bioremediation if required.

5.6.9 A site-wide soil turnover to 2.0m depth was proposed, with visual and chemical screening to remove soils above the target concentrations. All obstructions encountered were to be broken out, assessed and stockpiled separately for crushing and re-use on site. All tanks, pipework and perched waters encountered during these works were to be removed.

5.7 Summary of Report 6's findings

5.7.1 Report 6 comprises a 'Factual Remediation **Verification** Report' issued by Celtic in June 2017.

5.7.2 This report details all of the remediation works, verification testing and treatment activities undertaken in line with the above remediation strategy (Report 5). Any agreed alterations, details of unexpected ground/contamination and results of all validation tests are also included.

5.7.3 The report covers both the wider site and the area within the current red line boundary.

5.7.4 Whole site chemical remediation target concentration values for site-won re-use material were agreed with Newport City Council (NCC) and Natural Resources Wales (NRW) as part of the regulatory consultation for discharge of relevant planning conditions.

5.7.5 With respect to controlled waters, this report suggests that the excavation and remedial treatment of made ground contamination would ensure that any ongoing sources of groundwater contamination would be removed.

5.7.6 A total of 345 samples of soil from turnover material were analysed, 11 of which failed the remedial targets, however after further assessment the mean value of soil contamination concentrations were significantly below the remedial targets and therefore these were not considered significant.

5.7.7 A total volume of 274,345m^3 of soils were excavated and turned over during the remediation works (including hotspot areas). Of this, 5,175m^3 of soils were quarantined to undergo further bioremediation treatment.

5.7.8 A total of 9,804m^3 of perched water was treated by the Celtic treatment system and discharged via the foul sewer network. Monthly samples pre & post treatment were collected for analysis.

5.7.9 Contaminated perched groundwater encountered in excavations and any water leaching from the biopiles during treatment was pumped to a temporary retention lagoon and then into the water treatment system.

5.7.10 Verification soil samples recovered from the turnover and backfilled cells were taken on a 25m x 25m grid across the site. Samples from the side walls and base of hotspot removal areas confirmed that the backfilled materials to the Final Remediation Level met the remediation requirements of the strategy.

5.7.11 It was considered that remediation works were successfully carried out in accordance with the remediation strategy and subsequent agreements with Newport City Council and Natural Resources Wales. The works removed and identified all contamination sources and turnover of soils was completed to a minimum of 2.0m depth within made ground areas.

5.7.12 As a result of the remedial work, it was stated by Celtic that the site was chemically verified for the future development based on meeting the Remediation Strategy Requirements, subject to any conditions and restrictions imposed by planning or regulatory authorities and the specific requirements of future development works.

5.8 Lithos comments

5.8.1 Ground investigation undertaken by Arup in 2014 (**Report 1**) suggests deep structures/obstructions were historically present across the majority of site, including areas within the current red line boundary.

5.8.2 Using Arup's historical layout plan, the former waste pit identified in Bay 7 may encroach into the site's far western boundary. However, **Report 5 & 6** suggest soils within the waste pit were excavated and disposed of off-site with the subsequent void being backfilled.

5.8.3 Even if the waste pit did encroach into the site, it is understood the rising water main runs along the site's western boundary, and therefore any deep backfill associated with the historical waste pit is unlikely to be encountered within the area of proposed development.

5.8.4 Whilst the waste pit appears to have been remediated and is therefore unlikely to be of concern to human health, areas of deep made ground (backfill) may be a source of migrating hazardous ground gas, although this is considered to be a low risk.

5.8.5 Contamination 'hot spots' were encountered by Arup in 2014 in the soils in two areas within the red line boundary (within the historical waste pit and within the former gas furnace). **Reports 5 & 6** indicate that both hotspots identified by Arup were fully remediated (excavation of soils with subsequent treatment or disposal), with the rest of the site being remediated to a depth of 2.0m.

5.8.6 Contamination (metals, SVOCs & VOCs) was also identified by Arup in perched groundwaters beneath the site, which were thought to be discontinuous, isolated groundwater bodies. **Reports 5 & 6** suggest that all perched groundwaters encountered during reclamation works were treated via a pump and treat system designed by Celtic englobe. In addition, **Report 6** states that **all sources** of contamination have been removed and therefore there is no further risk to controlled waters.

5.8.7 Whilst no post-reclamation intrusive geotechnical investigation was undertaken within the current red line boundary, the ground investigation undertaken by Integral Geotechnique (**Report 4**) suggests the north of site will not be underlain by shallow drift soils, and therefore shallow foundations may be possible. However, alluvium is likely to be present in the south and therefore alternative foundation solutions (rafts or piles, depending on loading) will likely be required. This will be confirmed during Lithos' investigation.

5.8.8 The remediation validation report (**Report 6**) suggests that the site is suitable for redevelopment given that **all soils** tested post-remediation yielded concentrations of contaminants below the approved remedial targets, providing a 600mm clean soil cover layer underlain by a marker barrier is placed in all gardens and landscaped areas.

6 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 An assessment of potential contaminants associated with the former uses has been undertaken with reference to CLR8 and the following DETR Industry Profiles: Metal manufacturing, refining and finishing works: iron and steelworks.

6.2 Given that the site has previously subject to remediation which has been supervised and validated by Celtic between 2016 and 2017, and was confirmed to be suitable for re-use subject to a 600mm capping layer underlain by a marker barrier, anticipated potential contaminants, within soil and/or groundwater include:

- Inorganics (metals associated with made ground)
- Asbestos &/or ACMs within the made ground associated with from the former buildings etc, and also confirmed to be present in low levels within the turnover layer
- TPH & PAH (residual contamination from remediation works originating from fuels, oils associated with machinery use and maintenance, heating oils / diesel tanks).

6.3 The Verification report (see Section 5.7) has confirmed that all soils tested post-remediation yielded concentrations below the approved remedial targets, and therefore no further testing for VOCs and sVOCs within soil and groundwater has been undertaken.

6.4 It was considered by Celtic that remediation works were successfully carried out in accordance with the Remediation Strategy and subsequent agreements with Newport City Council and Natural Resources Wales. Consequently, Lithos' site investigation was not designed, nor intended, to validate remediation works previously undertaken at this site.

6.5 Historical plans show the presence of a possible backfilled drainage ditch in the northwest of site. In addition, 3rd party reports suggest the upper c. 2.0m of ground should comprised re-engineered fill which should be confirmed during site investigation.

6.6 If possible, excavation along the western boundary within the footprint of the former Bay 7 waste pit will be undertaken and evidence of remaining deep obstructions will be noted during the proposed site investigation, to confirm the removal of below ground obstructions during remediation works.

6.7 A preliminary conceptual site model, presented as Drawing 5088/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 5.7 inclusive of this report.

6.8 Potential contaminant linkages are shown on the preliminary conceptual site model.

6.9 The conceptual model will likely be subject to modification in light of data arising from the proposed intrusive ground investigation; see Section 11.2.

7 GROUND INVESTIGATION DESIGN

7.1 Anticipated ground conditions & potential issues

7.1.1 Based on the data reviewed in Sections 4 (Environmental Setting) and 5 (Previous Investigation Findings), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Anticipated to between c.2.0m and 2.5m depth and will likely comprise engineered fill with areas of localised deeper made ground within the footprint of former structures.
Natural soils	Alluvium (gravelly Clay and/or Peat) in the south of site, likely thin or absent in the north.
Bedrock	Mudstone anticipated at around 12 depth.
Mineworkings	None anticipated
Groundwater	Shallow, perched within made ground and/or drift soils.

7.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

- Inorganics (metals associated with made ground)
- Asbestos &/or ACMs within the made ground associated with from the former buildings etc, and also confirmed to be present in low levels within the turnover layer
  TPH & PAH (residual contamination from remediation works originating from fuels, oils associated with machinery use and maintenance, heating oils / diesel tanks)

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	1. Historical steel works 2. Made ground (top c.2.0m of soils) 3. Backfilled ponds/pits 4. Raw material storage etc	1. Inorganics, organics, asbestos. However, remediation works were undertaken site wide in 2016/2017. 2. Inorganics and asbestos associated made ground turnover layer. 3. Associated with the historical drainage ditch in the north of site (deep made ground) may be present. 4. Current use as a storage compound – spillage/leakage of fuels/oils.
Potential off-site contamination sources	1. Historical Steelworks 2. Backfilled pits 3. Landfill	1. Inorganics, organics, asbestos. However, remediation works were undertaken site wide in 2016/2017. 2. Associated with remediation of former steel works. 3. Associated with off site waste disposal site.
Potential geotechnical hazards	1. Relict buried obstructions 2. Deep MG 3. Soft ground	1. Associated with former steelworks infrastructure. Likely at >2.0m depth. 2. Associated with former steelworks infrastructure (mainly waste pit and furnace). 3. Soft clays and peat (alluvium).
Other potential constraints	1. Contaminated groundwater 2. Underground and/or overhead utilities	1. Shallow groundwater containing elevated concentrations of metals and organics – however, perched water was treated by Celtic in 2016 & 2017. 2. Rising water main will require easement.

7.2 Ground investigation design & strategy

7.2.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Exploratory holes	Purpose
TPs 1 to 10	To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of made ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc • Suitability of the ground for founding structures and highways
BHs 01 to 03	To confirm the density of natural in-situ granular soils and strength of cohesive deposits via SPTs. To install monitoring wells across the site in order to: • Monitor for hazardous gas • Determine groundwater levels and assess flow direction

7.2.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 6 above. A nominal 30m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.

7.2.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most pits.

8 FIELDWORK

8.1 Objectives

8.1.1 The original investigation strategy is outlined in Section 7.2 above.

8.1.2 One trial pit in the northeast was not advanced due to ongoing site operations (use of the site as a storage compound by Lovell Homes for the adjacent construction site).

8.2 Scope of works

8.2.1 Fieldwork was supervised by Lithos between the 9th to 12th December 2024 and comprised the exploratory holes listed below.

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 01 to 09	3.5m	Vane tests in cohesive soils
Cable percussive boreholes	BHs 01 to 03	12m to 25m	SPTs typically at 1.0m centres. Monitoring wells installed in all BHs

8.2.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

8.2.3 Exploratory hole logs are presented in Appendices F to G to this Report. These logs include details of the:

- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of the in-situ testing
- The monitoring wells installed

8.2.4 Exploratory hole locations are shown on Drawing 5088/6 presented in Appendix B; hole positions are based on data from a hand-held GPS (typically +/- 3m accuracy) and have not been surveyed in.

8.3 Exploratory hole location constraints

8.3.1 No access was available within the far north of site to investigate the backfilled drainage ditch due to ongoing use of the site as a storage compound by the adjacent development site.

8.3.2 No access was available in the far west of the site to investigate the possible deep made ground associated with the former waste pit (Bay 7) due to the presence of a rising water main.

8.3.3 Investigation around the remaining security building was not possible due to the presence of construction materials and ongoing use by the adjacent development site.

9 GROUND CONDITIONS

9.1 General

9.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F to G.

9.1.2 Typical ground conditions encountered at the site are described below in Sections 9.2 (made ground) and 9.4 (natural ground), with a summary provided in the table on page 19.

9.2 Made ground

9.2.1 The made ground on site is a heterogeneous mixture of materials and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of the following broad types:

- **Macadam Hardstand:** encountered in TP06 to 0.05m depth.
- **Cohesive Made Ground:** Light brown sandy gravelly Clay. Gravel comprised mixed lithologies including brick, concrete, wood and plastic. Encountered in 7 trial pits and 1 borehole to depths of between 0.3m and 2.8m (average depth of 0.8m).
- **Granular Made Ground:** Dark grey ashy sandy angular fine to coarse Gravel of brick, concrete, mudstone, wood and clinker encountered in all 9 trial pits and 2 boreholes to depths of between 1.6m and 2.6m (depth to base of 2.2m).
- **Brickfill:** encountered in TP01 between 0.2m and 0.3m depth as a slightly sandy angular to subangular fine to coarse Gravel of brick.

9.2.2 Review of the trial pit logs suggest made ground thicknesses beneath the site vary between 1.6m and 2.9m; average 2.3m. The thickest made ground (TP02) was encountered in the north of site. Made ground less than 2.0m thick was only encountered in TP09.

9.2.3 It is understood that the top 2.0m of soil was subject to turnover and re-compaction by Celtic and Walters UK Ltd between 2016 & 2017. Due to the presence of **fast water inflows,** inspection of trial pit walls was limited and therefore identification of the base of the turnover material was not possible.

9.3 Obstructions

9.3.1 It is apparent from a review of historical OS Plans (see Section 3) that buildings have been present on about 40% of the site area. Drawing 5088/3A shows the footprints of the former structures, and areas of hardstand.

9.3.2 However, it is understood that obstructions to depths of up to 2.0m (and locally deeper where required) were removed during the 2016/2017 reclamation works.

9.3.3 No obstructions were encountered in any of the 9 trial pits excavated across the site (4 within footprints of former buildings), however, the presence of obstructions cannot be entirely discounted, particularly at depths >2.0m which records suggest were not subject to turnover during the reclamation works and within the footprint of the security building which was not demolished.

9.4 Natural ground

9.4.1 Natural ground was encountered in all exploratory holes, and typically comprised:

- **Cohesive Tidal Flat Deposits:** encountered beneath the made ground as a Firm light grey gleyed brown slightly sandy Clay to depths of between 3.4m and 5.3m. **Peat** was encountered directly beneath the firm clay and was typically 0.6m to 0.8m thick. This was underlain by soft Clays to depths of between 9.5m and 12.7m.
- **Granular Tidal Flat Deposits:** encountered in BH03 from 9.5m as a reddish brown slightly clayey Sand to 11.8m, underlain by a Gravel of mixed lithologies to 12.2m depth.

9.4.2 **Bedrock** (St Maughans Formation Mudstone) was encountered in all 3 boreholes from between 12.2m and 12.7m depth. Where it was encountered, mudstone was penetrated by between 1.42m and 1.58m depth and comprised a weak reddish brown mudstone. Boreholes refused in the mudstone bedrock.

9.4.3 The in-situ relative density of granular deposits and strength of cohesive deposits on site was established by carrying out Standard Penetration Tests (SPTs) during the drilling of the boreholes; see Section 13.7.

9.5 Visual & olfactory evidence of organic contamination

9.5.1 No visual or olfactory evidence of organic contamination was noted during the investigation.

Summary of ground conditions

Hole	Final depth	Depth to Base of Made Ground	Depth to Base of						St Maughans Formation (mudstone)	Penetration	Remarks
			Made Ground				Natural Soils				
			Macadam Hardstand	Cohesive Made Ground	Brickfill	Granular Made Ground	Cohesive Tidal Flat Deposits	Granular Tidal Flat Deposits			
TP01	2.8	2.6	-	0.2	0.3	2.6	2.8	-	-	-	At 1.1m, saturated ground.
TP02	3.5	2.9	-	1.6	-	0.5, 2.9	3.5	-	-	-	At 1.6m, saturated ground.
TP03	3.6	2.0	-	0.3	-	2.0	3.6	-	-	-	At 0.9m, water seepage.
TP04	3.2	2.4	-	0.3	-	2.4	3.2	-	-	-	At 1.1m, saturated ground with stagnant organic odour.
TP05	3.3	2.3	-	0.5	-	2.3	3.3	-	-	-	At 1.7m, saturated ground.
TP06	3.3	2.1	0.1	-	-	2.1	3.3	-	-	-	At 1.7m, water seepage.
TP07	3.0	2.3	-	0.5	-	2.3	3.0	-	-	-	At 1.8m, water.
TP08	3.5	2.2	-	0.5	-	2.2	3.5	-	-	-	At 1.5m, water.
TP09	3.1	1.6	-	-	-	1.6	3.1	-	-	-	At 1.6m, water.
BH01	14.28	2.8	-	2.8	-	-	12.7	-	12.7	1.58	Monitoring well installed.
BH02	13.82	2.3	-		-	2.3	12.4	-	12.4	1.42	
BH03	13.69	2.5	-	-	-	2.5	9.5	12.2	12.2	1.49	

9.6 Groundwater

9.6.1 Significant inflows of groundwater were encountered during the investigation. Groundwater was encountered across the site from 0.9m depth, with the Granular Made Ground typically being fully saturated. This groundwater appears to be perched within the Made Ground, which has also previously been confirmed in third party investigations.

9.6.2 Groundwater levels recorded in the monitoring wells to date are summarised below.

Hole	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
			m bgl	m AoD#
BH01	1.0 – 3.0m (Granular Made Ground)	Perched	1.41	10.13
BH02	3.0 – 6.0m (Cohesive Alluvium & Peat)		1.62	9.69
BH03	3.2 – 5.2m (Cohesive Alluvium)		0.93	7.56

estimated from topo survey data to inform foundation design.

9.6.3 Dip data to date suggests a shallow water table. Groundwater was particularly shallow (within 1.5m of ground level) in all 3 boreholes. After an initial dip to record standing water level, the wells were bailed-out to establish an approximate rate of recharge. Findings were:

Hole	Vol. removed /litres	Water level lowered by /m	From / to m bgl	Water level recovered to /m bgl	After / mins	Recovery rate
BH01	8	0.46	1.68 to 2.14	2.11	12	Moderate
BH02	12	1.82	1.90 to 3.72	3.69	11	Moderate
BH03	12	Unable to locate the well on visit where bailing was undertaken				

Note: In a 50mm diameter well pipe there is approximately 2 litres of water per metre of water column.

9.6.4 Wells could not be bailed below 2.0m depth (BH01) and 3.7m depth (BH02) due to rapid recharge, therefore it is apparent from the above that permeability of the ground is high.

9.6.5 These results will be required by the foundation designer, drainage designer, and groundworker (especially if/where deep excavation is required).

9.7 Stability

9.7.1 Stability of excavations within made ground was typically poor. The assessment of natural strata stability was difficult given the presence of shallow groundwater, but shallow excavations are unlikely to remain stable.

10 CONTAMINATION (ANALYSIS)

10.1 General

10.1.1 The site formerly comprised the Courtybella Steelworks between the 1930's and 2009. Following demolition, the site was subject to reclamation works. More recently, the site was used as a temporary overflow car park for the adjacent hospital, before being used as a storage compound for ongoing residential development to the west of site.

10.1.2 Whilst records suggest the site was remediated and confirmed to be suitable for a proposed mixed end use including a school, residential and commercial, recent **post remediation** usage may have given rise to some (likely minor) ground contamination.

10.1.3 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 6.

10.1.4 In the context of risks to human health associated with residential redevelopment, the Tier 1 Soil Screening Values referenced in this report have been derived via the CLEA default conceptual site model (CSM) used for generating SGVs, but amended, where appropriate, to be more specific to redevelopment within the planning process.

10.1.5 Where available, Category 4 Screening Levels (C4SL) have also been referenced.

10.1.6 The site is intended to be redeveloped as a care home, which will include landscaped areas but no formal private gardens. Lithos Scenario C generic screening values have been adopted for the assessment of material for potential retention and re-use on site. Scenario C assumes ground floor apartments with indoor inhalation (individual apartments, with a smaller footprint than a private house), with a reduced outdoor exposure duration (cf. a private garden), with no allowance for homegrown produce.

10.1.7 The critical receptor is still a 0-6 year old female child, since it is not unreasonable to assume residents could have young children visiting, who could reasonably spend time in outdoor space. Using a child as a receptor therefore provides a conservative assessment.

10.1.8 Whilst some residents may enjoy working in the landscaped areas, this is unlikely to be representative of all residents and exposure in Scenario C should be sufficiently precautionary to account for this.

10.1.9 There is also a low possibility that residents may opt to start a shared 'allotment' style garden. However, the current layout does not allow for this, and previous experience of such schemes suggest these usually adopt raised planters to aid access. Such a scheme would require import of subsoil and topsoil, which is beyond the scope of this assessment.

10.1.10 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

10.2 Testing scheduled

10.2.1 Based on the above assessment, Lithos submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of sample	No. of samples	Determinands
Made ground	18	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID
Natural soil	2	TOC, Speciated Polycyclic Aromatic Hydrocarbons (PAH), Banded Total Petroleum Hydrocarbons (TPH)
Macadam Hardstand	1	Speciated PAH including coronene

10.3 Waste Acceptance Criteria (WAC)

10.3.1 Lithos only typically include WAC analysis during a site investigation if significant off-site disposal (of soil likely to be classed as hazardous waste) is anticipated and the source area (e.g. proposed basement) is known. Furthermore, WAC analysis is typically more appropriate following excavation and stockpiling of surplus soils (cf. in-situ soils) because the samples taken will be more representative of the waste mass to be exported.

10.3.2 However, LNT have requested WAC analysis on in-situ soils as part of this site investigation.

10.3.3 Lithos have scheduled a total of 6 samples for WAC testing, shown below:

- 4 x samples of Granular Made Ground
- 2 x samples of Cohesive Tidal Flat Deposits

10.3.4 Results of WAC testing are included in Appendix H. This data will be required if the materials are to be disposed of to landfill. Further advice regarding waste classification is provided in Section 11.7.

10.4 Soil contamination results

10.4.1 The soil contamination test results are summarised in the tables on pages 23 to 25.

10.4.2 Laboratory test certificates as received from the laboratory are presented in Appendix H to this report.

Summary of degree of soils contamination (inorganics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Trigger Level Concentrations are shown in BLUE and assume a **residential apartment with landscaped areas** end-use.											
			pH	As ∞	B~	Cd ∞	Cr x	Cu♣$	Pb ∞	Hg*	Ni	Se	Vn	Zn$	Asbestos
				40	5	149	4000	100	200	244	123	596	586	200	
TP01	0.25	Brickfill	10.1	5.4	0.5	0.3	17	9.3	13	0.07	5	0.9	16	48	N.D.
TP07	0.3	Cohesive Made Ground	11.0	18	1.9	0.5	80	70	140	0.42	31	0.5	73	**1300**	**Chrysotile**
TP01	0.1	Cohesive Made Ground	10.2	9.5	2.8	2.1	44	83	70	0.35	35	1.3	33	**300**	**Chrysotile**
TP02	0.6	Cohesive Made Ground	10.4	7.8	0.7	0.2	22	23	36	0.15	20	0.8	31	100	N.D.
TP03	0.2	Cohesive Made Ground	10.7	8.5	1.6	0.7	49	42	44	0.17	22	0.6	35	**210**	N.D.
TP04	0.2	Cohesive Made Ground	10.3	9.6	1.7	1.2	64	61	88	0.17	23	0.8	44	**250**	N.D.
TP05	0.3	Cohesive Made Ground	11.1	9	1.2	0.7	39	52	44	0.13	19	1	37	170	N.D.
TP08	0.2	Cohesive Made Ground	12.1	5.2	0.7	2.4	33	33	56	0.13	16	0.6	25	**360**	N.D.
BH02	2.4	Cohesive Tidal Flat Deposits	8.3	11	2.1	< 0.1	31	14	37	0.05	29	< 0.5	42	**2300**	N.D.
BH03	2.6	Cohesive Tidal Flat Deposits	8.8	7	0.5	0.1	30	18	18	0.17	34	0.5	38	130	N.D.
TP01	0.5	Granular Made Ground	11.9	4.8	1.9	0.2	27	18	21	< 0.05	19	0.7	24	88	**Amosite**
TP02	0.2	Granular Made Ground	11.7	2.1	1.1	< 0.1	13	6.3	9.9	< 0.05	4.4	0.8	10	46	N.D.
TP02	1.9	Granular Made Ground	11.2	7.9	1.2	0.2	110	24	44	0.07	11	1.8	330	82	N.D.
TP03	0.8	Granular Made Ground	11.5	6.4	1.1	0.3	27	20	70	0.12	8.6	0.5	43	**300**	**Chrysotile**
TP04	0.6	Granular Made Ground	11.6	6.9	1	0.2	110	37	57	0.06	16	1.2	74	**500**	**Chrysotile**
TP05	0.8	Granular Made Ground	11.0	6.5	1	0.1	16	40	50	0.06	14	< 0.5	14	140	N.D.
TP06	1	Granular Made Ground	11.0	9.2	1.4	0.5	58	53	94	0.15	20	0.7	51	**310**	N.D.
TP07	1.4	Granular Made Ground	11.6	4	1.2	0.3	15	16	60	0.08	5.9	0.8	19	120	**Chrysotile**
TP08	0.8	Granular Made Ground	11.6	4.9	1.1	0.3	200	33	45	< 0.05	11	2.8	170	**800**	**Chrysotile**
TP09	1.0	Granular Made Ground	11.3	7.5	1	0.3	99	60	99	0.1	14	1.9	140	**1200**	**Amosite**

Key		Source of guidance trigger level	
36	Parameter tested for and found to be in excess of Tier 1 value.	With the exception of those annotated with one of the symbols below (∞, $, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.071.	
179	Parameter tested for and found to be > 5 x Tier 1 value.		
12	Parameter tested for but not found to be in excess of Tier 1 value.	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).
	Parameter not tested for.	$	MAFF. Code of Practice for Agricultural Practice for the Protection of Soil, 1998.
♣	Tier 1 Value is pH dependent.	~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI Tier 1 would be 21mg/kg.		
ND	No fibres detected (asbestos screen)		
		*	Assumes mercury present as an inorganic compound (cf. elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.

Summary of degree of soils contamination (organics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Trigger Level Concentrations are shown in BLUE and assume a **residential apartment with landscaped areas** end use					
			% TOC	PAH		TPH - C6 to C40		
				B(a)P ∞	Naphthalene	GRO~ C_6 to C_{10}	DRO◊ C_{10} to C_{21}	LRO C_{21} to C_{40}
				5	37	23	215	3829
TP01	0.3	Brickfill	6.9	< 0.03	< 0.03	< 0.1	<30	<20
TP07	0.3	Cohesive Made Ground	6.1	0.51	0.04	< 0.1	<59	85
TP01	0.1	Cohesive Made Ground	2.9	0.17	0.03	< 0.1	<30	<20
TP02	0.6	Cohesive Made Ground	2	0.28	0.09	< 0.1	96	210
TP03	0.2	Cohesive Made Ground	3.3	0.07	< 0.03	< 0.1	<30	<20
TP04	0.2	Cohesive Made Ground	2.9	0.22	< 0.03	< 0.1	<30	<20
TP05	0.3	Cohesive Made Ground	2.5	0.18	0.04	< 0.1	<30	<20
TP08	0.2	Cohesive Made Ground	6.2	0.07	< 0.03	< 0.1	<30	<20
BH02	2.4	Cohesive Tidal Flat Deposits	0.5	< 0.03	< 0.03	< 0.1	<30	<20
BH03	2.6	Cohesive Tidal Flat Deposits	0.5	< 0.03	< 0.03	< 0.1	<30	<20
TP01	0.5	Granular Made Ground	3.2	0.33	< 0.03	< 0.1	**235**	895
TP02	0.2	Granular Made Ground	3.4	0.16	0.06	< 0.1	73	201
TP02	1.9	Granular Made Ground	3.8	0.08	< 0.03	< 0.1	<30	<20
TP03	0.8	Granular Made Ground	3.2	0.58	0.03	< 0.1	138	402
TP04	0.6	Granular Made Ground	7.0	2.5	0.15	< 0.1	**306**	647
TP05	0.8	Granular Made Ground	8.1	3.3	0.19	< 0.1	**228**	415
TP06	1.0	Granular Made Ground	6.9	0.89	0.2	< 0.1	68	213
TP07	1.4	Granular Made Ground	3.0	0.66	0.04	< 0.1	<30	<20
TP08	0.8	Granular Made Ground	5.2	2.1	0.06	< 0.1	**319**	855
TP09	1.0	Granular Made Ground	8.6	1.2	0.08	< 0.1	119	431

Key		Source of guidance trigger level	
60	Parameter tested for and in excess of Tier 1 concentration.	All Soil Screening Values in brackets above have been derived using CLEA v1.071. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).	
0.3	Parameter tested for but not in excess of Tier 1 concentration.	~	Assumes all GRO is aromatic fraction C7 to C8.
	Contaminant not tested for.	◊	Assumes all DRO is aliphatic fraction C10 to C12.
		∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).

Inorganic determinands

10.4.3 Of the 20 samples of made ground analysed for inorganic parameters, 9 can be classified as uncontaminated and 11 could be classified as contaminated.

10.4.4 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of proposed end-uses).

10.4.5 All 11 elevations encountered were for zinc, with the highest concentration of 2300mg/kg being recorded in BH02 at 2.4m depth within Cohesive Tidal Flat Deposits.

10.4.6 Current UK guidance regarding the statistical analysis of soil contamination data obtained during a site investigation is provided by CL:AIRE[1], and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

10.4.7 However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by heterogenous made ground, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not usually necessary to demonstrate that made ground soils are "clean" and therefore there is no need to test large numbers of samples and undertake statistical analysis. Heterogenous made ground sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).

10.4.8 The difference between the old and new approaches, including how Lithos apply the statistical assessment is detailed in Generic Note 04, included as Appendix A to this report.

10.4.9 Lithos can confirm that statistical assessment of the made ground and natural strata is not appropriate because:

- Made Ground is considered too heterogenous
- There are insufficient samples from Cohesive Made Ground and Cohesive Tidal Flat Deposits to allow representative statistical assessment to be undertaken.

10.4.10 However, **zinc** is a phytotoxic metal; phytotoxicity describes the inhibitive and toxic effect high concentrations of some substances can have on plant growth.

10.4.11 Most substances are harmful to human health at lower concentrations than would be detrimental to plant growth. However, there are three notable exceptions - boron, copper and zinc. Plants are the more sensitive receptor to these elements i.e. detrimental effects are seen in plants at concentrations which do not present a risk to human health. Consequently, for zinc, consideration and protection of flora would also be protective of human health.

10.4.12 Allowable concentrations of heavy metals in arable soils are set out in Defra's Code of Good Agricultural Practice 2009[2]. The value for zinc is 200mg/kg, and is based on a continued annual application of heavy metal rich fertiliser (sludge); as such it is not representative of activity in a standard UK garden.

[1] *CL:AIRE, 2020.Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.*
[2] *Defra – Protecting our Water, Soil & Air – A Code of Good Agricultural Practice for farmers, growers and land managers. 2009*

10.4.13 Lithos have also derived a value for zinc in relation to risks to human health, using the CLEA model, assuming a residential end use with consumption of home grown produce in a sandy loam soil with 6% SOM. The reported value is **2,170mg/kg**, ten times greater than the potential phytotoxic concentration.

10.4.14 Using the value of 2,170mg/kg only one sample of Cohesive Tidal Flat Deposits (BH03 at 2.4m) is considered to be elevated. However, this sample was taken from 2.4m depth and will therefore be isolated from end-users of the site and is therefore considered insignificant.

10.4.15 On balance, given the context of a residential development and the relatively low concentrations recorded, zinc is not considered significant and no special remedial measures are considered necessary.

Asbestos

10.4.16 No visual evidence of asbestos-containing materials (ACMs), such as broken fragments of asbestos-cement sheeting, was noted during the excavation of trial pits, however, due to the made ground being fully saturated, inspection of the trial pits and recovered spoil was limited.

10.4.17 It is understood that during remediation works undertaken by Walters Ltd and Celtic between 2016 and 2017, soils containing asbestos were placed in the following layers:

- 0.0m – 0.2m – soil containing <0.001% asbestos
- 0.2m – 1.0m – soil containing <0.01% asbestos
- >1.0m – soil containing <0.1% asbestos

10.4.18 Asbestos fibres were identified in 8 of the 20 samples screened. Further analysis (asbestos quantification) was instructed.

Hole ID	Depth (m)	Strata	ACM Identified?	Results of Asbestos quantification analysis
TP07	0.3	Cohesive Made Ground	No	0.001% chrysotile
TP01	0.1	Cohesive Made Ground	No	0.005% chrysotile
TP01	0.5	Granular Made Ground	Insulation	0.010% amphibole
TP03	0.8	Granular Made Ground	No	0.003% chrysotile
TP04	0.6	Granular Made Ground	No	0.006% chrysotile
TP07	1.4	Granular Made Ground	No	0.001% chrysotile
TP08	0.8	Granular Made Ground	No	0.001% chrysotile
TP09	1.0	Granular Made Ground	No	0.007% amphibole

10.4.19 The results are in broad accordance with the remediation works which are recorded to have been undertaken by Celtic.

10.4.20 If during appropriate laboratory analysis only 1 or 2 fibres (or fibre bundles) are seen and identified as asbestos, HSG248[3] suggests that the term 'trace asbestos identified' can be used; the reported concentration will be < 0.001%. Consequently, all of the results reported here whilst are mostly very low, are more than a trace.

[3] *HSG:2021. Asbestos: The Analysts' Guide.*

Organic determinands

10.4.21 As discussed above, the site is intended to be redeveloped as a care home, which will include landscaped areas, but no formal private gardens. Lithos Scenario C generic screening values have been adopted for the assessment of material for potential retention and reuse on site. Scenario C assumes ground floor apartments for indoor inhalation (individual apartments, with a smaller footprint than a private house), with a reduced outdoor exposure and duration (cf. a private garden), and no allowance for home grown produce.

10.4.22 Lithos have used the CLEA model to derive risk-based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.

10.4.23 However, these screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with lower screening values may be required.

10.4.24 In order to check the validity of Lithos' Tier 1 Soil Screening Values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill type	Typical TOC (%)	Comparison of soil results with revised screening value necessary?
Brickfill	>5%	No
Cohesive Made Ground	3.7%	Yes, but no significant organic contamination was recorded in this soil type. All determinands well below "6%" screening value; most below limit of detection.
Granular Made Ground	>5%	No
Cohesive Tidal Flat Deposits	0.5%	Yes, but no significant organic contamination was recorded in this soil type. All determinands well below "6%" screening value; most below limit of detection.

Hydrocarbons (TPH & PAH)

10.4.25 Given the remediation works which records indicate were completed in 2016/17, and the absence of visual/olfactory evidence of any hydrocarbon contamination, only a simple banded TPH (cf. full speciation) was scheduled on 10 samples of Granular Made Ground, 7 samples of Cohesive Made Ground, 1 sample of Brickfill and 2 samples of Cohesive Tidal Flat Deposits.

10.4.26 TPH can be associated with a variety of sources and elevated TPH concentrations do not automatically infer a petroleum product is present; indeed the absence of petroleum products on this site is reflected in the preliminary conceptual model. TPH analysis will detect most hydrocarbons and is not restricted to those detailed within the TPHCWG reports.

10.4.27 Whilst not necessarily associated with a petroleum product, the significance of these hydrocarbons, with respect to health, should still be assessed. Providing no other plausible sources are present on site (solvents, degreasers etc), it can be assumed that the most problematic compounds detected within the banded TPH screen are polycyclic aromatic hydrocarbons (PAHs).

10.4.28 The significance of PAHs can be determined by considering indicator compounds. In most cases, benzo(a)pyrene is adopted as an indicator (due to the wealth of toxicological data available) and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food.

10.4.29 A C4SL toxicity assessment using the surrogate marker approach can be used to estimate the significance of a mixture of PAHs in soil, using toxicity data for indicator compounds within that mixture. Exposure to the indicator (or surrogate marker) is assumed to represent exposure to all PAHs in that matrix.

10.4.30 The sample profiles here are sufficiently similar to the toxicity study adopted for the C4SL assessment, and B(a)P concentrations are below Lithos' Tier 1 Value. Consequently, the hydrocarbons detected are unlikely to pose any unacceptable risk to end users, and no remediation is required.

Polycyclic Aromatic Hydrocarbons (PAH)

10.4.31 There are numerous PAH compounds. The USEPA identified 16 PAHs that are considered to represent the most problematic in terms of toxicology, fate and behaviour. The UK have also focused on these 16 and these are included in the laboratory report where speciated PAH analysis has been scheduled.

10.4.32 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).

10.4.33 Speciated analysis has confirmed the absence of significant concentrations of both **benzo(a)pyrene** and **naphthalene** in the soils beneath this site.

11 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

11.1 Summary of significant contamination

11.1.1 Made ground underlies the entire site to depths of between 1.6m and 2.9m (average depth to base of 2.3m) and typically comprises Cohesive Made Ground underlain by Granular Made Ground.

11.1.2 The made ground contains concentrations of **asbestos** above trace levels, and contains materials (e.g. brick, concrete and clinker etc) which would generally be considered undesirable as a near surface material in garden areas.

11.1.3 Records suggest remediation works were undertaken on site, and across the wider area by Walters UK Ltd and Celtic between February 2016 and January 2017. Works comprised the removal of all identified contamination hotspots (two were located within the red line boundary), turnover and remediation of the upper 2.0m of soil, and pump & treat with subsequent disposal of all perched waters encountered during the remediation works.

11.1.4 Soils were treated to an agreed screening criteria for a commercial end use with a 600mm clean soil cover and marker barrier layer.

11.1.5 This report is **not** intended to validate the above remediation works which it is understood were approved by Newport City Council and Natural Resources Wales in 2017.

11.1.6 Given the previous remediation works undertaken, no significant remediation should be necessary other than the placement of a capping layer, in accordance with recommendations given in the Celtic Validation Report (Ref. R1664/17/4768). Some preparatory works will also be necessary to render the site suitable for development; see Section 15.2.

11.2 Revised conceptual ground model (contamination)

11.2.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.

11.2.2 A revised Conceptual Site Model is presented as Drawing 5088/7 in Appendix B. The Model includes the contaminants described in Section 11.1 above, and potential contaminant linkages (summarised below in Section 11.4) to receptors.

11.3 Environmental setting & end use

11.3.1 As discussed in Section 11.1 above, contamination exists in the soil beneath this site. In order to assess the significance of this contamination, consideration must be given to the site's environmental setting and the proposed end use.

11.3.2 The underlying Drift Soils are classified as an unproductive aquifer. The St Maughans Formation (mudstone) bedrock is classed as a Secondary A Aquifer. The nearest surface watercourse is the Twenty Acres Reen located 119m west. Therefore, the site's environmental setting is considered to be **low sensitivity**.

11.3.3 With respect to human health, the proposed end use (residential) is considered sensitive.

11.3.4 Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 15.6.

11.4 Contaminant linkages

11.4.1 In terms of a proposed redevelopment of this site, plausible contaminant linkages can be summarised as follows.

Contaminants

11.4.2 Contaminants have been summarised in Section 11.1 above.

Pathways

11.4.3 Potential contaminant pathways include:

- Inhalation of contaminated particulates
- Migration of hazardous gas

Receptors

11.4.4 Potential contaminant receptors include:

- End users of the site (residents)

11.4.5 It can be concluded that there are plausible pathways between the soil contaminants summarised in Section 11.1 above and potential receptors.

11.5 Potential remediation options

General

11.5.1 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

Soil cover

11.5.2 As discussed in more detail below, in accordance with recommendations given in the Celtic Validation Report (Ref. R1664/17/4768) and due to the presence of **asbestos** at >0.001% in shallow soils, placement of a **600mm** thick surface cover of "clean" soil including a minimum **150mm** hard-dig/marker layer at the base should be placed in landscaped areas. Due to the proposed end use of a care home, no areas of private gardens are anticipated.

11.5.3 In areas covered by hardstand, or floor slabs (buildings) contaminants will be satisfactorily isolated from end users.

11.5.4 New utilities should be laid in trenches reinstated with 'clean' backfill in order to prevent exposure to maintenance workers in the future.

Asbestos

11.5.5 CL:AIRE has published a Joint Industry Working Group (JIWG) guidance[4] document with the support of the Health & Safety Executive which provides an explanation of how legal requirements of the Control of Asbestos Regulations 2012 have been interpreted to be more directly applicable to the risks associated with asbestos contaminated soil and construction & demolition materials.

11.5.6 Samples of soil and/or construction & demolition material recovered from brownfield sites may exhibit a wide range of concentrations of asbestos contamination. Due consideration should therefore be given to the interpretation of any 'trace' concentrations in the wider context of the site. Guidance prepared by the JIWG asbestos suggests that judgements on the nature, degree and significance of contamination present should not be made on the basis of individual samples alone.

11.5.7 As discussed in Section 10.3.4, an asbestos ID (screen) was scheduled on 20 samples of made ground, with asbestos identified in 8 samples. Supplementary analysis (asbestos quantification) of 8 samples yielded all results above detection limits. However, it is understood that asbestos was placed in layers based on the concentration of asbestos within the soils. Quantification results recorded concentrations between 0.001% and 0.007%.

11.5.8 Made ground soils with only a trace of asbestos still have the potential to be hazardous to human health. This is because soil with a low asbestos content of say 0.001% may contain thousands, possibly hundreds of thousands, of potentially respirable asbestos fibres per gram of soil. However, asbestos fibres only pose a risk if they are allowed to become airborne, and release from soil to air can only occur if the soil is dry and then agitated (e.g. by vehicle movement, excavation, wind etc).

11.5.9 Provided soils are kept damp the risk of airborne fibre release, even during disturbance associated with excavation, should be negligible, and certainly below the control limit (as set by the Control of Asbestos Regulations 2012) of 0.1 f/cm^3 airborne fibres averaged over a 4-hour period.

[4] *Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance. CL:AIRE, 2016.*

11.5.10 In our experience, damp soils do not allow the release of asbestos fibres, even from soils that contain concentrations in excess of the hazardous waste threshold (0.1%).

11.5.11 Consequently, in line with the principles of sustainable development, there should be no need to export any soil from site.

11.5.12 There may be transient risks during the excavation of made ground soils. Exposure to asbestos of personnel involved in these excavation works is considered likely to be sporadic and of low intensity (provided soils are kept damp). Therefore in accordance with Regulation 3(2) of the Control of Asbestos Regulations (2012), exemption from Regulations: 9 (notification of work with asbestos); 18(1)(a) (asbestos areas); and 22 (health records and medical surveillance) should apply, provided it is 'clear from a suitable and sufficient risk assessment that the control limit of 0.1 f/cm3 airborne fibres averaged over a 4-hour period will not be exceeded'.

11.5.13 Nonetheless, risks must be mitigated by appropriate measures (principally damping down), working procedures, and PPE. Method Statements and Risk Assessments should be prepared by the Contractor, and then be reviewed by the Client and Lithos.

11.5.14 Any fragments of asbestos cement sheeting encountered during the excavation works, should be gathered by hand and placed in double sealed bags. Personnel involved in this activity must be equipped with an appropriate respirator (i.e. a FFP3 or better), in addition to their "standard" PPE. The bags of asbestos waste should be placed in a sealed skip for off-site disposal at a suitably licensed landfill site; such material will be classified as hazardous waste.

11.5.15 In accordance with recommendations given in the Celtic Validation Report (Ref. R1664/17/4768), due to the presence of **asbestos** at concentrations in excess of 0.001% in shallow soils, the placement of a **600mm** thick surface cover of "clean" soil is required, the cover layer should include a **150mm** hard-dig layer at the base.

11.5.16 New utilities should be laid in trenches reinstated with 'clean' backfill in order to prevent exposure to maintenance workers in the future.

11.5.17 See also comments in the 'Waste Classification' Section below.

Inorganic contamination

11.5.18 Whilst no significant inorganic contamination has been encountered, in accordance with the Factual Remediation Verification Report (Ref. R1664/17/4768) issued by Celtic in June 2017, there is a requirement for a minimum **600mm** soil cover underlain by a underlain marker in all garden and landscaped areas. This cover will break potential contaminant linkages between the asbestos known to be present and future end-users.

Organic contamination

11.5.19 No areas of gross organic contamination were encountered during the site works. However, localised areas of more onerous contamination than that identified to date may be present on site.

11.5.20 Given the comments made in Section 3 above (site's former usage), it would be prudent to allow for the off-site disposal of some grossly contaminated soil in the event that unexpected contamination is encountered. Further advice should be sought from a specialist contractor, with experience of brownfield remediation, regarding an appropriate contingency.

11.5.21 Furthermore, it would be prudent to install a **vapour membrane** beneath the proposed care home.

11.6 Summary of potential contaminant linkages & mitigation

11.6.1 In terms of the proposed redevelopment plausible contaminant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Plausible contaminant linkage? (and remediation options where required)
Human health (Future residents) ◊	Inhalation (dust and/or vapours)	Asbestos in the made ground	Isolation beneath at least 600mm clean soil cover including a 150mm hard to dig layer at the base in garden and landscaped areas
Buildings	Migration & accumulation of explosive gas	Methane, carbon dioxide	To be assessed on completion of monitoring and gas risk assessment

◊ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

11.7 Waste classification

11.7.1 Disposal of the made ground off site is generally not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc. Disposal to landfill (or an appropriate soil / aggregate transfer station) may be the most practical solution, if redistribution and retention on site is not feasible.

11.7.2 Following excavation and stockpiling, sampling will be required prior to disposal.

11.7.3 As there is no WRAP protocol for soils, the characterisation, sampling and classification of soils arising from brownfield sites has been incorporated within the Environment Agency's Technical Guidance WM3[5]. Classification of soils as non-hazardous or hazardous in accordance with WM3 is quite a complex process, although it ultimately results in a simple classification as hazardous or non-hazardous. Note: inert is not a class under WM3; WAC testing is required to determine whether a waste soil can be considered inert.

11.7.4 If waste soil is classed as hazardous following classification under WM3, and destined for landfill, waste acceptance criteria (WAC) leachate testing will need to be undertaken. Similarly, if waste soil destined for landfill is classed as non-hazardous under WM3, and suspected to be inert, WAC leachate testing will need to be undertaken. However, non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

11.7.5 WAC analysis is different to the 'routine' laboratory testing (such as that included earlier in this Section) undertaken in order to determine hazardous properties. Lithos typically only include WAC analysis if significant off-site disposal (of soil classified as hazardous waste) is anticipated.

11.7.6 It is critical if material is to be exported from site that this is allocated an appropriate waste code, following the steps within WM3. Waste carriers transporting, and sites accepting, this material should have a corresponding code within their permits. It is the responsibility of those generating the waste (i.e. the Developer), to ensure that the waste is handled and disposed of appropriately.

[5] *Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015*

11.7.7 A total of 2 samples of natural soil and 4 samples of made ground were submitted for Waste Acceptance Criteria (WAC) testing. Test results are included in Appendix H to this report.

11.7.8 It should be noted that WAC analysis is different to the 'routine' laboratory testing (such as that outlined above in section 10). Routine testing is undertaken to determine hazardous properties; hazardous properties of a waste cannot be determined by WAC testing.

11.7.9 Formal waste classification has **not** been undertaken as this was beyond the agreed scope, but this section provides a **basic review** of the data and allocated **likely** waste codes. A full, more detailed assessment is recommended on stockpiled material prior to removal off-site.

11.7.10 Review of the currently available limited data in Section 10.4 above **indicates** that the Granular Made Ground might be classified as **hazardous** on the grounds of elevated pH and zinc.

11.7.11 Review of the limited data for the Cohesive Tidal Flat Deposits (Drift soils) **suggests** that natural soils are likely to be classified as **hazardous** on the grounds of elevated zinc.

11.7.12 Both Granular Made Ground and Tidal Flat Deposits are likely to be allocated a code of **17 05 03** – Soil and stones containing hazardous substances.

11.7.13 Soil treatment facilities (STFs) provide an alternative to landfill. STFs are regulated by the Environment Agency and allow soils to be treated and screened (effectively recycled to be used at other sites). Export to an STF does not require WAC testing and suitability of various soil types will be dependent on material waste codes, which may be allocated after consideration of the data in Section 11 but will often need supplementing with further testing after soils have been stockpiled (see also advice in Section 15.3).

11.7.14 Most STFs are permitted to accept soils with waste code 17 05 04 (i.e. soils which do not exhibit hazardous properties). Lithos has a list of permitted STFs and can help identify one local to this development site.

11.7.15 With respect to **asbestos**, waste soils will be classed hazardous if the soil mass contains more than 0.1% asbestos fibres that are free and dispersed. However, WM3 states that where the waste contains identifiable pieces of asbestos (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%. If a stockpile of soil contained rare fragments of broken asbestos-cement sheeting, the whole stockpile would be classed as hazardous unless all the fragments could be picked-out (even though the concentration of asbestos in the soil mass might be orders of magnitude less than 0.1%).

11.7.16 Tarmac hardstand was encountered in TP06, within the vicinity of the former hospital overflow car park.

11.7.17 This **tarmac** could be recycled and crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-1[6]). Crushed tarmac could also be blended with crushed concrete etc to generate 6F2 graded material. 6F2 can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters and, if the proportion of asphalt is greater than 20%, the recovered bitumen content is less than 2%).

11.7.18 However, if off-site disposal is anticipated, tarmac assessment is based on the amount of coal tar present, this will vary depending on the age of the tarmac. The assessment is based on the amount of benzo(a)pyrene and has a concentration limit of 50mg/kg.

[6] *BS598 (2003) Sampling and examination of bituminous mixtures for roads and other paved areas.*

11.7.19 Speciated PAH analysis has been undertaken on the sample of tarmac obtained from TP06 and B(a)P concentrations were < 50mg/kg. Consequently, this area of tarmac is likely to fall within waste code **17 03 02**:

- 17 - Construction and Demolition wastes
- 03 – bituminous mixtures, coal tar and tarred products
- 02 – bituminous mixtures other than those mentioned in 17 03 01

11.7.20 17 03 02 is a mirror non-hazardous entry (17 03 01 is the corresponding mirror hazardous entry). This code along with this supporting report, in particular the laboratory results, should be used to complete a paper trail documenting disposal routes for tarmac.

11.7.21 Contractors exporting waste from the site should review the site investigation data and make their own assessment. Alternatively, Lithos could undertake this assessment once exported waste streams have been identified.

12 HAZARDOUS GAS

12.1 General

12.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Very low**: made ground essentially inert, with little degradable matter
	Buildings	Explosion		
Off-site landfill (237m southwest)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	**Very low**: natural strata to at least 5m depth are generally of low permeability.
	Buildings	Explosion		
Peat deposits	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Very low**: thin bands of peat encountered but generation of a gas flow may still be possible.
	Buildings	Explosion		

12.1.2 Given the above gas monitoring wells have been installed in 3 boreholes across the site. Details of the installations are given on the borehole logs presented in Appendix G.

12.1.3 The generation potential of the gas source was initially considered to be Very Low and this has been confirmed by the monitoring results obtained. Consequently, in accordance with CIRIA Report C665[7], given the proposed residential end use, 6 visits have been scheduled over a 3-month period.

12.2 Scope of works

12.2.1 To date, the wells have been monitored on 2 occasions for groundwater levels and soils-gases, and the results are presented in Appendix J.

12.2.2 A standard procedure was followed, in accordance with CIRIA guidance:

- Ambient oxygen concentration
- Atmospheric temperature & pressure
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
- Standing water level using a dipmeter
- Ambient oxygen concentration (check for instrument drift)

12.3 Monitoring results

12.3.1 The results of the monitoring completed to date are summarised below.

Well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
BH01	1.0 – 3.0m (Granular Made Ground)	ND	ND – 0.2	ND – 3.6
BH02	3.0 -6.0m (Cohesive Alluvium & Peat)	ND	ND	ND - 1.5
BH03	3.2 – 5.0m (Cohesive Alluvium)	ND	ND	3.2

ND – None Detected

[7] *CIRIA C665: Assessing risks posed by hazardous ground gases to buildings (2007).*

12.4 Discussion (methane & carbon dioxide)

12.4.1 Two monitoring visits have been carried out to date, on both occasions the response zones in **all** wells were fully **saturated**. The groundwater is considered to be reflective of true groundwater levels and the ground is likely to remain saturated post-construction.

12.4.2 A hazardous gas risk assessment incorporating all of the results and taking into account ground conditions and the presence of groundwater will be issued on completion of monitoring in March 2025.

12.5 Radon

12.5.1 Requirements with respect radon measures are set out in Building Regulations Approved Document C. Probability bandings (based on the proportion of properties in a given area that exceed the Action Level; currently 200 $Bq.m^{-3}$) are used to determine whether a property requires no, basic or full measures.

12.5.2 In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.

12.5.3 The HSA website indicates that the site is in an area where between 10% and 30% of homes are estimated to be above the action level, and full radon protection measures are required in new dwellings.

12.5.4 However, the HSA website only provides a preliminary indication of the measures required for a particular site, based on the highest geological radon potential within 1km grid squares – a relatively 'low resolution'. Radon potential often varies considerably within a given grid square, therefore a 'higher resolution' site-specific report (based on 25m grid squares) has been obtained from BGS (copy is included in Appendix E).

12.5.5 The site-specific report notes the site is located in an area where **0-1%** of homes are estimated to be above the radon action level and therefore '**no radon protective measures are required**'.

13 GEOTECHNICAL TESTING

13.1 General

13.1.1 A total of 45 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.

13.1.2 The geotechnical laboratory test results are presented in Appendix I to this report.

13.2 Atterberg limits

13.2.1 The plasticity indices of 13 samples of cohesive soil have been determined; results are summarised below.

Soil type	No. samples tested	Moisture content range % (average)	Range of Plasticity Indices % * (average)	Shrinkability
Cohesive Tidal Flat Deposits	13	18.1-70 (30)	9.1-79 (27)	Medium

* Modified where appropriate in accordance with Chapter 4.2 of the NHBC Standards

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

13.2.2 For the purposes of foundation design, it is recommended that the majority of cohesive soils be regarded as being of **Medium** shrinkability. However, soils containing peat/peaty clay should be regarded as being of **High** shrinkability.

13.3 Particle size distribution

13.3.1 The grading of 3 samples of Cohesive Tidal Flat Deposits and 1 samples of Granular Tidal Flat Deposits has been determined by wet sieving and the results are summarised in the table below:

Sample & depth	Field description	% passing 37.5mm sieve	% passing 20mm sieve	% passing 2mm sieve	% fines	Material description (based on grading & plasticity)
BH02, 3.0m	Slightly sandy Clay	100	100	92	89	Slightly sandy slightly gravelly Clay
BH02, 4.3m	Spongy pseudo fibrous Peat	100	100	90	78	Slightly sandy slightly gravelly Clay
BH03, 3.4m	Slightly sandy Clay with frequent plant remains	100	100	99	96	Slightly sandy slightly gravelly Clay
BH03, 10.0m	Slightly clayey Sand	100	100	100	19	Clayey Sand

13.3.2 The results of the grading scheduled broadly confirm field descriptions.

13.3.3 NHBC Chapter 4.2 considers shrinkable soils to be those containing more than 35% fines and having a Modified Plasticity Index greater than 10%.

13.3.4 Fines (silt and clay) were found to comprise between 78% and 96% (average 88%) of the material sampled (Cohesive Tidal Flat Deposits). Therefore, the Cohesive Tidal Flat Deposits encountered on this site can therefore be regarded as shrinkable.

13.3.5 The Granular Tidal Flat Deposits encountered contained 19% fines, and can therefore be regarded as non-shrinkable.

13.4 Soluble sulphate and pH

13.4.1 In accordance with BRE SD1[8], this site has been classified as brownfield with a mobile groundwater regime.

13.4.2 It is envisaged foundations will extend to depths of about through made ground into bedrock samples of natural strata have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

13.4.3 The concentrations of sulphate in the aqueous natural soil extracts of 19 samples were determined. The pH value of each sample has also been determined. In addition, 17 samples of made ground were tested for pH as part of the contamination suite.

13.4.4 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, the UK Health Security Agency (HSA) would like to see all new build include basic measures.

13.4.5 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the table below.

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Cohesive Tidal Flat Deposits	15	7.3	1800
St Maughans Formation bedrock	4	8.7	32
Cohesive Made Ground	7	10.2	-
Granular Made Ground	10	11.0	-

13.4.6 pH values were all above 5.5, therefore concentrations of chloride and nitrate are considered insignificant.

13.4.7 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class **DS-3**, with the site allocated an ACEC Classification of **AC-3**.

13.5 One dimensional consolidation tests

13.5.1 To assess the settlement characteristics of the natural cohesive strata, one-dimensional consolidation tests were carried out on 6 samples of natural cohesive strata. Four loading pressures and one unloading pressure were specified in accordance with BS1377[9].

13.5.2 Laboratory certificates are included in Appendix I. The results are provided as plots of voids ratio and coefficient of consolidation against applied pressure. The coefficient of volume compressibility (m_v) has been derived for each test in accordance with BS1377 at a pressure range starting close to overburden (p_0).

[8] *BRE Special Digest 1 (2005) – Concrete in aggressive ground.*
[9] *BS1377 (1990) – Methods of test for Soils for civil engineering purposes. Part 5: Compressibility, permeability & durability tests.*

13.5.3 Tests are summarised in the table below.

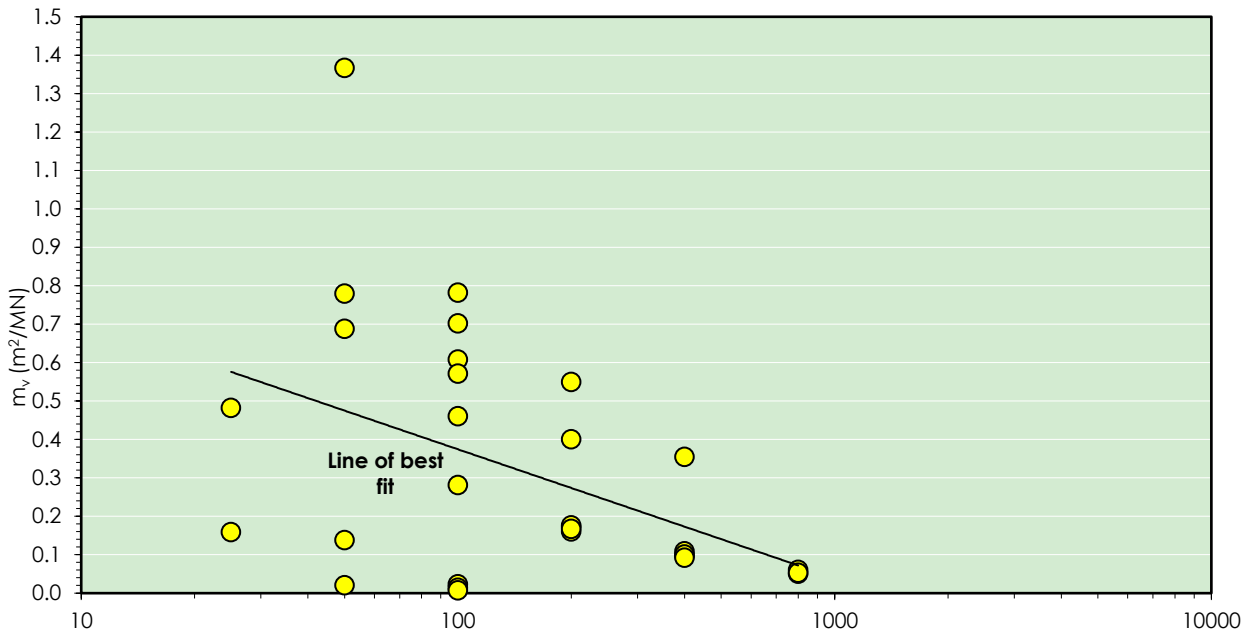
Hole	Depth (m)	Material	m_v (m^2/MN)*	Compressibility assessment
BH01	8.0	Cohesive Tidal Flat Deposits (Clay with occasional plant remains)	0.23	Medium compressibility
BH02	8.0	Cohesive Tidal Flat Deposits (slightly sandy Clay)	0.19	Medium compressibility
BH02	3.0	Cohesive Tidal Flat Deposits (slightly sandy Clay)	0.46	High compressibility
BH02	5.0	Cohesive Tidal Flat Deposits (Slightly sandy Clay with pockets of plant material)	0.72	High compressibility
BH03	5.0	Cohesive Tidal Flat Deposits (sandy slightly gravelly Clay)	0.28	Medium compressibility
BH03	8.0	Cohesive Tidal Flat Deposits (sandy slightly gravelly Clay)	0.26	Medium compressibility

* m_v value calculated for a stress increment starting at the approximate overburden pressure.

13.5.4 The graph below shows variation in m_v with depth (increasing overburden pressure; as plotted on a log scale).

Maximum Volume Change Potential (Mv) Vs Overburden Pressure

(Cohesive Tidal Flat Deposits- All)



13.6 Undrained shear strength testing

Undrained triaxial compression tests

13.6.1 Unconsolidated undrained triaxial compression tests were carried out at a single cell pressure, roughly equal to the overburden pressure, on 6 specimens.

13.6.2 Fully saturated conditions were assumed and the apparent undrained cohesion Su, was taken as half the deviator stress at failure. Results are summarised in the table below.

Hole	Depth (m)	Material	Field description	Laboratory Shear strength/kPa	Strength term
BH01	8.0	Cohesive Tidal Flat Deposits	Firm	43	Firm
BH02	8.0		Firm	22	Soft
BH02	3.0		Firm	39	
BH02	5.0		Firm	32	
BH03	5.0		Soft	28	
BH03	8.0		Soft	36	

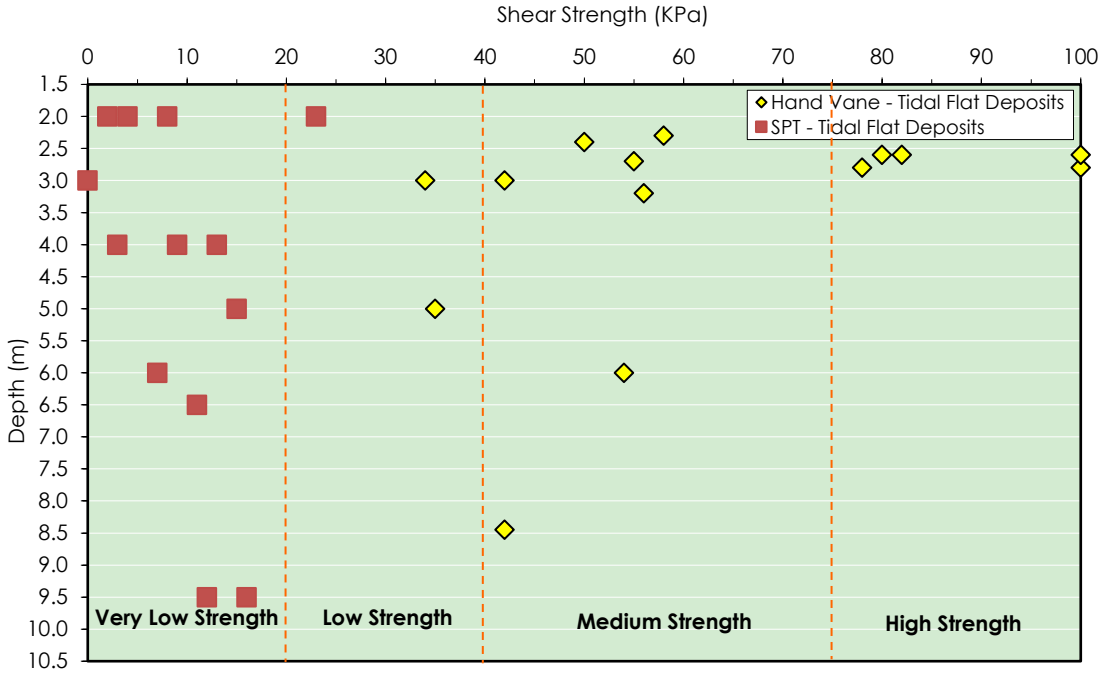
13.6.3 Triaxial testing has confirmed the variability in the strength of soils, most likely due to the presence of sand and plant matter within the Cohesive Tidal Flat Deposits. In addition, the Cohesive Tidal Flat Deposits appear to be borderline soft to firm (shear strength minimum of 40kPa for a firm clay).

Hand shear vane testing

13.6.4 Hand shear vane testing was undertaken within trial pits in-situ to around 1.0m depth where possible and from larger blocks of excavated clay below that depth.

13.6.5 The results are summarised within the plot below and illustrate undrained shear strength (Su) within the Cohesive Tidal Flat Deposits of 30kPa to 100kPa. The plot below provides a summary of undrained shear strengths.

Undrained Shear Strength (Cohesive Soils)



13.7 Standard penetration test (SPT)

13.7.1 The in-situ relative density of granular soils and strength of cohesive soils was established by carrying out Standard Penetration Tests (SPTs) during the drilling of the cable percussion boreholes.

13.7.2 The SPT results are summarised below:

Stratum	SPT 'N' value	Estimated strength or density	Remarks
Granular Tidal Flat Deposits	18	Medium Dense	Encountered in BH03 at 9.5m
	13		Encountered in BH03 at 11.0m

13.7.3 The reported blow counts suggest the single band of Granular Tidal Flat Deposits encountered in BH03 are medium dense.

14 GEOTECHNICAL ISSUES

14.1 Conceptual site model

14.1.1 Made ground has been encountered beneath the entire site to an average depth of 2.3m; maximum depth of 2.9m. Made Ground predominantly comprises Cohesive Made Ground underlain by Granular Made Ground. It is understood the top 2.0m of made ground has previously been subject to turnover and remediation in 2016/2017.

14.1.2 Natural ground beneath the site predominantly comprises Cohesive Tidal Flat Deposits. This typically comprised a slightly sandy clay to depths of between 3.4m and 5.3m. Peat was encountered directly beneath the firm clay and was typically 0.6m to 0.8m thick. Cohesive deposits were variable throughout their depth ranging from soft to firm over the full thickness.

14.1.3 Granular Tidal Flat Deposits were only encountered in BH03 from 9.5m to 12.2m depth.

14.1.4 Bedrock (St Maughans Formation Mudstone) was encountered from between 12.2m and 12.7m depth and was penetrated by between 1.42m and 1.58m depth where it was encountered.

14.1.5 Groundwater was encountered at shallow depth (from 0.9m) across the site and typically resulted in the Granular Made Ground being fully saturated. Groundwater monitoring to date has confirmed a shallow water table with fast recharge.

14.1.6 Shallow excavations are **unlikely** to remain stable in the short term due to the presence of perched water within the made ground.

14.2 Site regrade and/or ground improvement

14.2.1 Made ground currently underlies the entire site, to an average depth of about 2.3m; maximum of 2.9m. This made ground is of variable and poor strength and is therefore not considered a suitable foundation material. It has also been found to contain low levels of asbestos and contains materials (e.g. brick, concrete, clinker, etc), which would generally be considered undesirable as a near-surface material in garden areas.

14.2.2 Given the substantial volume of made ground present, export to landfill is not considered economically viable.

14.2.3 Given that remediation works in 2016/2017 comprised the turnover of the top 2.0m of made ground to identify and treat contamination and remove obstructions, turnover of the made ground is not considered necessary.

14.2.4 We have assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned, by LNT should consider implications for the foundation recommendations outlined below. Due to the compressible nature of the Cohesive Tidal Flat Deposits, any increase in ground levels could reduce in additional consolidation settlement of the ground around the care home, which could cause issues for level access and service entries.

14.2.5 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 11.7 should apply.

14.3 Settlement

14.3.1 Due to the compressible nature of the Cohesive Tidal Flat Deposits, loading of the ground (i.e. raising of levels) will likely create consolidation settlement of the underlying compressible soils upon loading. The magnitude of the consolidation settlement is dependent on the extent of any ground level raising.

14.3.2 Consolidation settlement is associated with a reduction in volume caused by expulsion of water from soil pores and transfer of load from excess porewater pressure to soil particles.

14.3.3 Preliminary estimates suggest that if ground levels were to be raised by c. 0.5m, that settlement of the ground around the care home would be in the region of c. 15mm, increasing to c. 30mm if the ground levels were to be raised by c. 1.0m.

14.3.4 Where ground levels are to be lifted by more than about 1.0m, consideration will need to be given to the potential for significant settlement of ground beyond the footprint of the piled care home, which is underlain by soft alluvial clays and peat. Further assessment and advice will be needed.

14.3.5 At this stage, it is considered that the presence of soft alluvium and peat will have implications for:

- Foundations – likely piled; see further details in Section 14.4.
- Drainage – likely need to be placement at steeper gradients using flexible connections to prevent any backfalls should differential settlement of the fill occur. There is potentially the need to pile manholes (subject to depth and size).
- New utilities – should be constructed of flexible materials. Electricity and communications cabling should also be laid with sufficient 'slack' to accommodate a degree of movement. The use of flexible joints is recommended where possible, particularly where service connections extend across a rigid/flexible structure interface (e.g. from a piled foundation into a garden area).
- Hardstanding and access roads may need an increased construction.

14.4 Foundation recommendations

General

14.4.1 It is understood that consideration is being given to redevelopment of the site with a 3 storey 'C' shaped care home, with associated parking and landscaped areas.

14.4.2 The care home is expected to impart a maximum line load of 145kN per m run.

14.4.3 Consequently, foundation recommendations assume that development will be a three-storey construction and that line loads will not exceed 145kN/m run. If this is not the case then significant alterations to these recommendations will be required.

14.4.4 We have assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned, by LNT should consider implications for the foundation recommendations outlined below.

14.4.5 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.

14.4.6 Sub-surface concrete in contact with the made and natural ground should be Design Sulphate Class DS-3, with the site allocated an ACEC Classification of AC-3.

Piled foundations

14.4.7 Piled foundations will be the most suitable foundation solution for the proposed care home due to the presence of deep made ground underlain by soft Clays and peat.

14.4.8 The following general comments relating to piling are provided for guidance, and further advice should be sought from a specialist-piling contractor. Piles are likely to be end bearing in bedrock, therefore in accordance with BS 8004[10] and EC7[11], piling contractors may require further boreholes extended a minimum 5m into competent bedrock using rotary coring techniques.

14.4.9 Should any impenetrable shallow obstructions be encountered, i.e. boulders, former foundations etc, they should either be grubbed-up, or alternatively the piling layout could be re-designed (although this might also require design of foundations able to span and/or cantilever as necessary).

14.4.10 Piled foundations should extend into the underlying bedrock. The safe working load that may be supported on a pile is dependent on the pile diameter, its founding depth and the method of installation.

14.4.11 Boreholes indicate that competent mudstone bedrock lies at depths of between 12.2m and 12.7m, below current ground levels.

14.4.12 As piles would be founded in bedrock, they will be essentially end bearing, although there may also be some shaft adhesion in the Cohesive Tidal Flat Deposits.

14.4.13 Given the presence of some lower strength soils in the uppermost 4m, it is essential that pile design allows for **down-drag** (negative skin friction).

14.4.14 Consequently, preliminary estimates for pile lengths in the order of 15 to 17m.

[10] *BS 8004 (2015) - Code of practice for foundations.*
[11] *BS EN 1997-1:2007. Eurocode 7: Geotechnical design – Part 2: Ground investigation & testing*

14.4.15 It is recommended that flexible service connections are used on this site, especially where they enter the buildings, in order to avoid any possible damage due to self-settlement of the weak strata once the site is developed.

14.4.16 Driven piles may lessen the volume of potentially contaminated made ground requiring off-site disposal (cf. arisings associated with say trench fill). However, driving can induce some ground vibration. Assessment of any vibration risk to adjacent structures and/or existing site features should be undertaken by pile designer.

14.4.17 Should any impenetrable shallow obstructions be encountered, i.e. old foundation, they should either be grubbed-up, or alternatively the piling layout could be re-designed (although might also require design of foundations able to span and/or cantilever as necessary).

14.4.18 The proposed care home can be built off ring beams designed to span the piles. In order to bond them to the piles, the tops of the piles must be broken out to expose the reinforcement, which can then be tied to that of the beams.

14.4.19 Ground conditions at this site are considered likely to require provision of a piling mat (working platform) and further advice should be sought from the appointed specialist-piling contractor regarding the proposed plant loadings and resulting pressures. This data, together with a knowledge of the strength and variability of the near-surface ground conditions is required in order that design of a mat can be undertaken in accordance with guidance provided in the 2004 BRE document, "BR 470: Working platforms for tracked plant".

14.4.20 The design of working platforms for tracked plant is a geotechnical design process and should be carried out by a competent person. The following parties should have input into the design:

- Permanent works designer, to consider additional uses for platform material as part of the overall development
- Principal contractor, to define any other purposes for which the platform might be used
- Contractor or subcontractor, to specify requirements for the platform, including gradients, ramps and edges

14.4.21 Piles can provide an enhanced pathway for the vertical migration of mobile contaminants. The Environment Agency may therefore object to the adoption of piles as a foundation solution. However, objection is considered unlikely given the nature of the contamination encountered (asbestos), and the fact that the site has been previously remediated and validated in 2016/2017.

14.5 Floor slabs

14.5.1 Floors for the low rise care home (2-3 storeys) constructed on piled foundations typically utilise reinforced concrete ground beams which rest on pre-cast or in-situ pile caps. A suspended 'Beam and Block' ground floor is then usually constructed using concrete or polystyrene blocks placed between further concrete beams suspended across the ring beams.

14.5.2 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).

14.5.3 In accordance with NHBC Standards Chapter 4.2, a minimum void height of 300mm should be adopted for a precast block and beam (or suspended timber) floor; this includes a 150mm ventilation allowance. If a suspended, cast in-situ slab (on a void former) is proposed, a minimum clear void height of 150mm should be adopted; of course, the actual thickness of the void former will be significantly greater.

14.5.4 Ventilation should be provided to precast and timber suspended floors in accordance with NHBC Standards Chapter 5.2.

14.5.5 Floor slab design should be finalised/take account of the results of the gas monitoring and protection measures required, which will be detailed in Lithos' gas risk assessment, to be issued on completion of monitoring in March 2025.

14.6 Designated concrete mixes

14.6.1 Designated mixes are considered in BRE SD1[12] and BS 8500[13]. However, in addition to soil chemistry (sulphate class), there are a number of other considerations relating to structural design that need to be taken into account when determining an appropriate concrete mix.

14.6.2 Consequently, LNT should seek advice from their appointed Structural Engineer.

14.7 Excavations

14.7.1 Groundwater control over and above normal site pumping practices may be required for any excavations in excess of 1.0m deep.

14.7.2 Groundwater should be controlled in accordance with CIRIA Report R113[14].

14.7.3 The stability of even shallow excavations is likely to be **poor**, most notably in saturated made ground, and therefore allowance should be made for shoring.

14.8 Drainage

14.8.1 Based on observations made during the investigation, soakaways are very unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SuDS), and there may be a need for surface water balancing.

14.8.2 Alternative SuDS options (see CIRIA C753[15] for further details) include:

- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
- Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
- Basins - a ground depression designed to store surface water that is normally dry, except during and immediately following a rainfall event.
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

[12] *BRE Special Digest 1 (2005) – Concrete in aggressive ground.*
[13] *BS 8500-1&2:2015+A2:2019. Concrete. Complementary British Standard to BS EN 206. Method of specifying and guidance for the specifier (1) & Specification for constituent materials and concrete (2).*
[14] *CIRIA Report R113 (1986) - Control of Groundwater for Temporary Works.*
[15] *CIRIA C753 (2015) – The SuDS Manual.*

14.8.3 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.

14.8.4 Impermeable liners are accepted where groundwater is recorded <1m below the base of the feature. However, depending upon the depth of groundwater this may need to be used in conjunction with an under drain (in which case a watercourse outfall for the under drain is typically required).

14.8.5 Appropriate design usually comprises a fall across the short axis (to centre of basin), and then along the long axis (possibly inclusive of a pipe in gravel trench) to the outfall. However, some Independent Authorities allow a flat base but usually with a controlled flow channel.

14.8.6 It may be possible to connect surface water drainage to the existing drainage network.

14.8.7 It is recommended that the developer contact the traditional Water Authority with respect to capacity in existing foul and surface water sewers in the vicinity of the development area. However, surface water can go to watercourse and in terms of hierarchy should before sewer. If that is the case, consultation may include the Natural Resources Wales, the Environment Agency (Main River), or Internal Drainage Board (only limited UK coverage), or Local Authority as Lead Local Flood Authority. Landowner Rights (riparian) are always required for watercourse discharge.

14.9 Car Parking

14.9.1 In situ CBR testing undertaken during validation works by Integral Geotechnique (Report Ref. 11734/AF/17/FER/Rev A issued in February 2017) suggest that a CBR value of over 5% was consistently recorded at all but one test location (reported as 4.9%). Consequently, the made ground across the site is likely to yield a CBR value of around 5%, however, it should be noted that Integral Geotechnique's validation works did not cover land within the red line boundary and therefore **cannot** be relied upon.

14.9.2 The values reported by Integral Geotechnique should be verified prior to or during construction.

14.10 External works

14.10.1 Any digital terrain modelling undertaken, or commissioned, by LNT should be made available to their Engineering Designer prior to issue of an External Works Drawing.

15 REDEVELOPMENT ISSUES

15.1 General

15.1.1 This report has presented options with respect to foundation solutions, treatment of contamination etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.

15.1.2 Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the construction phase.

15.1.3 If unexpected ground is encountered during the construction phase, the Contractor should immediately seek further advice from the Engineer.

15.2 Remediation strategy

15.2.1 Given the absence of any significant contamination and remediation works previously undertaken and validated by Celtic in 2016/2017, a remediation strategy is not considered necessary. Nonetheless, some preparatory works will be required, most notably:

- General site clearance of surface materials and vegetation
- Demolition of the security building and grubbing up of foundations
- Provision of **600mm** thickness of clean soil cover including a **150mm** hard dig layer at the base in all landscaped areas

15.2.2 Whilst records suggest remediation of both soil and groundwater was carried out by Celtic between 2016 and 2017, given the past use of the site it would be prudent to install a **vapour membrane** beneath the proposed care home.

15.3 Control of excavation arisings

15.3.1 Excavations into made ground are likely to yield arisings containing low levels of asbestos. The groundworker should carefully segregate (and stockpile separately) made ground arisings from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.

15.3.2 It should be ensured that the groundworker understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: tarmac; excess clean, natural soil arisings; general construction waste etc.

15.3.3 Further characterisation of stockpiled materials is likely to be required if off-site disposal is proposed. See also comments in Section 11.7 regarding asbestos.

15.3.4 Made ground arisings could be:

- Isolated beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users;
- Isolated beneath the **600mm** clean cover including a 150mm hard dig layer at the base
- Exported from site to a suitably licensed landfill facility

15.4 Good practice guidance

15.4.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:

- CIRIA C741[16]
- EA Pollution Prevention Guidelines[17]:
  - PPG6 - Working at construction and demolition sites
  - PPG2 - Above ground oil storage tank
  - PPG7 – The safe operation of refuelling facilities
  - PPG21 – Incident Response Planning

15.4.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site and the import of natural soils from another development site. Therefore, the Contractor should prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011) [18].

15.4.3 The MMP will document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with.

15.5 New utilities

15.5.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

15.5.2 It is recommended that trenches for services including site drainage and water supply are cut over size in order to isolate pipe materials from potential contaminants and to enable maintenance to be conducted in "clean" material.

15.5.3 Water Companies have a statutory duty to supply wholesome water, which could be compromised by the selection of an inappropriate pipe material. For example, compounds such as petroleum hydrocarbons and solvents can permeate commonly used plastics pipes, and/or corrosive chemicals can reduce the service life of metallic pipes. Guidance has been developed for the selection of pipes in brownfield sites and is contained in a UKWIR Report[19].

15.5.4 This site is brownfield, and therefore consideration of soil contaminant concentrations is required. Samples taken must be representative of the soil conditions in which the water pipes are proposed to be laid; normally water pipes are laid 0.7m to 1.3m below finished ground level.

15.5.5 At the time of writing, the proposed route(s), and total length, of water supply pipes were unknown. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance has not been undertaken.

15.5.6 However, it is considered likely that the adopting Water Authority will request the use of barrier pipe mains, with plastic coated copper house connections, given that residual organic contaminants will still be present post-remediation, albeit at acceptable concentrations.

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16 *CIRIA C741 (2015) - Environmental Good Practice on Site*

17 *Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.*

18 *The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.*

19 *UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.*

15.6 Health & safety issues - construction workers

15.6.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.

15.6.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

15.6.3 Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.

15.6.4 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

15.6.5 It should be noted that all materials on site potentially contain low levels of asbestos fibres and ACMs and therefore **additional protection measures** may be required for site workers when working with made ground on site. These materials should be controlled in accordance with the Control of Asbestos Regulations 2012 and risks must be mitigated by appropriate measures including but not limited to:

- Damping down of soils
- Appropriate PPE/RPE based on the contractors risk assessment
- General site controls (i.e. speed limits, controlled stockpiling) to reduce dust generation
- Precautionary airborne fibre monitoring to ensure that airborne fibre concentrations do not exceed the clearance limit of 0.01 fibres/millilitre (cm3)

15.6.6 Comments in Section 11.7 regarding asbestos should also be referred to.

15.7 Potential development constraints

15.7.1 Some deterioration of the surface is likely to be caused by trafficking, especially during/after periods of significant rainfall. Consequently, it would be prudent to consider placement of a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) along the line of proposed highways and any temporary haul roads to protect formation during the construction phase.

15.7.2 Consideration could also be given to flexibility in the groundworks programme to take advantage of any prolonged dry\warm weather (typically between May and September) to enable footings to be cast and blockwork brought up to DPC level well in advance of the build programme (i.e. so it is never necessary to dig deep footings in winter/early spring, when the groundwater table is likely to be higher).

15.7.3 Excavations within the made ground will likely require shoring and pumping due to the presence of shallow groundwater.

15.7.4 The rising water main along the western and northern boundary of site will require an easement.

16 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

16.1 General

16.1.1 The site is located off Mendalgief Road, approximately 1km south of Newport town centre, and currently comprises a single parcel of land most recently used as a storage compound for the adjacent residential development.

16.1.2 The site (and wider area) was historically associated with the Courtybella Steelworks. Former structures within the red line boundary included two framing bays, a gas furnace and the main office block. The steelworks was demolished to ground level in 2008 and was subsequently subject to remediation works between February 2016 and January 2017.

16.1.3 Records suggest remediation works included removal of obstructions, treatment of Japanese Knotweed and turnover and compaction of made ground to 2m depth across the site and wider area (now undergoing development with housing). Remediation works were validated by Celtic in June 2017 with subsequent agreements with Newport City Council and Natural Resources Wales.

16.1.4 The proposed development comprises a 66 bed 3 storey 'C' shaped care home with associated landscaping, parking and an area of POS.

16.1.5 Made ground is present across the site to depths of up to 2.9m (average depth to base of 2.3m) and typically comprised Cohesive Made Ground underlain by Granular Made Ground.

16.1.6 Natural strata comprise Cohesive Tidal Flat Deposits (slightly sandy Clay) to depths of between 3.4m and 5.3m. Peat was encountered directly beneath the Clay and was typically 0.6m to 0.8m thick. This was underlain by Soft Clays to depths of between 9.5m and 12.7m.

16.1.7 Granular Tidal Flat Deposits were encountered in one borehole between 9.5m to 12.2m depth. Mudstone bedrock was encountered in all 3 boreholes from between 12.2m and 12.7m depth.

16.1.8 Groundwater was encountered at shallow depth across the site from 0.9m depth during the ground investigation. Groundwater monitoring has confirmed a shallow perched groundwater table with fast recharge.

16.2 Mining

16.2.1 The site lies beyond the Mining Remediation Authority's defined coal fields.

16.3 Hazardous gas

16.3.1 The site is in an area where less than 1% of homes are estimated to be above the radon action level and therefore no radon protection measures are required.

16.3.2 The site lies within 250m of a former landfill and is underlain by deep made ground and peat. Consequently, gas monitoring is ongoing, with a Hazardous Gas Risk Assessment due to be issued in March 2025.

16.4 Contamination & remediation

16.4.1 To date, no significant contamination has been encountered, however, made ground does contain asbestos.

16.4.2 Remediation of the site was undertaken to a clean-up criteria for a mixed end-use which included a requirement for the placement of a **600mm** clean soil cover system underlain by a marker barrier in all landscaped/garden areas.

16.4.3 Due to the presence of asbestos, and in line with recommendations given by Celtic in their remediation validation report (Ref. R1664/17/4768, issued June 2017), a minimum **600mm** clean soil cover including **150mm** thick hard dig layer at the base should be placed in all landscaped areas.

16.5 Foundations

16.5.1 Piled foundations will be the most suitable foundation solution for the proposed care home. Piles should be end bearing in the mudstone bedrock. Due to the presence of soft compressible alluvium, negative skin friction will need to be allowed for.

16.6 Flooding

16.6.1 The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low.

16.7 Drainage

16.7.1 Soakaways will not provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SuDS), and there may be a need for surface water balancing.

16.7.2 LNT should enquire with the landowner and developer of the adjacent site about connecting to any existing pumped drainage systems installed on the wider steelworks site post-remediation.

16.8 Car parking

16.8.1 Validation testing undertaken by Integral Geotechnique across the wider site (Report Ref. 11734/AF/FER/Rev A issued in February 2017) suggests that CBR values across the site were at least 5%, however, this did not include any testing within the current red line boundary and therefore these values should be verified prior to or during construction.

16.9 Further works

16.9.1 In accordance with BS 8004 and EC7, piling contractors may require rotary cored boreholes extended a minimum 5m into competent bedrock using rotary coring techniques.

Appendix A

General Notes

01 - Environmental setting
Generic notes – geoenvironmental investigations

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the "Search Responses" Appendix of this Geoenvironmental Report.

Geology, mining & quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced by reference to current and historical OS plans.

In July 2011, the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into High Risk and Low Risk areas. **High Risk** areas are likely to be affected by a range of legacy issues that pose a risk to surface stability, including: mine entries; shallow coal workings; workable coal seam outcrops; mines gas; and previous surface mining sites. **Low Risk** areas comprise the remainder of the defined coalfield, and are areas where no known defined risks have been recorded; although there may still be unrecorded issues. Where a site lies within either a High or Low Risk area, a mining report is obtained from the CA.

Landfills

Reference is made to publicly available Government held digital data via **QGIS** (an Open Source Geographic Information System), data from Landmark or Groundsure, and sometimes the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site.

Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move though fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211[1], and the UK Health Protection Agency (HPA) website. In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.

Advice on the limitation of exposure of the population to radon in buildings was originally published in 1990 by the National Radiological Protection Board (NRPB), which joined the HPA in 2005; the HPA updated NRPB advice in July 2010[2].

The HPA recommended that the NRPB radon Action Level for homes be retained, and a new Target Level for radon in homes be introduced. The values of the Action Level and Target Level, expressed as the annual average radon concentration in the home, are 200 Bqm^{-3} and 100 Bqm^{-3} respectively. The Target Level was to provide an objective for remedial action in existing homes and preventive action in new homes.

The term 'radon Affected Area' is defined as those parts of the country with >1% of homes estimated to be above the Action Levels. The level of protection needed is site-specific and can be determined by reference to this mapping on the Public Health England website, which indicates the highest radon potential within each 1km grid square. Each 1km grid square is classified on the basis of the percentage of existing homes within that grid square estimated to have radon concentrations above the Action Level. There are 6 'bands': <1%; 1 to 3%; 3 to 5%; 5 to 10%; 10 to 30%; and >30%.

The NRPB advised that action should be taken to reduce radon concentrations in existing homes if the radon concentration exceeded the Action Level of 200 Bqm^{-3} in room air averaged over a year; ten times the average UK domestic radon concentration. NRPB advice informed changes in the requirements for radon protection in new buildings.

- **Basic** preventive measures are required in new buildings, extensions, conversions and refurbishments if the probability of exceeding the Action Level is **>3%** in England and Wales, and >1% in Scotland and Northern Ireland.
- Provision for further preventive (**Full**) measures is required in new buildings if the probability of exceeding the Action Level is **>10%**.

At present Building Regulations Approved Document C advocates basic measures for the probability banding 3% to 10%, and full measures if >10%. However, HPA would like to see all new build include basic measures.

Action & Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hrs/yr and to all schools.

Hydrogeology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers: These include a wide range of rock layers or superficial deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into three types:

- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
- Secondary undifferentiated - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

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1 BRE Report BR211, 2023: "Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects".

2 Limitation of Human Exposure to Radon, Documents of the Health Protection Agency - Radiation, Chemical and Environmental Hazards, RCE-15. July 2010.

Unproductive strata: These are rock layers or superficial deposits with low permeability that have negligible significance for water supply or river base flow.

The EA maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no superficial deposits are present; to do this, it is necessary to consult the published geological survey maps.

For the purposes of the EA's Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- If no superficial (drift) aquifers are shown, the bedrock designation is adopted
- In areas where the bedrock designation shows unproductive strata (the uncoloured areas) the superficial designation is adopted
- In all other areas, the more sensitive of the two designations is used (e.g. If secondary superficial overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated groundwater Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Surface water quality
- Recorded pollution incidents
- Licensed abstractions (groundwater & surface waters)
- Licensed discharge consents
- Site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are 6 GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas. There are two different kinds of area shown on the Flood Map:

1. Dark blue areas (Flood Zone 3) could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas (Flood Zone 2) show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading (Flood Zone 1), there is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year, areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist who can advise on appropriate mitigating measures; i.e. raising slab levels, provision of storage etc. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for: proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and any new development in Flood Zones 2 and 3.

COMAH & explosive sites

Lithos obtain information from Landmark or Groundsure with respect to Control of Major Accident Hazards (COMAH) or explosive sites within 1km of the proposed development site. Lithos' report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary conceptual site model

The site's environmental setting (and proposed end use) is used by Lithos to assess the significance of any contamination encountered during the subsequent ground investigation.

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential receptors.

Potential pollutant linkages are shown on a preliminary conceptual site model (pCSM). A CSM is essentially a cross-section through a site that reflects both the surface topography and underlying geology, and shows surface features of interest. The most significant sources of contamination are then superimposed onto this cross-section together with potential receptors (human health & controlled waters), and plausible pathways between the two. In addition to environmental issues, the CSM should also highlight geotechnical issues.

A pCSM is prepared after consideration of all available "desk study" data, and before design of the ground investigation. Data reviewed should include historical plans (with superimposition on a current-day plan), previous SI reports, geological maps etc. The pCSM, in conjunction with knowledge of site constraints (buildings, services, slopes etc) is used to design the ground investigation.

The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

02 - Ground investigation fieldwork
Generic notes – geoenvironmental investigations

General

Lithos Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:2015 "Code of practice for site investigation"
- Eurocode 7: BS EN 1997-1:2004. Geotechnical design - Part 1: General rules
- Eurocode 7: BS EN 1997-2:2007. Geotechnical design - Part 2: Ground investigation and testing
- BS10175:2013 "Code of practice for the identification of potentially contaminated sites"
- "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
- "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

Exploratory hole locations

Exploratory hole locations are selected by Lithos, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 2015 and BS1377: 1990. Techniques most commonly used by Lithos include:

- Machine excavated **trial pits**, usually equipped with a backactor and a 0.6m wide bucket. Allows a thorough inspection of the ground; especially the uppermost 1m or so (but able to reach depths of up to c. 4m), with the recovery of representative, disturbed samples. Also used to conduct soakaway testing.
- **Window or windowless** sampling boreholes (**dynamic sampling**). Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).
- **Cable percussive** (Shell & Auger) boreholes, typically using 150mm diameter tools and casing. Enables the recovery of soil samples and data from greater depth than is possible via trial pitting or a mini-percussive drill rig. Also enables the installation of better/deeper monitoring wells (cf use of a mini-percussive drill rig) due to the utilisation of temporary steel casing during drilling.
- **Rotary percussive** open-hole probeholes are typically drilled using a tri-cone rock roller or polycrystalline diamond compact (PDC) bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse. Often used to penetrate bedrock to investigate abandoned shallow mineworkings
- **Rotary cored** boreholes. A rock core is cut by a bit, passes up into the inner barrel and, at the end of the coring run, the core barrel assembly is lifted to the surface. Core drilling is relatively expensive, but essential if quality data is required to assess issues associated with deep excavation, rock slope stability etc.

Where installed, gas\groundwater monitoring **wells** typically comprise a lower slotted section, surrounded by a filter pack of 10 mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete. Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ testing

Relative densities of granular materials given on the trial pit logs are based on visual inspection only, they do not relate to any specific bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as N* = x. The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results (hand vane readings) reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- A sufficient number of samples from each (common) site material are tested
- Horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model
- Any localised, significant, but non-pervasive conditions are considered

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Representative bulk samples of the **soil mass** are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the **soil matrix** of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).

At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones[1] – some crush and test the "as received" soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

In essence, samples taken from coarser soils for contaminant analysis are "screened" by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables)
- Remain on vegetables after washing (consumption of vegetables)
- Be eaten (accidentally by an adult, or deliberately by a child)
- Be whipped-up by the wind for dust generation (inhalation)
- Stick to the skin for any length of time (dermal contact)
- Yield toxic vapour (inhalation)

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix '*' (eg 2D*, or 4G*). Lithos' site engineer describes both the unrepresentative sample, and the soil mass from which it was been taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4ºC, until delivery to the selected laboratory.

Anticipated testing	Container(s)
Asbestos identification	1000ml plastic tub
pH & metals	1000ml plastic tub or 250ml glass jars
non-volatile organics	250ml glass jars
Speciated TPH	250ml & 50ml glass jars
VOCs (incl. naphthalene and\or GRO)	50ml glass jar

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests is proposed.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork. Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Description of strata

Soils encountered during a Lithos investigation are described (logged) in general accordance with BS 5930:2015. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text. The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

[1] *Mark Perrin. Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.*

03 – Geotechnical laboratory testing
Generic notes – geoenvironmental investigations

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing is routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

Where soft, cohesive soils are encountered, one-dimensional consolidation tests are scheduled in order to assess settlement characteristics, and unconsolidated undrained triaxial compression tests to assess shear strength.

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading
- Compaction tests
- Particle density

Test results are presented as received in an Appendix to the Geoenvironmental Report.

Atterberg limits & moisture content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Lithos typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%. PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'p), defined as:

I'p = Ip * (%< 425µm/100)

i.e. if PI is 30%, but the soil contains 80% < 425µm, then: I'p = 30 * 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs. Lithos apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- The average values for each particular soil type (ie differentiate between residual soil and alluvium)
- The number of results in each class and
- The actual values

Unless the judgment strongly indicates otherwise, Lithos typically adopts a conservative approach and recommends assumption of the higher classification.

Soluble sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Lithos refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- The nature of the site (greenfield, brownfield or pyritic)
- The groundwater regime (static, mobile or highly mobile)
- The design sulphate class (DS class) and
- The aggressive chemical environment for concrete (ACEC class)

Lithos reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Oedometer (Consolidation) tests

Oedometer tests measure a soil's consolidation properties, and are performed by applying different loads to a soil sample and measuring the deformation response. Typically the sample is subject to 5 incremental pressures (4 loading & 1 unloading), and the convention is for each subsequent pressure to be double the previous pressure. BS1377 suggests the **initial** pressure should be:

a) For stiff soils the effective overburden pressure*
b) For firm soils "somewhat less" than the effective overburden pressure
c) For soft soils "appreciably less" than the effective overburden pressure, usually 25 kPa or less
d) For very soft soils very low, typically 5 kPa or 10 kPa

* Effective **overburden pressure** (kNm^{-2}) = depth (m) x soil bulk unit weight (kNm^{-3})

Results from these tests are used to predict how a soil in the field will deform in response to a change in effective stress.

Triaxial tests

This test measures the mechanical properties of a soil by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, with fluid used to apply a confining pressure in the perpendicular directions. During the test, the surrounding fluid is pressurized, and then stress on the platens is increased until the material in the cylinder fails.

From triaxial test data, it is possible to extract fundamental material parameters, including its angle of shearing resistance, apparent cohesion, and dilatancy angle. These parameters are then used in computer models to predict how the material will behave in a larger-scale engineering application.

Quick (single stage, Unconsolidated, Undrained tests) are most appropriate for foundation design. This is because load is applied relatively quickly, and shear strength of the clay will be lowest initially; after the applied load causes some consolidation of the ground (after drainage results in dissipation of short-term excess pore water pressure), the in-situ clays will become progressively stronger and hence the factor of safety will increase. Confining pressure is specified as equivalent to overburden pressure (kNm^{-2}).

Foundations on granular soils would use effective shear strength parameters (c' and phi') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Unconsolidated Undrained triaxial tests are most appropriate for assessment of the stability of fill slopes on clays. Similar to foundations, the application of load gradually increases the strength of the clays and hence the critical case is the short term undrained condition.

Consolidated Undrained (or sometimes **Consolidated Drained**) triaxial tests are most appropriate for assessment of the stability of cut slopes in clays. This is because unloading of the ground leads to short term reduction in pore pressures that approximately balance the unloading, hence the soil strength is largely unchanged. Over time the reduced pore pressures suck water in, which leads in to the progressive increase in pore pressure and loss of strength. The fully drained state is critical, which must be modelled using effective strength parameters and a reasonable estimate of the long term water table conditions.

Slopes formed in granular soils would use effective shear strength parameters (c' and phi') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Determination of analytical suite

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "Potential contaminants for the assessment of land" and the relevant DETR Industry Profile(s).

Common contaminants

Common **Inorganic** Contaminants include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc
- Semi-metals, most notably arsenic, selenium, and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction. Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to UV digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO_4), sulphides etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common **Organic** Contaminants include hydrocarbons, phenols, and polychlorinated biphenyls.

Petroleum is a mixture of hydrocarbons produced from the distillation of crude oil, and includes aliphatics (alkanes, alkenes and cycloalkanes), aromatics (benzene and derivatives) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen. Petroleum hydrocarbons can be grouped based on the carbon number range:

- GRO – Gasoline Range Organics (typically C_6 to C_{10}). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C_{10} to C_{28})
- LRO - Lubricating Oil Range Organics (typically C_{28} to C_{40})
- MRO – Mineral Oil Range Organics (typically C_{18} to C_{44})

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies. Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C_5-C_{40}, whereas others define TPH as C_{10}-C_{30}.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (e.g. petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C_4 to C_5 range) that are volatile. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polycyclic aromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present. Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present. Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have two or more fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (benzo(a)pyrene) and\or mobile in the environment (naphthalene).

Volatile Organic Compounds (VOCs) are organic chemicals, and most are liquids that readily evaporate on exposure to air. Examples include benzene, toluene, xylene, chloroform etc. Semi-Volatile Organic Compounds (sVOCs) include phenol and benzo(a)pyrene, and have relatively low boiling points. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group (-OH) attached to an aromatic ring (ie include a benzene ring and an –OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known; in the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of analysis (organic compounds)

TPH by GC-FID is an analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C_{10} to C_{40} (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a broad, 'banded' breakdown of the TPH results into gasoline range organics (GRO), diesel range organics (DRO) and heavier lubricating oil range organics (LRO), or fully speciated results with the reporting of hydrocarbon concentrations in 14 specific carbon bandings based upon behavioural characteristics, e.g. aliphatic C_6 to C_8, aromatic C_{10} to C_{12} etc.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH by GC-FID.

Note: Risk assessment models require physiochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physiochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK guidance

The UK approach to contaminated land is set out in Land Contamination Risk Management (2020). The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source; (2) a receptor (eg controlled water or people); and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels, Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 & 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 & 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software Handbook, Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was to provide technical guidance in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A, where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and\or exposure parameters used within CLEA (while maintaining current exposure parameters).

Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YALPAG (collection of Yorkshire & Lincolnshire local authorities) and received confirmation that they are satisfied with this approach.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with revised, lower screening values may be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for five different CSMs (scenarios); these are:

A - Residential with gardens, but no cover (or only up to 300mm)

B - Residential with gardens and 600mm 'clean' cover

C - Residential apartments with landscaping (i.e. no home grown produce)

D - Commercial/industrial with landscaping

E – Importation of soil cover

The **exposure** pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	• Inhalation of indoor vapours • Inhalation of outdoor vapours	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.

Scenario	Land use	Pathways	Justification
D	Commercial/ industrial with landscaped areas no cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of outdoor vapours and dust	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is **not** placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundation; i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default.

Lithos have derived Tier 1 values for a number of inorganic and organic determinands in the context of the five Scenarios A to E. The Tier 1 values are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part 2A of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; or
- Groundwater and surface water

Inorganic Tier 1 values for scenarios A to E

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen" If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			4,000		4,000	28,767	4,000	Assumes Cr is CrIII
Pb	450	200	200		314	2,330	200	C4SL adopted
Ni	130		109		123	892	109	Assessment of health risk only
Se	350		434		596	13,018	434	
Hg	170		199		244	3,603	199	Assumes in an inorganic compound
Vn			584		586	4,994	584	
B			5		5	5	5	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Cu			100		100	100	100	
Zn			200		200	200	200	

Organic Tier 1 values for scenarios A to E

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.7	<1^	<1^	63	<1	<1 based on professional judgement and lower than calculated value.
Toluene	610		836	2,048	1,912	5,000	<1	Scenario D based on professional judgement and lower than calculated value.
Ethyl Benzene	350		379	592	566	5,000	<10	
Xylenes	240		535	590	585	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Phenol	420		1,434	3,360	2,264	5,000	<10	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5	76	5	C4SL adopted. Scenario B 5 times scenario A
Naphthalene			6	6	6	619	<10	Scenario E based on professional judgement and lower than calculated value
Gasoline Range Organics			22	23	23	2178	626	See 3-step assessment of TPH below ^Based on professional judgement and lower than calculated value
Diesel Range Organics			215	218	215	^5,000	1,429	
Lubricating Range Org			3,299	5,000	3,829	^5,000	3,299	

* *For a residential end use*

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (BaP) must be present in all soil samples
- Profile of the different PAH relative to BaP should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study[1]

To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

[1] SP1010 Appendix E, Provisional C4SIs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach.

Similarly, **TPH** cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the bandings.

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

The equation used to assess cumulative effects in step 3 is shown below.

$$HI = \sum_{F_i=1}^{16} HQ\ F_i = \frac{Measured\ concentration\ F_i\ (mg\,kg^{-1})}{SGV\ F_i\ (mg\,kg^{-1})}$$

where HI = Hazard Index
HQ = Hazard Quotient
F_i = Fraction $_i$
SGV = Soil Guideline Value

Statistical Assessment

Current UK guidance is provided by CL:AIRE[2], and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by **heterogenous made ground**, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not necessary to demonstrate that made ground soils are "clean" and therefore there is no need to test large numbers of samples and undertake statistical analysis. Sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).

The CL:AIRE (2020) guidance replaces the withdrawn "Guidance on Comparing Soil Contamination Data with a Critical Concentration" (2008).

The old approach to statistical analysis was based on a definitive yes/no answer which required limited consideration of the dataset and Conceptual Site Model. It was widely accepted that this did not allow sites or risk to be adequately assessed. The updated approach requires a comprehensive understanding of the datasets within the context of the Conceptual Site Model.

Current guidance requires that:

- A robust CSM is in place which identifies source areas, averaging areas and averaging zones
- Sampling locations are relatively evenly spread across the site and were selected using simple or stratified random sampling with no targeting being undertaken
- The field data and CSM do not suggest the presence of a hotspot of contamination which should be treated as a separate zone
- The samples are all taken from a similar same depth and within the same material type across the zone being assessed
- A minimum of 10 samples have been taken. It should be appreciated that confidence in a dataset increases as the number of samples obtained and tested from a zone increases.

The statistical analysis assumes a homogenous distribution of strata and contamination and therefore the dataset will be normally distributed (symmetric, log symmetric or fat tailed).

A normally distributed dataset is assessed using a number of statistical tools to generate a Dot and Box Plot which includes summary statistics and confidence intervals. The review of statistical data enables the assessor to make a decision, with an associated level of confidence, where the true mean of the sample population lies in relation to the critical concentration.

It is essential when using statistics to assess sample data that all decisions relate back to the conceptual site model. Statistics cannot indicate if contamination on a site is likely to present a risk to the end user, this is the role of the 'competent person' i.e. Lithos.

However, broadly speaking the following applies:

- Mean and UCL below the critical concentration – no further assessment required.
- Mean below the critical concentration, but UCL above – consider the CSM and likely sources.
- Mean and UCL above the critical concentration – further assessment required, remediation likely depending on the CSM.
- LCL, Mean & UCL above the critical concentration – further assessment required, remediation likely.

[2] *CL:AIRE, 2020.Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.*

Other screening values used by Lithos

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to The Sewage Sludge in Agriculture: Code of Practice 2018 for copper and zinc (at pH 5.5 to 6.0). The CLEA derived Tier 1 value is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Concrete in aggressive ground', 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that: "*In general … it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn*".

Tier 1 **groundwater risk assessments** are always site specific and compare leachate or groundwater concentrations with the appropriate water quality standard based on the CSM and consideration of relevant water quality impacts and assessments.

Waste classification & WAC

In the context of waste soils generated by remediation and\or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated 'natural' soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds)
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds)

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (e.g. by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

Possible action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 (see above) in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 provides some guidance on averaging areas noting that they are the area within which a receptor may be exposed to contamination but leaving the site assessor to determine the appropriate averaging area for their site.

Lithos consider the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and\or by former use in a given sub-area of the site, before undertaking statistical analysis; i.e. the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass, i.e. contamination would normally be more pervasive and significant in granular soils than cohesive soils

05 – Hazardous gas
Generic notes – geoenvironmental investigations

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 01 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a "carrier" for hazardous gas
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas monitoring procedure

Lithos adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration
- Gas emission rate
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism. Where samples of gas are required for laboratory analysis, Gresham Tubes or multi-layer Tedlar / ALTEF sampling bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current guidance

CIRIA Report 151 (1995) identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2007) advocated two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006 for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow. However, the NHBC traffic light guidance will be withdrawn in July 2025, and consequently Lithos typically now only refer to Situation A methodology.

Relevant UK guidance includes:

- BS8485:2015+A1:2019 – Code of Practice for the characterisation & remediation from ground gas in affected developments.
- BS8576:2013 Guidance on investigations for ground gas – permanent gases and volatile organic compounds
- Wilson, Card & Haines (CIEH, 208) The Local Authority Guide to Ground Gas
- CIRIA C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings
- CIRIA C735 (2014) Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases
- CL:AIRE (October 2021) Good Practice for Risk Assessment for Coal Mine Gas Emissions
- CL:AIRE Research Bulletin RB17 (November 2012) A Pragmatic Approach to Ground Gas Risk Assessment
- CL:AIRE Research Bulletin RB13 (February 2011) The Utility of Continuous Monitoring in Detection & Prediction of 'Worst-Case' Ground Gas Concentration
- BRE\Environment Agency Report BR 414 (2001) – "Protective Measures for housing on gas-contaminated land".
- YALPAG (December 2016) - Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants.
- Environment Agency Report LFTGN 03 - Guidance on the management of landfill gas, June 2014
- NHBC Foundation (April 2023) Hazardous Ground Gas – an Essential Guide for Housebuilders (NF94)

Situation A Methodology (All development)s

(Wilson & Card, 1999) revised Table 28 of CIRIA 149 in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Characteristic Situation	Gas Screening Value, CH_4 or CO_2 (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworkings flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworkings – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworkings unflooded, inactive
6	>70		Recent landfill site

Notes: Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr). Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

Appendix B

Drawings

Reproduced from OS Explorer map 1:25,000 scale by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. Crown copyright. All rights reserved. Licence number 100049696.

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CLIENT	LNT CONSTRUCTION
JOB TITLE	ROYAL VICTORIA COURT, NEWPORT
DRAWING TITLE	SITE LOCATION PLAN
DRAWN	CC
DATE	23 01 2025
CHECKED	AG
DATE	23 01 2025
STATUS	FOR COMMENT ☐ DRAFT ☐ FOR APPROVAL ☐ FINAL ☑
SCALE	1:25,000
SHEET	A4
DRAWING NO.	5088/1
REVISION	

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM LNT CONSTRUCTION'S DRAWING REFERENCE NP20-2NW-F-01, DATED MARCH 2024

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2024	DRAFT ☐
		FINAL ☑

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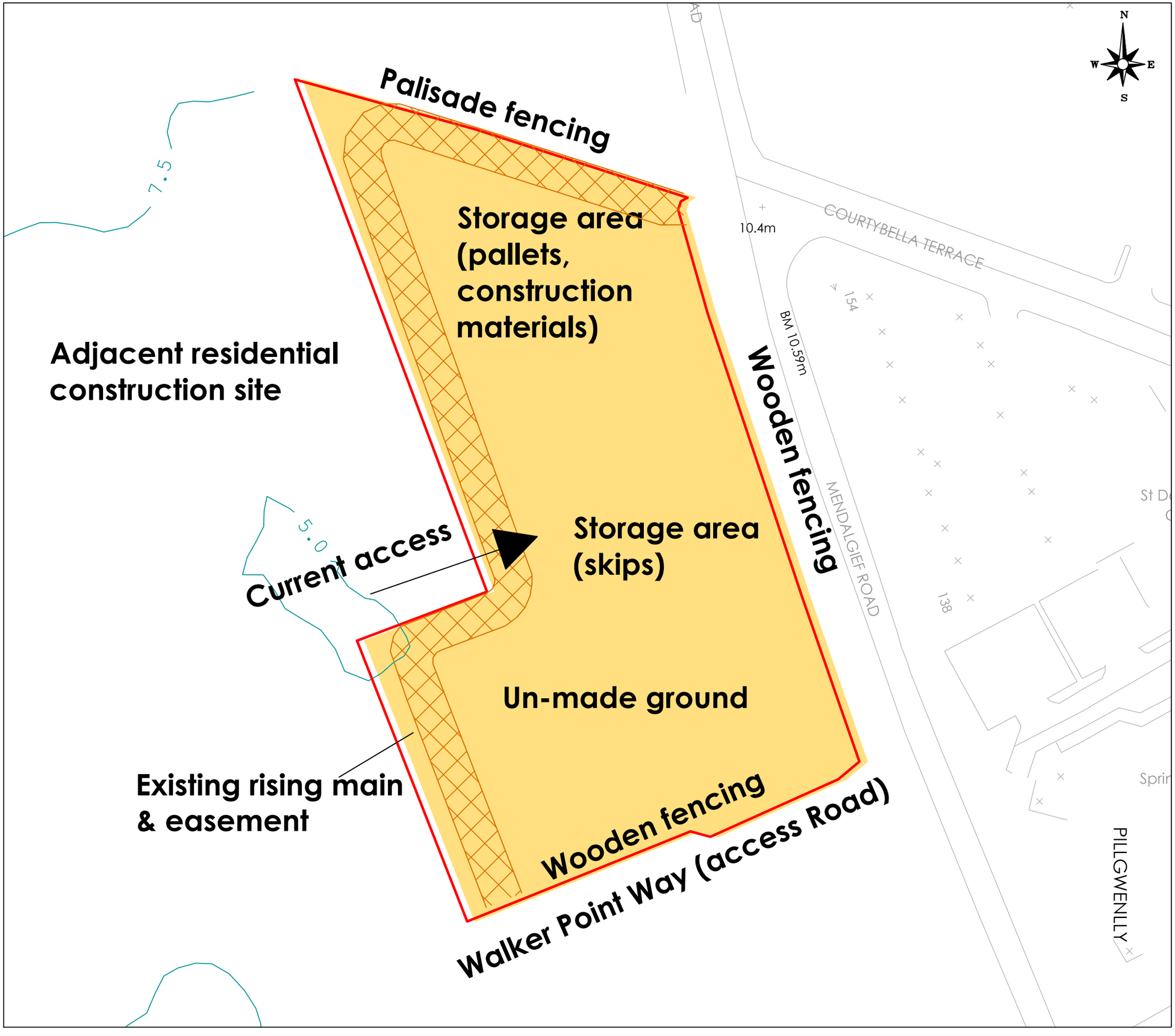

NOTES

- RISING MAIN EASEMENT
- UN-MADE GROUND
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2025	DRAFT ☐
		FINAL ☑

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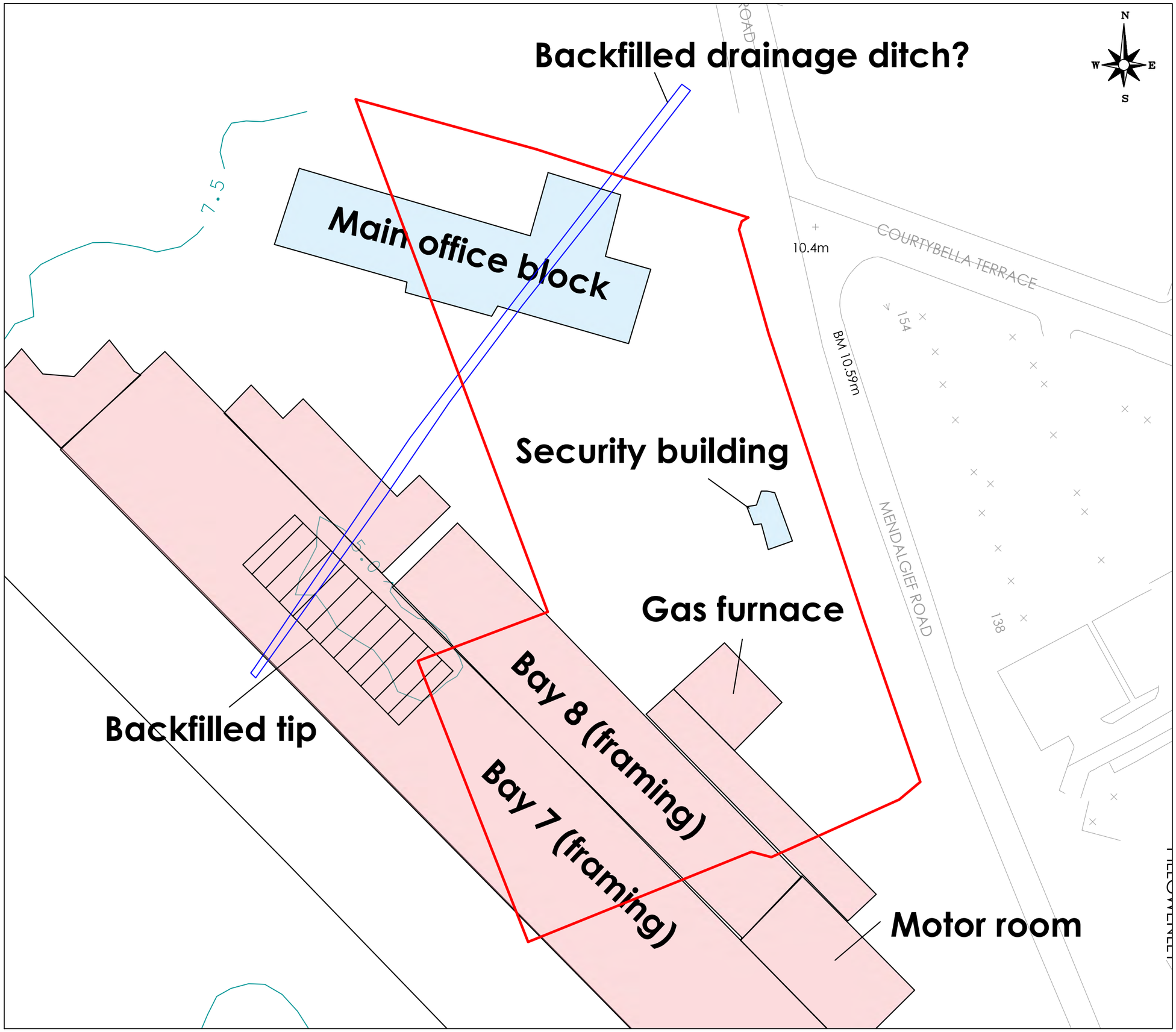

NOTES

APPROXIMATE SITE BOUNDARY

ARUP 2014 FEATURES

HISTORICAL BUILDING (GENERAL)

HISTORICAL BUILDING (WORKS)

HISTORICAL WASTE PIT

HISTORICAL OS MAP FEATURES

HISTORICAL DRAINAGE DITCH

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

HISTORICAL SITE FEATURES

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2025	DRAFT ☐
		FINAL ☑

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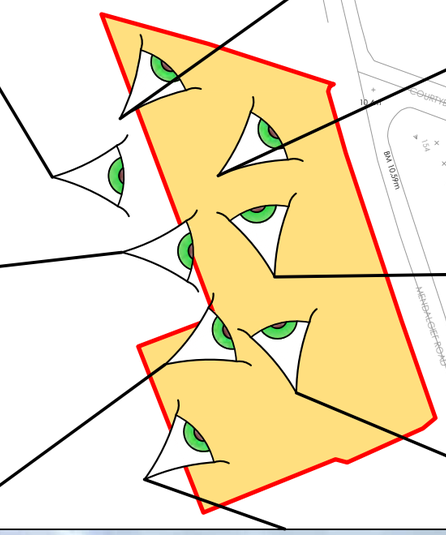

NOTES

UN-MADE GROUND

APPROXIMATE SITE BOUNDARY

LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2025	DRAFT ☐
		FINAL ☑

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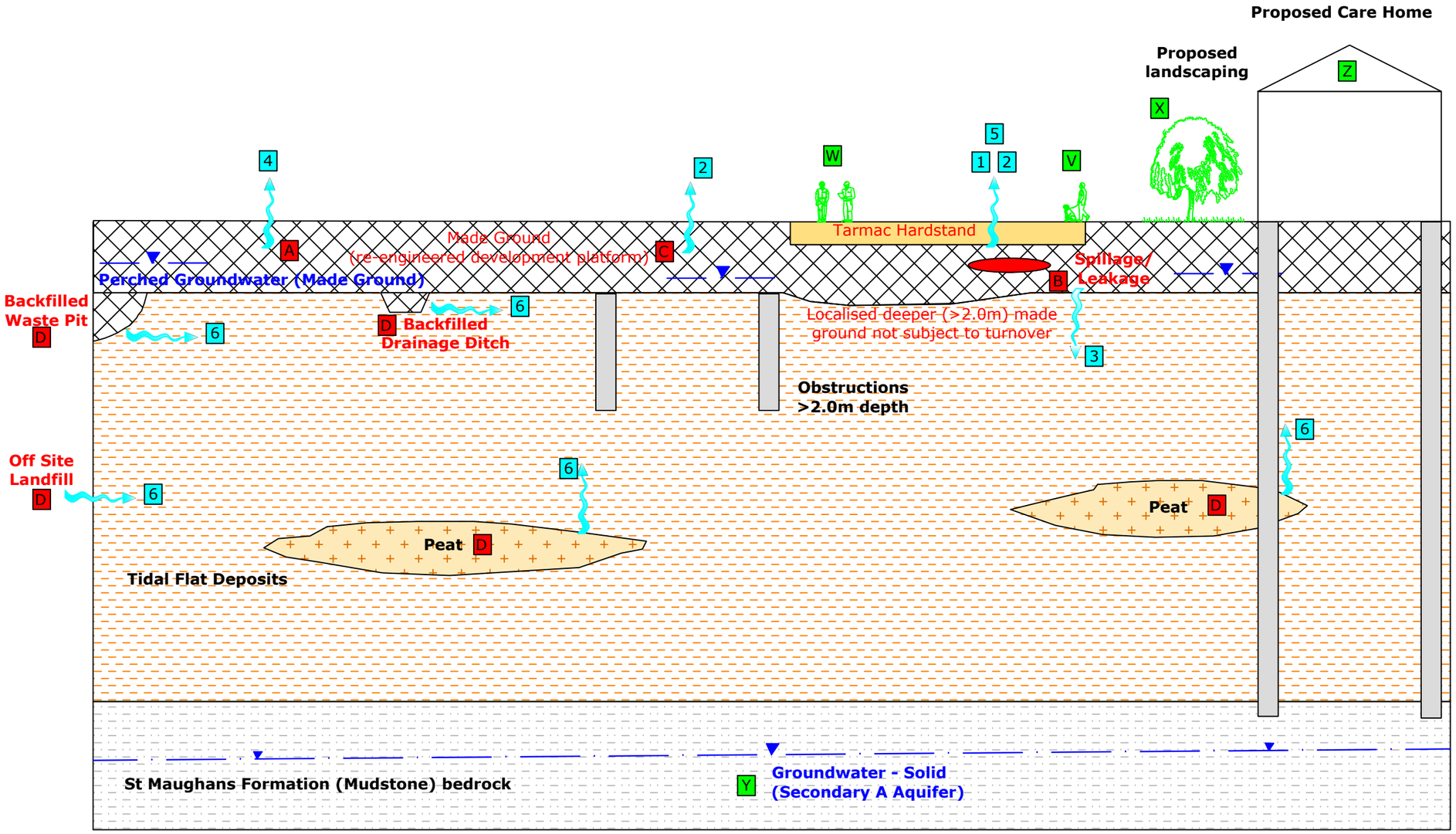

SOURCES	PATHWAYS	RECEPTORS
RECENT USE (CAR PARK & SITE COMPOUND)	1 DERMAL CONTACT	V END USERS (RESIDENTS)
A MADE GROUND (INORGANICS)	2 INGESTION/INHALATION	W SITE WORKERS
B LEAKAGE/SPILLAGE (ORGANICS)	3 LEACHING OF CONTAMINANTS	X VEGETATION
POST-REMEDIATION	4 UPTAKE BY PLANTS	Y GROUNDWATER
C ASBESTOS	5 VOLATILISATION	Z PROPOSED BUILDING
D HAZARDOUS GAS	6 MIGRATION OF GAS	

NOTES

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2025	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	5088/5	

NOTES

TRIAL PIT LOCATION

BOREHOLE LOCATION

APPROXIMATE SITE BOUNDARY

EXPLORATORY HOLE LOCATIONS BASED ON DATA FROM A HAND-HELD GPS (+/- 3M ACCURACY)

REPRODUCED FROM LNT CONSTRUCTION'S DRAWING REFERENCE NP20-2NW-F-01, DATED MARCH 2024

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

DRAWN	DATE	STATUS
CC	16 12 2024	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	16 12 2024	DRAFT ☐
		FINAL ☑

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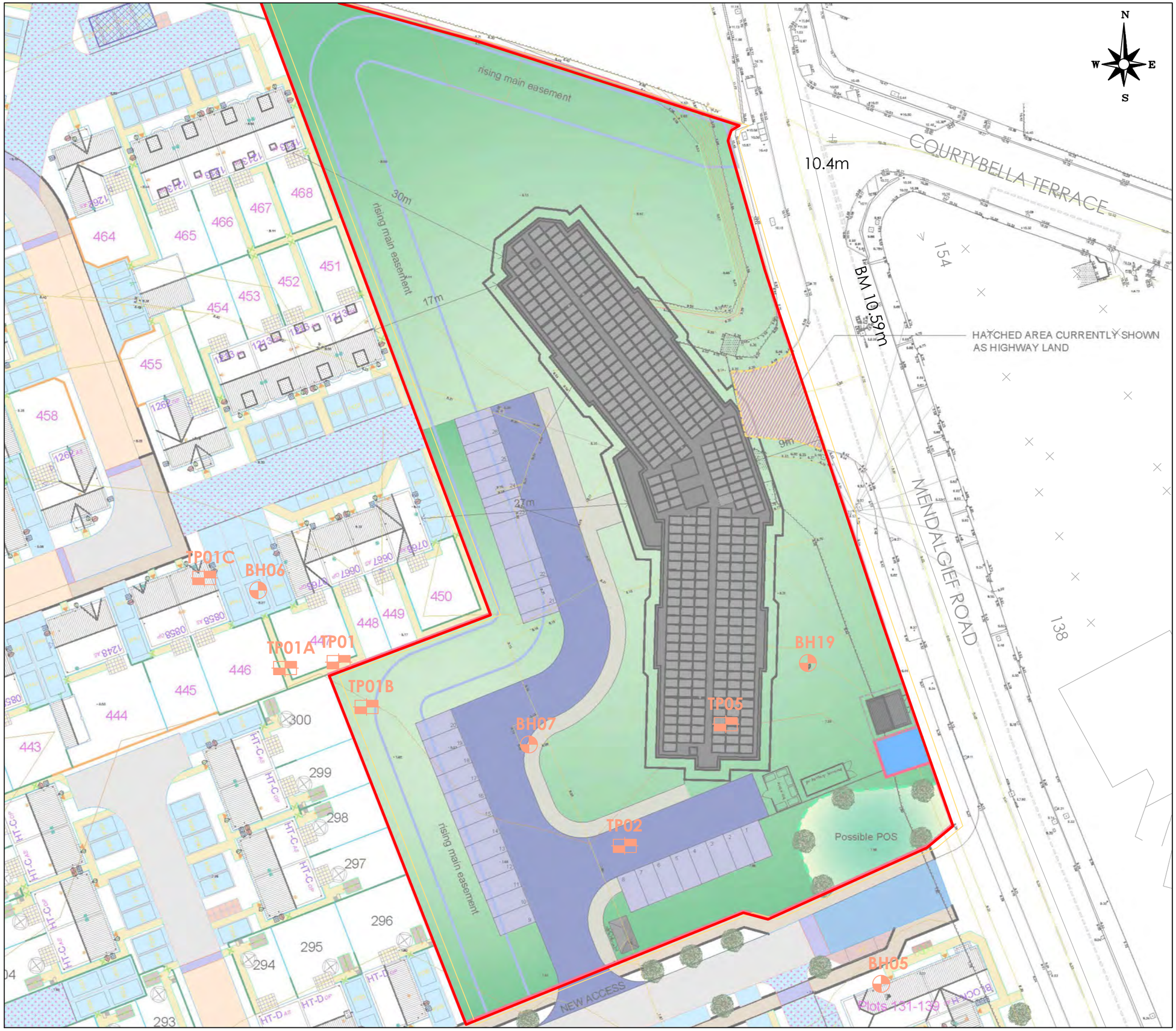

NOTES

ARUP 2014 EXPLORATORY HOLES

- TRIAL PIT LOCATION
- BOREHOLE LOCATION
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

ARUP 2014 EXPLORATORY HOLE LOCATIONS

DRAWN	DATE	STATUS
CC	16 12 2024	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	16 12 2024	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
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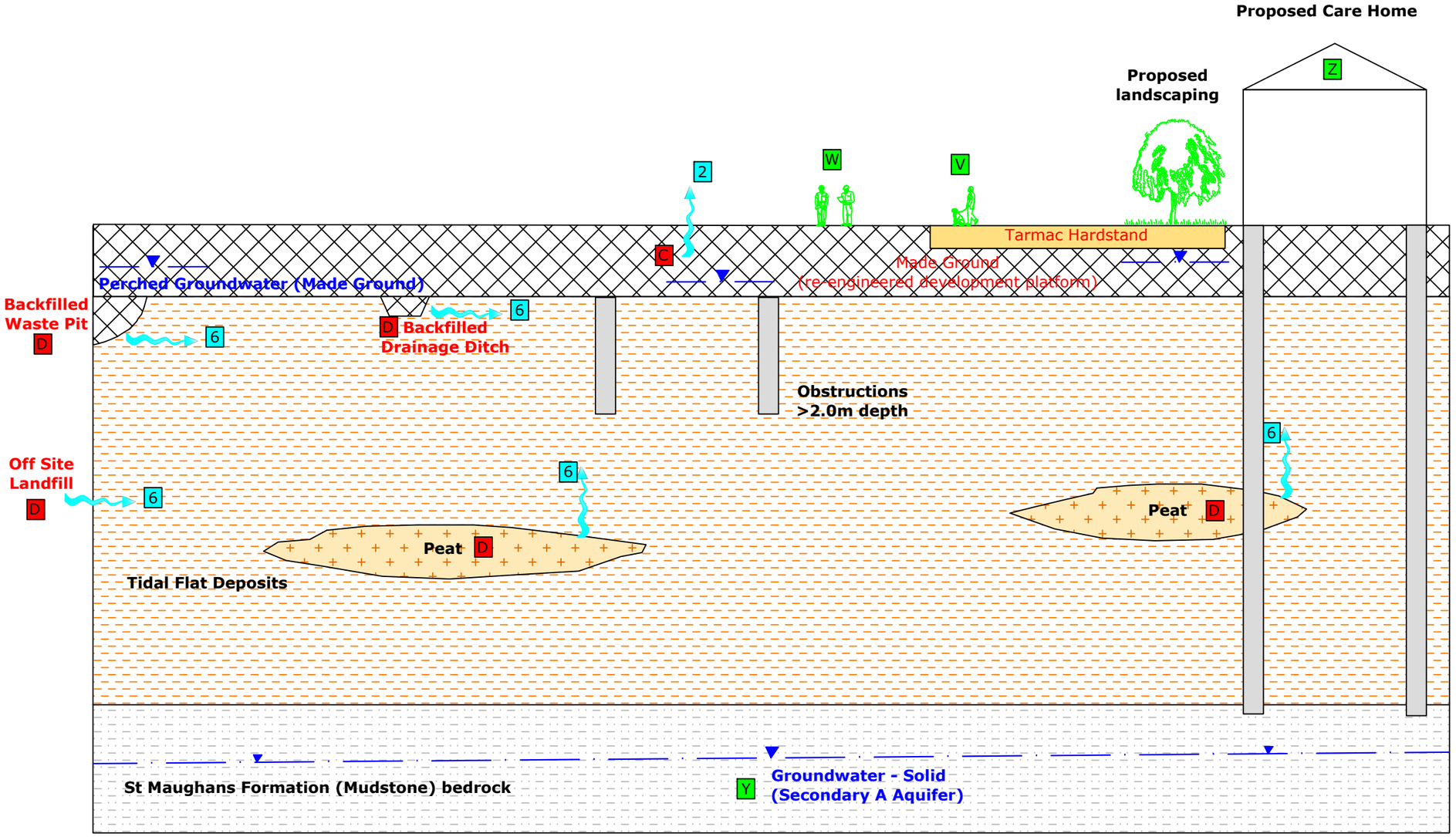

SOURCES	PATHWAYS	RECEPTORS
C ASBESTOS	2 INHALATION	V END USERS (RESIDENTS)
D HAZARDOUS GAS	6 MIGRATION OF GAS	W SITE WORKERS
		Z PROPOSED BUILDING

NOTES

REV.	DESCRIPTION	DATE

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JOB TITLE

ROYAL VICTORIA COURT, NEWPORT

DRAWING TITLE

REVISED CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
CC	23 01 2025	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	23 01 2025	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	5088/7	

Appendix C

Commission

010/5088/AG

08th November 2024

Registered in England 07068066

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Mr Gary Little
LNT Care Developments
Helios 47
Isabella Road
Garforth
LS25 2DY

Dear Gary

Royal Victoria Court, Mendalgief Road, Newport, S. Wales

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that proposed development will include a 3-storey care home with associated car parking and landscaping; a layout has been provided.

Review of the information supplied suggests that the site consists of a single parcel of land (c. 0.7ha) within a wider ongoing residential redevelopment. Review of Google Maps suggests the site is being used to stockpile construction materials (north) and arisings (south).

Brief review of internet data suggests the site and the third party reports supplied suggests the site:

- Appears to have been developed around the 1930s with Whitehead Steelworks. The Steelworks were demolished between 2009 & 2013 with remediation/reclamation earthworks of the site in 2016 & 2017. Construction of residential dwellings on the wider site commenced in 2022.
- Is located within 250m of a known landfill site (Newport Sidings);
- Is not within a groundwater source protection zone;
- Is in an area where the risk of encountering UXO is considered low; and
- Is located within a Coal Mining Development beyond the Coal Authority's defined coalfields.

Brief examination of the relevant geological map and third party exploratory hole records suggests the site is underlain by up to 2.5m of (re-engineered?) made ground overlying Tidal Flat Deposits (soft clays & peat) to around 7.0m depth. Bedrock is likely to comprise St Maughan's Formation Mudstone at around 12m depth.

The scope of works outlined in this letter should enable us to assess abnormal development issues, associated with the ground. However, the nature of site investigation is such that it is not always possible to foresee all the potential issues. Consequently, it is sometimes necessary to recommend additional work, but where this occurs we will inform you immediately, provide costs, and seek your further instruction. We have visited site and reviewed available internet data and our geological maps in order to minimise the likelihood of further work.

Ground investigation is generally best undertaken once site operations have ceased and preferably post-vacation; access constraints associated with stockpiles, operations and underground service runs, can prevent thorough inspection of the ground via extensive trial pitting/trenching. Consequently, some uncertainties may remain and a supplementary, post-demolition ground investigation may be required by the relevant regulatory authorities. Nonetheless, useful data can be obtained at this time and we will certainly aim to resolve as much uncertainty relating to ground as possible, in order to enable you to make an unconditional offer for the site.

We will need a Promap or topo survey in CAD format, to provide a base plan for technical drawings etc. If you do not have one, we could obtain for an E\O of £ .

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, LCRM etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.

This proposal allows for the following works:

Desk study: Environmental search data and historical maps (obtained from Landmark or Groundsure), will be reviewed in order to determine whether past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined.

We will also obtain a natural ground stability report from BGS in order to check whether or not bedrock is considered prone to dissolution (but likely very low risk) and a Mining & Ground Stability search from Landmark.

We will also visit site to undertake a walkover survey. However, given travel time to Newport, the walkover will be done the day before (usually we would do a walkover a week or two in advance of fieldwork).

The HSA Radon Map indicates the site lies within an area where 10% to 30% of dwellings are above the radon action level, therefore we will obtain a site specific BGS radon report.

We will complete a more detailed review of the Arup & IG reports.

Fieldwork: We have allowed for a day's trial pitting and the drilling of 3 cable percussion boreholes. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

This proposal has been put together without a recent site visit and the following is assumed:

- All construction materials currently being stored on the north of the site will be moved prior to the investigation.
- Lithos will have unobstructive access and no other groundworks/machinery movements will be taking place within the LNT parcel.
- The site is secured from the general public.

Trial pitting will enable us to determine the:

- Nature of any made ground, including:
  - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
  - the proportion of "oversize", boulder-sized material
- Nature, distribution and thickness of shallow soils
- Suitability of the ground for founding structures and highways

Given nature of the ground conditions and the time of year, we have allowed for pits to be dug using a tracked 360° excavator. Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each trial pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf etc.

Based on review of ground conditions (up to 2.5m of made ground overlying soft Clays & peats), **soakaways** will not provide a satisfactory solution for surface water drainage and no allowance has been made for soakaway testing at this stage.

The **cable percussion boreholes** will be advanced to depths of c. 15m or refusal in bedrock, whichever is the shallower, and are primarily intended to enable the retrieval of geotechnical data from depth to inform pile design.

Given the anticipated presence of soft Tidal Flat Deposits, SPTs will be undertaken at approximate 1m to 1.5m intervals as the boreholes are advanced. SPTs allow assessment of the in-situ density of granular soils, enabling determination of allowable bearing capacity and thereby definitive foundation advice.

Undisturbed, thin wall open-tube samples (UT100) will be obtained from natural in-situ cohesive soils on striking and then alternate with SPTs (except in soft clays where only UT100s will be recovered) at intervals of 1m to 1.5m.

The boreholes will be cased-off during drilling to at least rock head, in order to reduce the possibility of blowing sands, groundwater ingress, mis-sampling etc.

Boreholes will also allow the installation of gas & groundwater wells (50mm ID, HDPE pipework with bentonite seals and a gravel filter pack). Well headworks will comprise a 100mm diameter steel security helmet which will extend about 150mm above ground level (if required, the position of each helmet could be "marked" with a 1.5m high fence post to reduce the likelihood of damage by construction machinery).

At this stage, we have assumed that overnight security will not be required, but this will be reviewed following a site visit. If required, security would be an E\O of £ per night.

Exploratory holes will be positioned a hand-held GPS (typically +/- 3m accuracy); if required we could arrange for a **surveyor** to pick-up exploratory holes (and provide co-ordinates/ground levels) for an E\O cost of £ .

Given the likely presence of peat and adjacent area of landfill within 250m of the site, we have allowed for the installation of wells in 3 holes and monitoring for hazardous **gas** (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Very Low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 6 visits over a 3-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

We strongly recommend that groundwater / gas wells be decommissioned after monitoring has been completed. Decommissioning involves removal of the metal covers, unscrewing the upper 1m to 2 m of pipework and filling the void / remaining well with bentonite.

Decommissioning of monitoring wells removes the potential for groundwater pollution caused by accidental spillages during the construction phase and prevents gas migration into sub-floor voids. Subject to your instruction, we will decommission accessible wells after the last monitoring visit for an E\O price of £ +VAT.

Testing: This will comprise routine **geotechnical** soils analysis, including 16 moisture content & Atterberg limits, and 20 pH & water-soluble sulphate and 4 gradings.

Given the anticipated soft and potentially compressible alluvial deposits, we have allowed for single stage, undrained unconsolidated triaxial tests on 6 undisturbed samples to assess shear strength, and one-dimensional analysis on 6 undisturbed samples to enable assessment of potential settlement and therefore aid foundation design.

This site is brownfield and therefore likely to be underlain by made ground which in turn is likely to be subject to re-engineering prior to the construction of new estate roads. Consequently, there is no merit in obtaining CBR values at this stage.

Appropriate **chemical analyses**, based on our review of the existing SI reports and knowledge of the site's history, have been allowed for; this will comprise 20 samples for a suite including heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Within in our proposal we have allowed for the screening (ID) of 20 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

We have also allowed for 6 waste acceptance criteria (**WAC**) tests (4 on made ground and 2 on natural ground). WAC testing is required for any material deposited within a landfill and will identify which landfill type can accept the waste i.e. inert, non-hazardous etc. WAC analysis is different to the 'routine' laboratory testing undertaken in order to determine hazardous properties; hazardous properties of a waste cannot be determined by WAC testing.

We will also schedule 'routine' analysis on the 2 samples of natural ground (to aid waste classification).

In the event that steel slag is identified within the made ground, potential **slag expansion** (simple evaluation) testing will be required to assess the expansivity of the steel slag. This would be undertaken on 3 samples at an E\O total cost of £ +VAT.

Reporting & timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within 3 days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive, factual and interpretative report will be issued. This will contain exploratory hole logs, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health. The report will also include consideration of foundation types.

Our report will provide a review of laboratory results considered against relevant hazardous properties and concentration limits within WM3. This **basic review** will provide an indication of whether the surplus soil is hazardous or non-hazardous and provide the likely waste code. However, in some cases, particularly where there is a mixture of contaminants, or individual metal concentrations are found to exceed 1,000 mg/kg, a more detailed assessment may be required (allow an E\O of £).

At the time of writing, fieldwork could be commenced within 3 to 4 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

A completed copy of the **HBF** Contaminated Land Assessment Form will be included in an Appendix to our Report. However, the proposed route(s), and total length, of water supply pipes are not currently known and no allowance has been made for laboratory testing of soil samples in line with UKWIR guidance.

Given previous usage of this land, it is considered highly likely that a **Remediation Strategy** report will be required by the Local Authority, and our proposal allows for this.

It should be noted that a Remediation Strategy outlines the remediation objectives necessary to protect environmental receptors and render a site suitable for the proposed end use. A Remediation Strategy is not the same as a Method Statement; the latter should be prepared subsequently, usually by a Contractor, in order to detail how the objectives will be achieved.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of **£** plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent. Revision of the costings provided may be required if works are not instructed within **3 months** of the date this proposal was issued.

Our proposal allows for submission of a single piece of correspondence with NHBC and\or the local authority to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project on completion of each Item(s) instructed.

Please note if following instruction of the works outlined in this proposal, it is necessary to subsequently **postpone or cancel**, this should be done at least 3 working days before Lithos are due to commence intrusive investigation on site. We reserve the right to charge a cancellation fee in the event of later notification to cover plant / drill rig costs and abortive consultancy time. The cancellation fee will not exceed £ plus VAT.

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of **welfare** will be included within the Method Statements. However, this investigation is expected to last for 3 to 5 working days and assumes that welfare facilities are **already present** for the wider site and the Lithos engineer and subcontractors will have access to these facilities.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

Under the **CDM** Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

If no other designers or contractors have been appointed, Lithos could perform the role of Principal Contractor but only for the duration of the site investigation outlined in this proposal. If you require us to perform the role of Principal Contractor, please make this clear in your instruction. It should be noted that we are not suitably qualified to perform this role where other designers or contractors are also appointed.

It is anticipated that the site investigation outlined in this proposal will be undertaken several months before any construction is commenced on site. Consequently, our works can be considered in isolation and, given the anticipated number of person days on site, this site investigation is not notifiable to the HSE.

Terms & conditions: LNT and Lithos have agreed Terms and Conditions, a copy of which are enclosed.

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely

Adam Gombocz
Director
for and on behalf of
LITHOS CONSULTING LIMITED

1 DEFINITIONS AND INTERPRETATION

1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting Limited"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing:

"Client" shall mean the party for whom the Services are being provided to by Lithos;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films, and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trademarks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme, or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed, or produced by any person;

"Lithos" shall mean Lithos Consulting Limited of Parkhill, Walton Road, Wetherby, West Yorkshire, LS22 5DZ ;

"Reliance Letter" shall mean the form of reliance letter substantially (save for factual information) in the form appended to these Terms;

"Parties" shall mean the Client and Lithos;

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;

"Proposal" means the offer document prepared by Lithos in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by Lithos pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;

"Site" means Royal Victoria Court, Newport

"Terms" means these terms entitled "Terms and Conditions for the Appointment of Lithos".

1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.

1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.

1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.

1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.

1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

2.1 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the **provisions of the Agreement.**

3 OBLIGATIONS OF LITHOS

3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional environmental firms in performing similar services under similar conditions.

3.2 Lithos shall perform the Services in accordance with all relevant environmental and safety legislation current at the time of undertaking the project.

4 OBLIGATIONS OF THE CLIENT

4.1 Throughout the period of this Agreement the Client shall afford to Lithos or procure the affording to Lithos of reasonable access to any site where access is required for the performance of the Services.

4.2 The Client accepts responsibility for ensuring that Lithos is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Lithos prior to the commencement of the Services. The Client shall also inform Lithos in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services.

4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Lithos pursuant to the Agreement, he will advise Lithos in writing of such defect, conflict or other fault and Lithos shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.

5 INTELLECTUAL PROPERTY

5.1 The copyright in all Intellectual Property prepared by or on behalf of Lithos in connection with the Project for delivery to the Client shall remain vested in Lithos.

5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any license to amend any drawing, design or other Intellectual Property produced by Lithos.

5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Lithos (not to be unreasonably withheld or delayed). Lithos shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Lithos.

5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Lithos and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.

5.5 In the event of the Client being in default of payment of any fees or other amounts due, Lithos may suspend further use of the licence on that Project on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 TITLE

6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third-party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.

6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.

6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.

6.4 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.

7 CONFIDENTIALITY

7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.

7.2 Subject to the above and to the advance prior written consent of the Client, Lithos shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

8.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and Lithos will only agree to an assignment on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos' legal and other costs associated with any assignment.

8.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.

8.3 Lithos will consent to any request from the Client for Lithos to enter any one or more collateral warranty or letters of reliance with/to a long leaseholder, tenant, funder, or purchaser of the whole or a significant part of the Site (excluding purchasers of individual residential units) with regard to the Services provided under the Agreement, subject at all times to a maximum number of 6 collateral warranties or letters of reliance (or such other number as may be agreed from time to time). Lithos will only enter a collateral warranty or provide a letter of reliance on its terms (in substantially the form attached to this Agreement).

9 INSURANCE

9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION) in the aggregate cover . This policy is annually renewable and whilst renewal is not automatic, Lithos shall maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.

9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.

10 LIMITATIONS ON LIABILITY

10.1 Lithos' liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall not exceed five million pounds in the aggregate.

10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.

10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.

10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 PAYMENT

11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.

11.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.

11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.

11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

12 DELAY

12.1 Lithos will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Lithos undertakes to complete the Services within a reasonable period but will not be liable to the Client for any delay as a result.

13 TERMINATION

13.1 The Agreement may be determined by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of determination must be given to the party which is insolvent by the other party.

13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to determine its appointment in respect of the Services by seven days written notice to the Client.

13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.

13.4 Any determination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos to require payment for all services performed up to the date of such determination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

14 NOTICES

14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.

14.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

15 ENTIRE AGREEMENT

15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications, and representations, whether express or implied and any claim against Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.

15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.

15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.

16 DISPUTES AND GOVERNING LAW

16.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.

16.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland, and Northern Ireland.

Kind regards,

Adam Gombocz
Director
Lithos Consulting Ltd
M 07951 497021
DD 01937 543353
www.lithos.co.uk

From: Gary Little <Gary.Little@Intcaredevelopments.co.uk>
Sent: Friday, November 8, 2024 8:24 AM
To: Adam Gombocz <Adam.Gombocz@lithos.co.uk>; Charlotte Copley <Charlotte.Copley@lithos.co.uk>
Cc: Claire Howes <Claire.Howes@Intconstruction.co.uk>; Sam Rose <sam.rose@Intcaredevelopments.co.uk>; Lyndsey-Jane Lupton <lyndsey-jane.lupton@Intconstruction.co.uk>
Subject: RE: 5088 - Newport - Interim Update

Excellent. Thanks Adam.

Gary Little

Pre-Construction Technical Manager

T 07547 105 172
E gary.little@Intcaredevelopments.co.uk

From: Adam Gombocz <Adam.Gombocz@lithos.co.uk>
Sent: Friday, November 8, 2024 8:16 AM
To: Gary Little <Gary.Little@Intcaredevelopments.co.uk>; Charlotte Copley <Charlotte.Copley@lithos.co.uk>
Cc: Claire Howes <Claire.Howes@Intconstruction.co.uk>; Sam Rose <sam.rose@Intcaredevelopments.co.uk>; Lyndsey-Jane Lupton <lyndsey-jane.lupton@Intconstruction.co.uk>
Subject: 5088 - Newport - Interim Update

Morning Gary,

Thanks for the update, that's great. We will get this booked in and get updated RAMS sent across.

I will also revisit the quote, as we currently have a piecemeal approach, with 2 mobs, whereas now we only need one, resulting in a reduction in total cost.

Kind regards,

Adam Gombocz
Director
Lithos Consulting Ltd
M 07951 497021
DD 01937 543353
www.lithos.co.uk

From: Gary Little <Gary.Little@Intcaredevelopments.co.uk>
Sent: Thursday, November 7, 2024 8:53 PM
To: Adam Gombocz <Adam.Gombocz@lithos.co.uk>; Charlotte Copley <Charlotte.Copley@lithos.co.uk>
Cc: Claire Howes <Claire.Howes@Intconstruction.co.uk>; Sam Rose <sam.rose@Intcaredevelopments.co.uk>; Lyndsey-Jane Lupton <lyndsey-jane.lupton@Intconstruction.co.uk>
Subject: Re: Newport - Interim Update

Adam/Charlotte,

We've now heard back from the seller who's telling us they've made good progress with their site clearance works and are now on track to get the works completed by the end of this month.

With that been the case, could we line yourselves up to undertake the ground investigation works **W/C 9th December**? Please confirm your availability asap and I will liaise with the seller to firm up the specific date(s).

Assuming that is okay, can you also get your RAMS updated and sent across (the previous RAMs were on the basis of doing the investigations in a piecemeal manner, whereas you'll now have full access so likely able to do it all in one go).

Thanks,

Gary Little

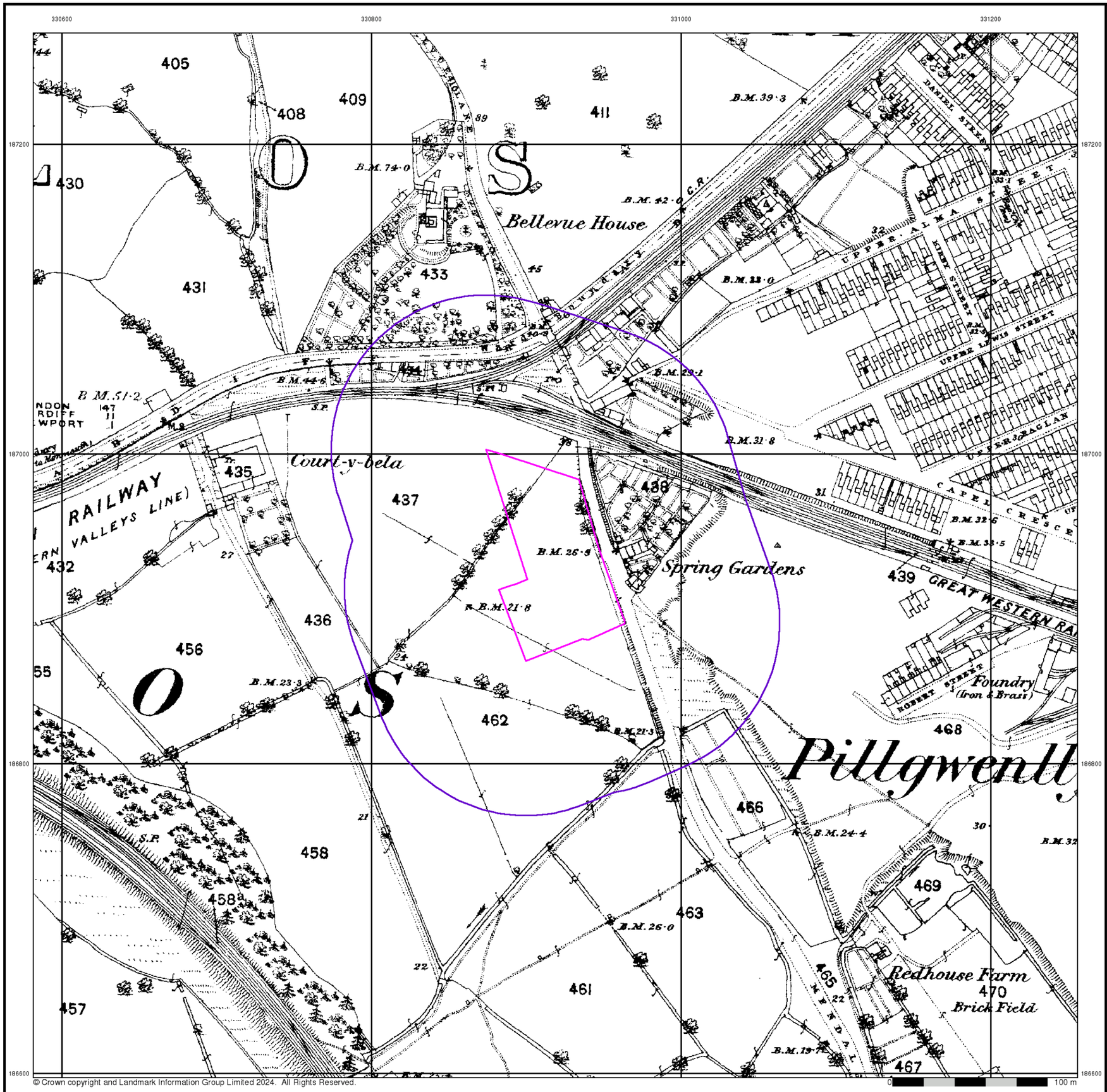
Pre-Construction Technical Manager

T 07547 105 172
E gary.little@Intcaredevelopments.co.uk

From: Adam Gombocz <Adam.Gombocz@lithos.co.uk>
Sent: Friday, September 20, 2024 3:49 PM
To: Gary Little <Gary.Little@Intcaredevelopments.co.uk>; Charlotte Copley <Charlotte.Copley@lithos.co.uk>
Cc: Claire Howes <Claire.Howes@Intconstruction.co.uk>; Sam Rose <sam.rose@Intcaredevelopments.co.uk>

Appendix D

Historical OS Plans



LITHOS CONSULTING

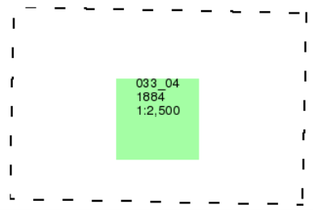
Monmouthshire

Published 1884

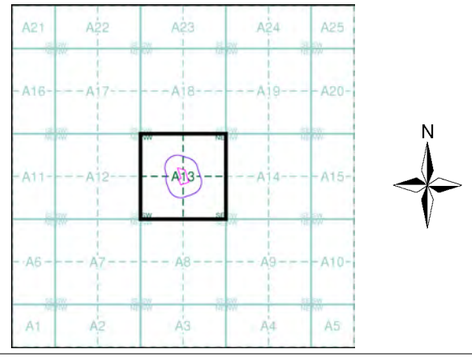
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



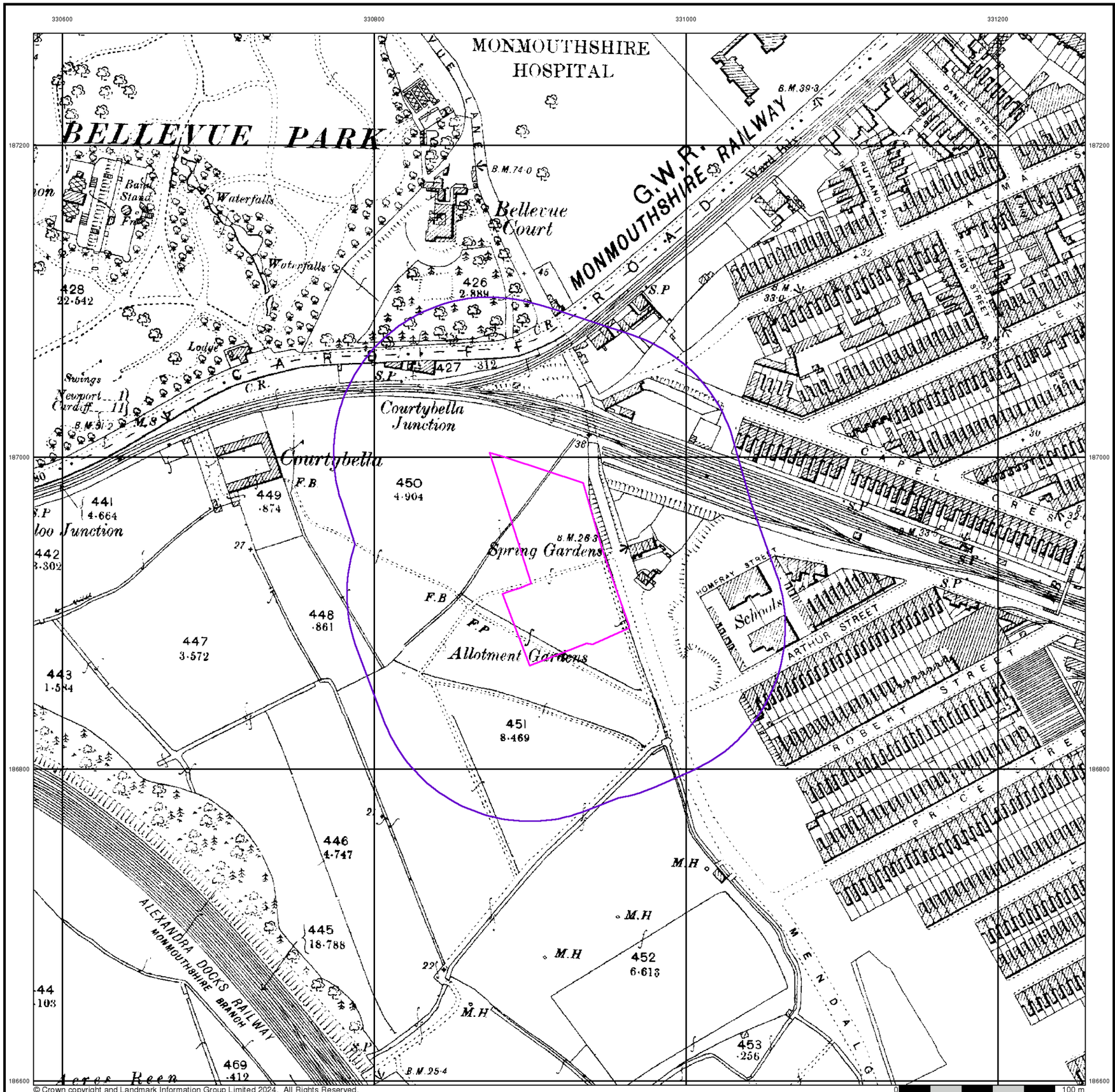
Order Details

Order Number:	363113560_1_1
Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	100

Site Details

Victoria Court, Newport, NP20 2NJ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



LITHOS CONSULTING

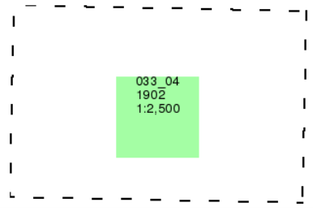
Monmouthshire

Published 1902

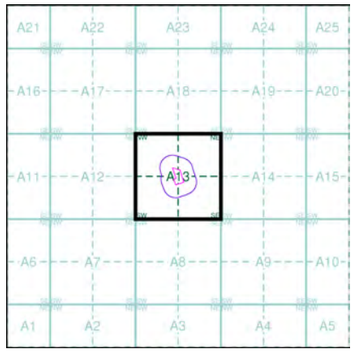
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	363113560_1_1
Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	100

Site Details

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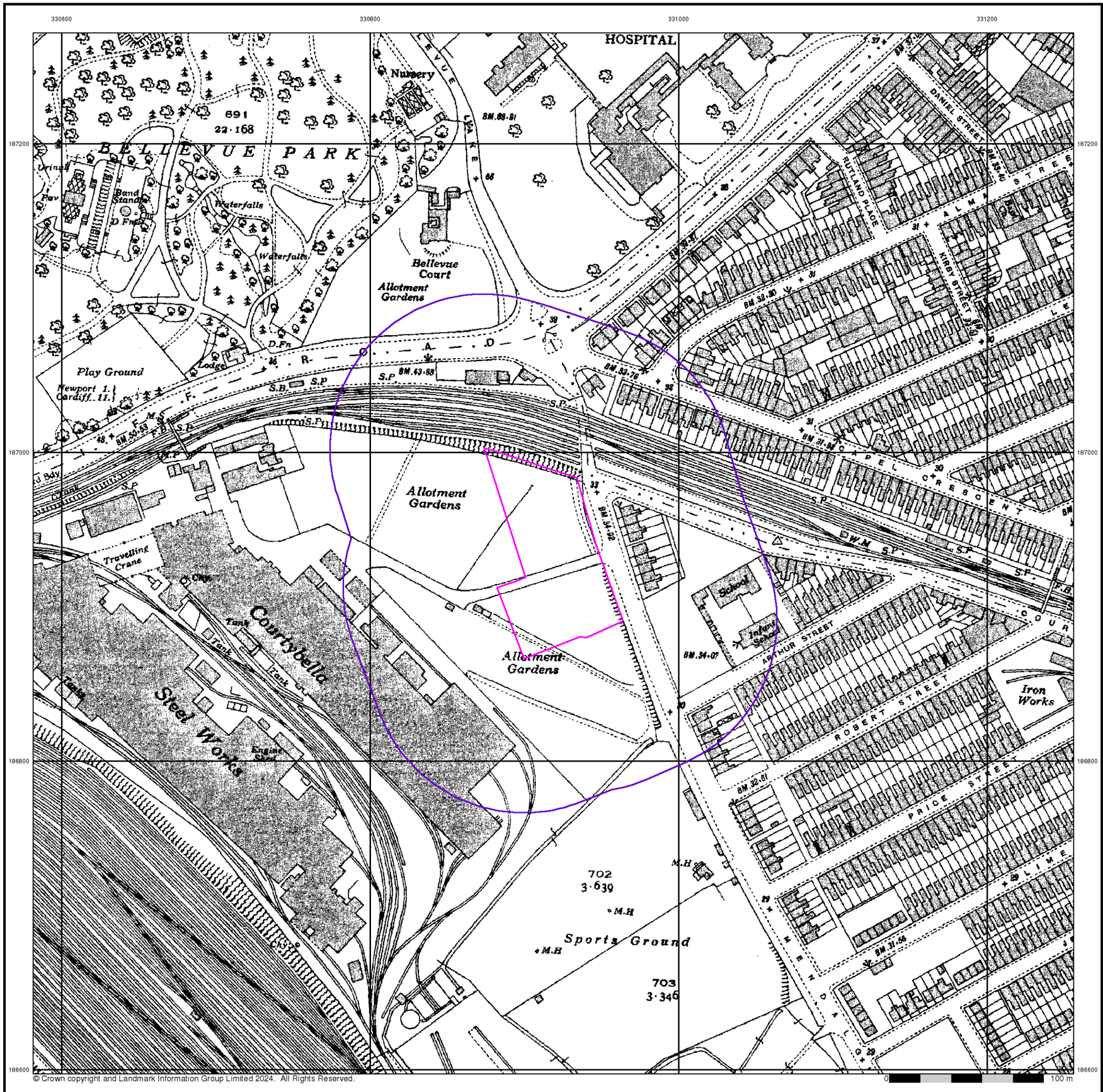


LITHOS CONSULTING

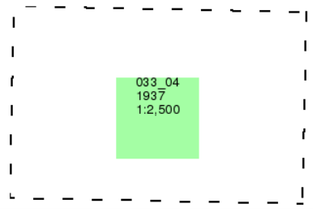
Monmouthshire

Published 1937

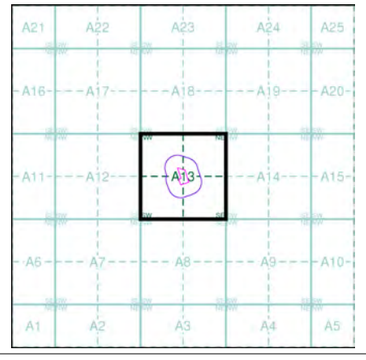
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



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Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	100

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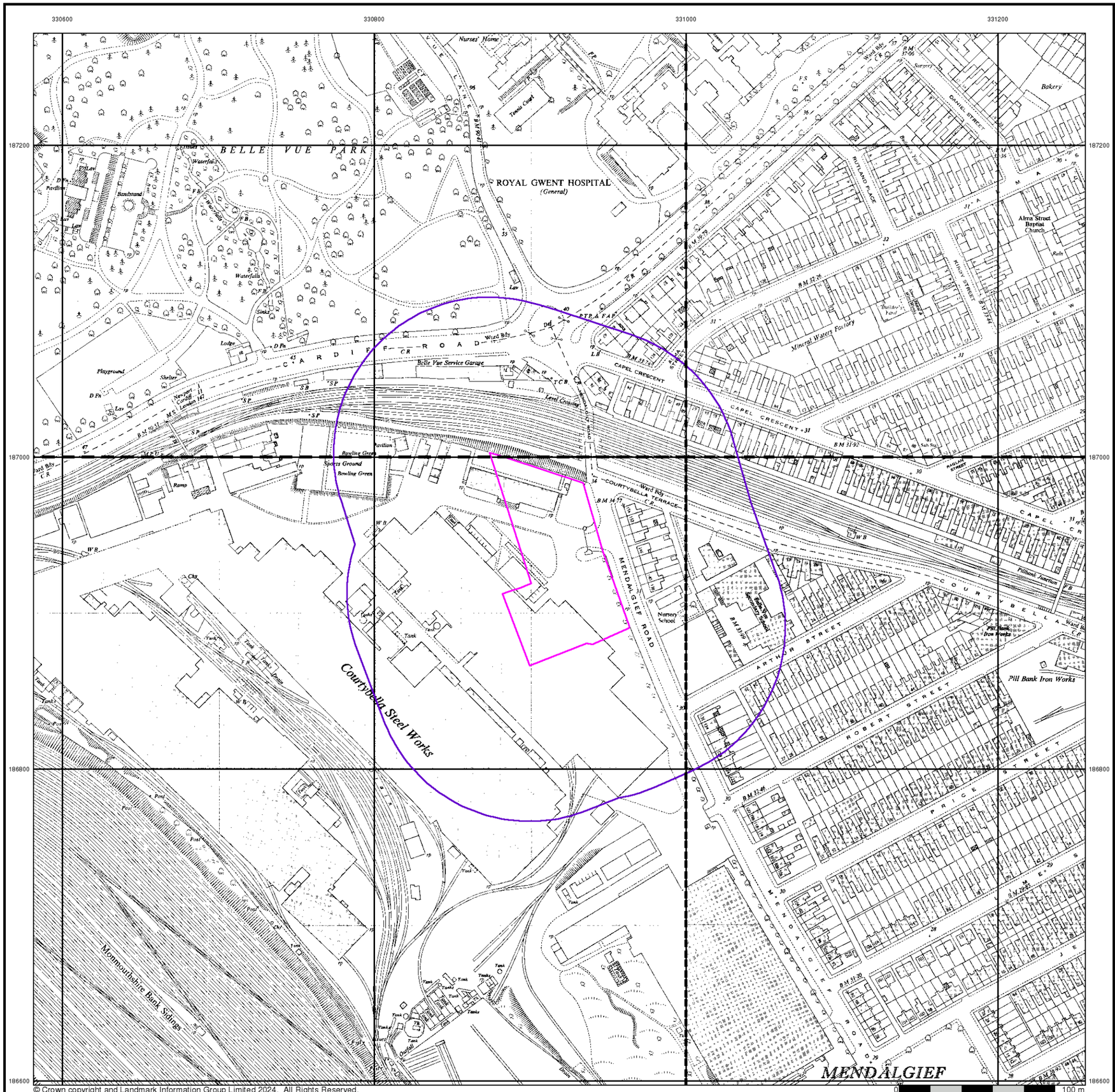


LITHOS CONSULTING

Ordnance Survey Plan

Published 1956

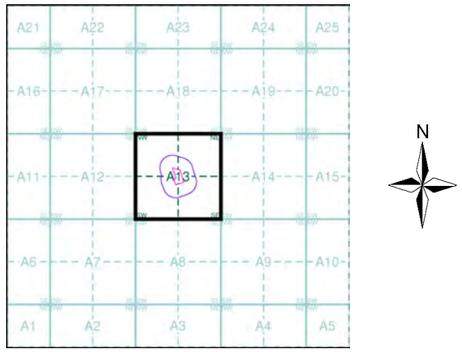
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

ST3087SE 1956 1:1,250	ST3187SW 1956 1:1,250
ST3086NE 1956 1:1,250	ST3186NW 1956 1:1,250

Historical Map - Segment A13



Order Details

Order Number:	363113560_1_1
Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	100

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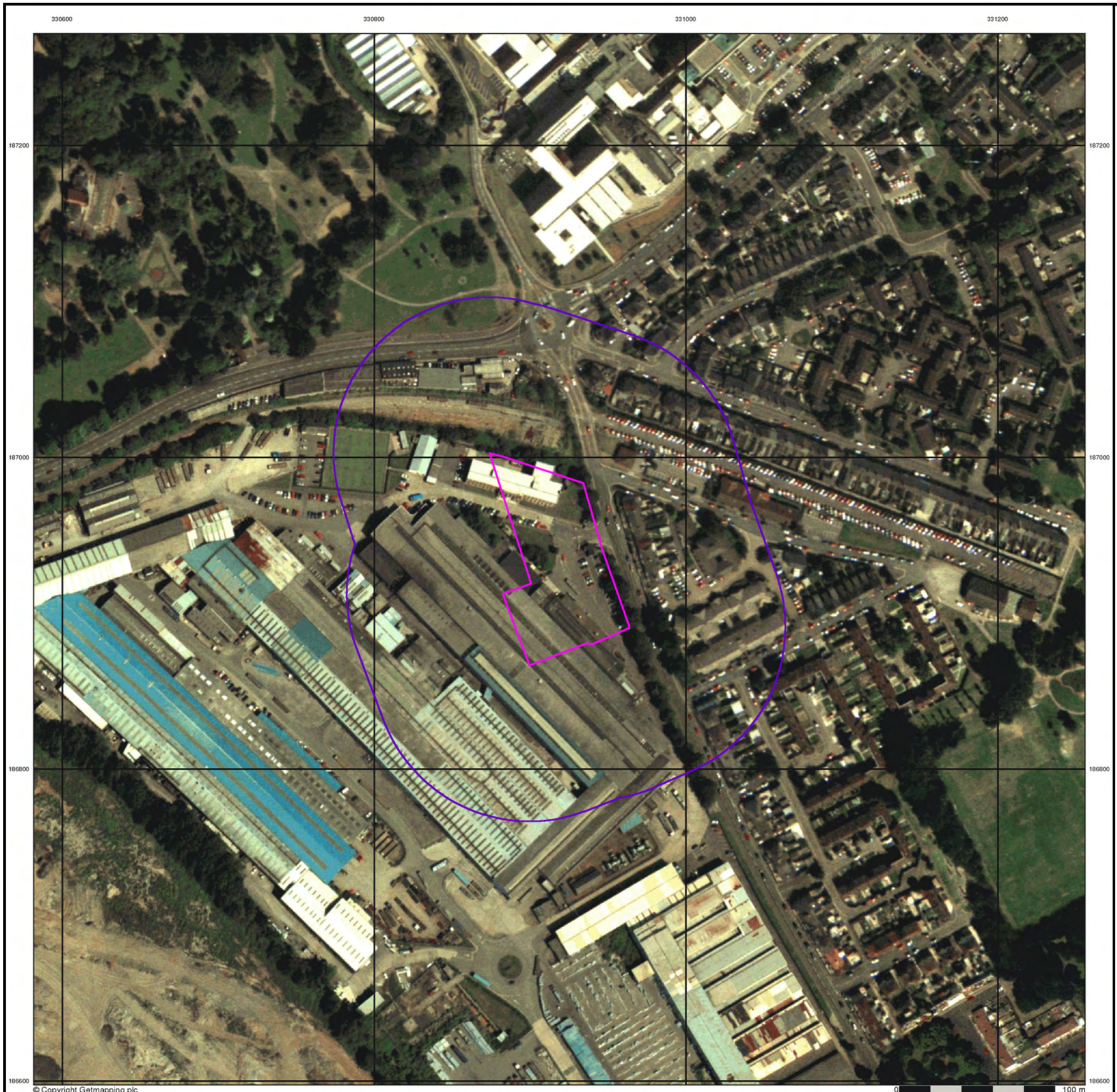


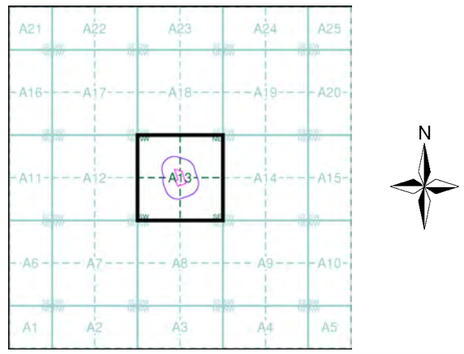
LITHOS CONSULTING

Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13



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National Grid Reference:	330910, 186930
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Search Buffer (m):	100

Site Details

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Appendix E

Search Responses & other Correspondence

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
363113560_1_1

Customer Reference:
5088

National Grid Reference:
330910, 186930

Slice:
A

Site Area (Ha):
0.69

Search Buffer (m):
1000

Site Details:

Victoria Court
Newport
NP20 2NJ

Client Details:

Mr M Perrin
Lithos Consulting Ltd
Parkhill
Walton Road
Wetherby
LS22 5DZ

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.
In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Report Version v53.0

LITHOS CONSULTING

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility					n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1			6	30
Prosecutions					
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control	pg 10				1
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 10			2	10
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 11		Yes		
Pollution Incidents to Controlled Waters	pg 11			1	2
Historical Prosecutions					
Registered Radioactive Substances	pg 12		16	2	6
Substantiated Pollution Incident Register	pg 16			1	1
Water Abstractions	pg 16				2 (*4)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 18	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 18	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 18	Yes	n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 18		2	5	43
Water Framework Directive - Catchment					
Water Framework Directive - Groundwater	pg 24	Yes			Yes
Water Framework Directive - Surface Waters	pg 24				Yes

Summary

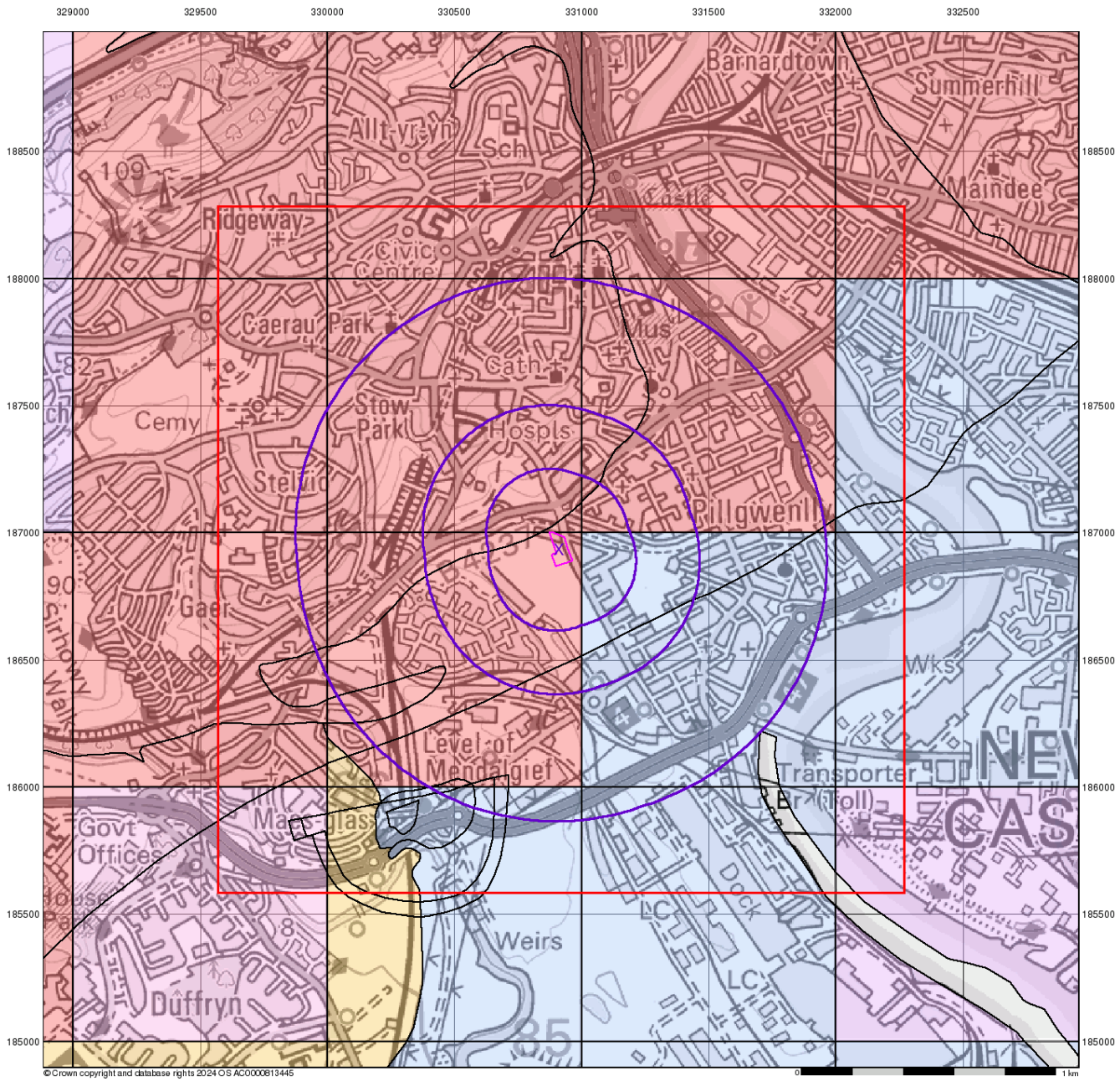
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 25		1	1	5
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)	pg 26		1		1
Licensed Waste Management Facilities (Locations)	pg 26			1	8
Local Authority Landfill Coverage	pg 28	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 28			1	2
Potentially Infilled Land (Water)	pg 28	1	7	13	15
Registered Landfill Sites	pg 30			1	4
Registered Waste Transfer Sites	pg 32			1	
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)	pg 33				2
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)	pg 33				2
Planning Hazardous Substance Consents	pg 33				1
Planning Hazardous Substance Enforcements					

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 34	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 34	Yes			Yes
BGS Recorded Mineral Sites	pg 34				1
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 35	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 35		Yes	n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 35	Yes		n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 35	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 35	Yes		n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 35	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 36	3	5	7	355
Fuel Station Entries	pg 67		1		3
Points of Interest - Commercial Services	pg 67				126
Points of Interest - Education and Health	pg 78		3	1	3
Points of Interest - Manufacturing and Production	pg 78		18	7	38
Points of Interest - Public Infrastructure	pg 84			1	25
Points of Interest - Recreational and Environmental	pg 86		2	3	11
Underground Electrical Cables					

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland					
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest	pg 88				1
Special Areas of Conservation	pg 88				1
Special Protection Areas					
World Heritage Sites					



LITHOS CONSULTING

Groundwater Vulnerability

General

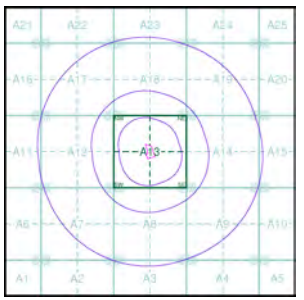
Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Agency and Hydrological

Bedrock Aquifers	Superficial Aquifers
High Vulnerability, Principal Aquifer	High Vulnerability, Principal Aquifer
High Vulnerability, Secondary Aquifer	High Vulnerability, Secondary Aquifer
Medium Vulnerability, Principal Aquifer	Medium Vulnerability, Principal Aquifer
Medium Vulnerability, Secondary Aquifer	Medium Vulnerability, Secondary Aquifer
Low Vulnerability, Principal Aquifer	Low Vulnerability, Principal Aquifer
Low Vulnerability, Secondary Aquifer	Low Vulnerability, Secondary Aquifer

Unproductive Aquifer
Soluble Rock

Site Sensitivity Context Map - Slice A



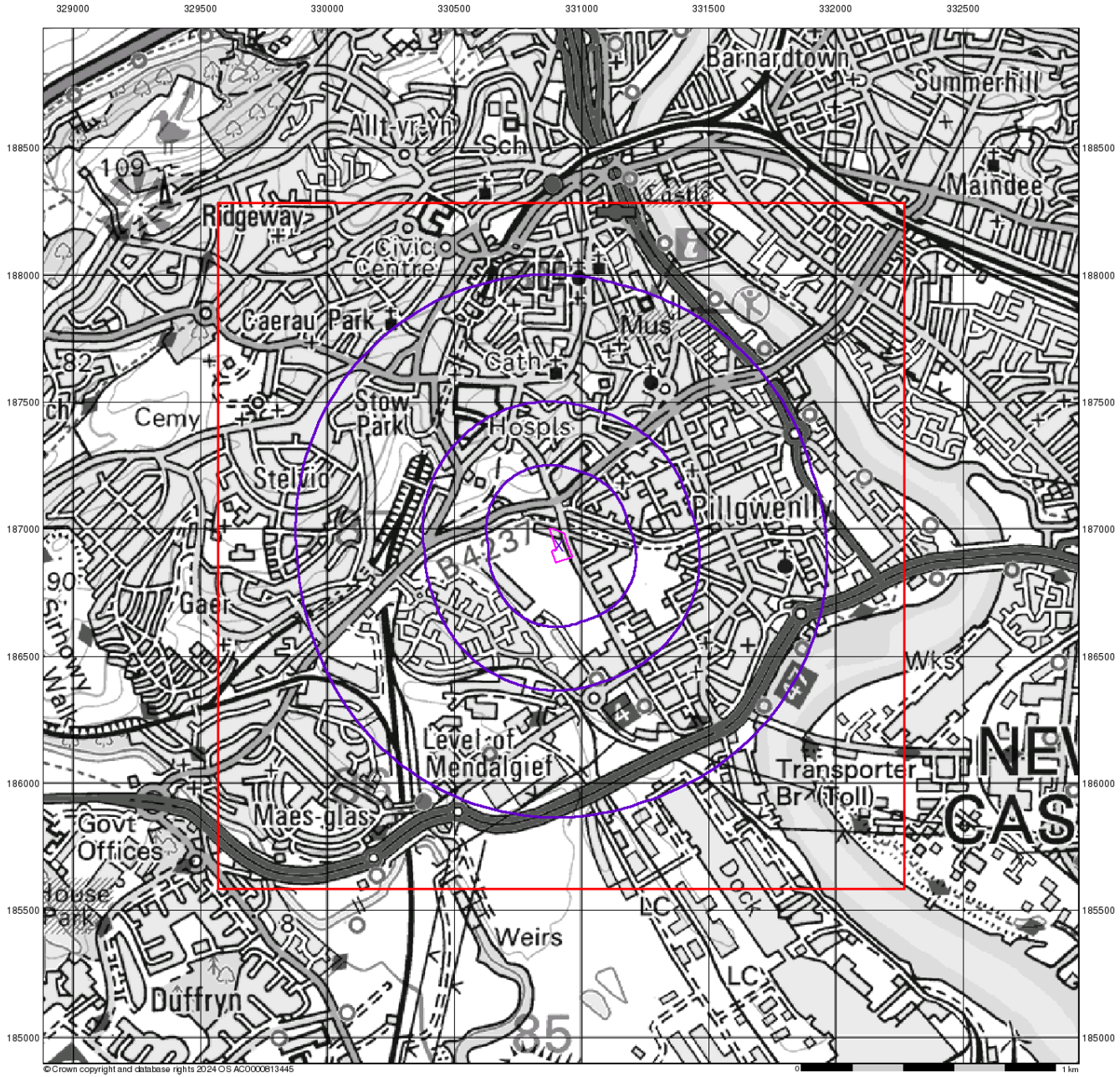
Order Details

Order Number:	363113560_1_1
Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	1000

Site Details

Victoria Court, Newport, NP20 2NJ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



LITHOS CONSULTING

Source Protection Zones

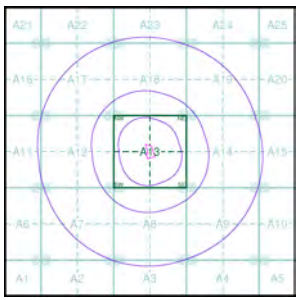
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



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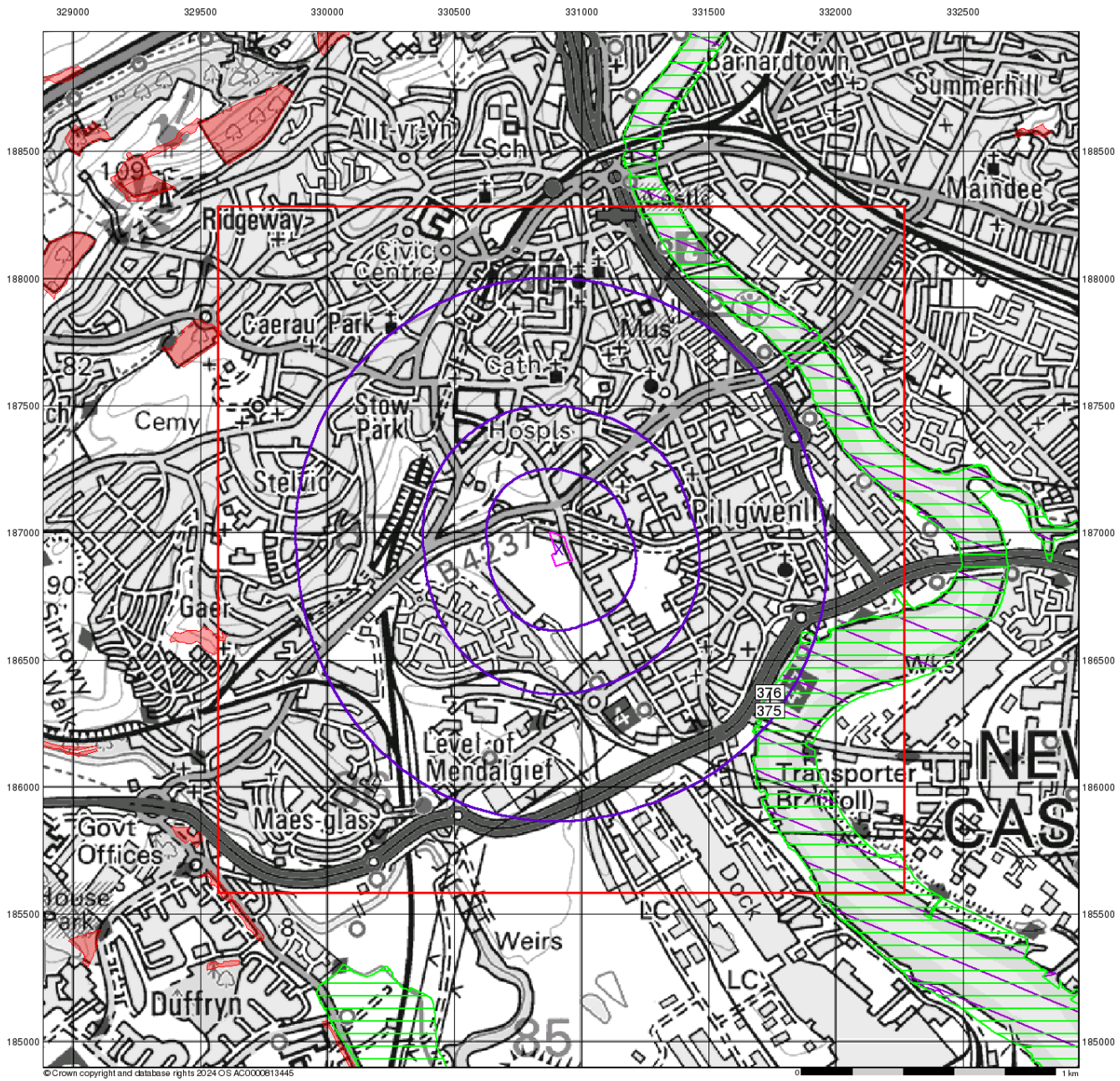


LITHOS CONSULTING

Sensitive Land Uses

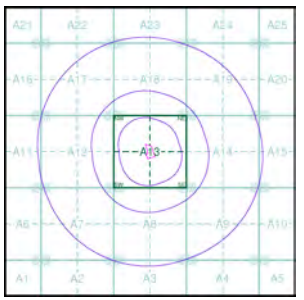
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A



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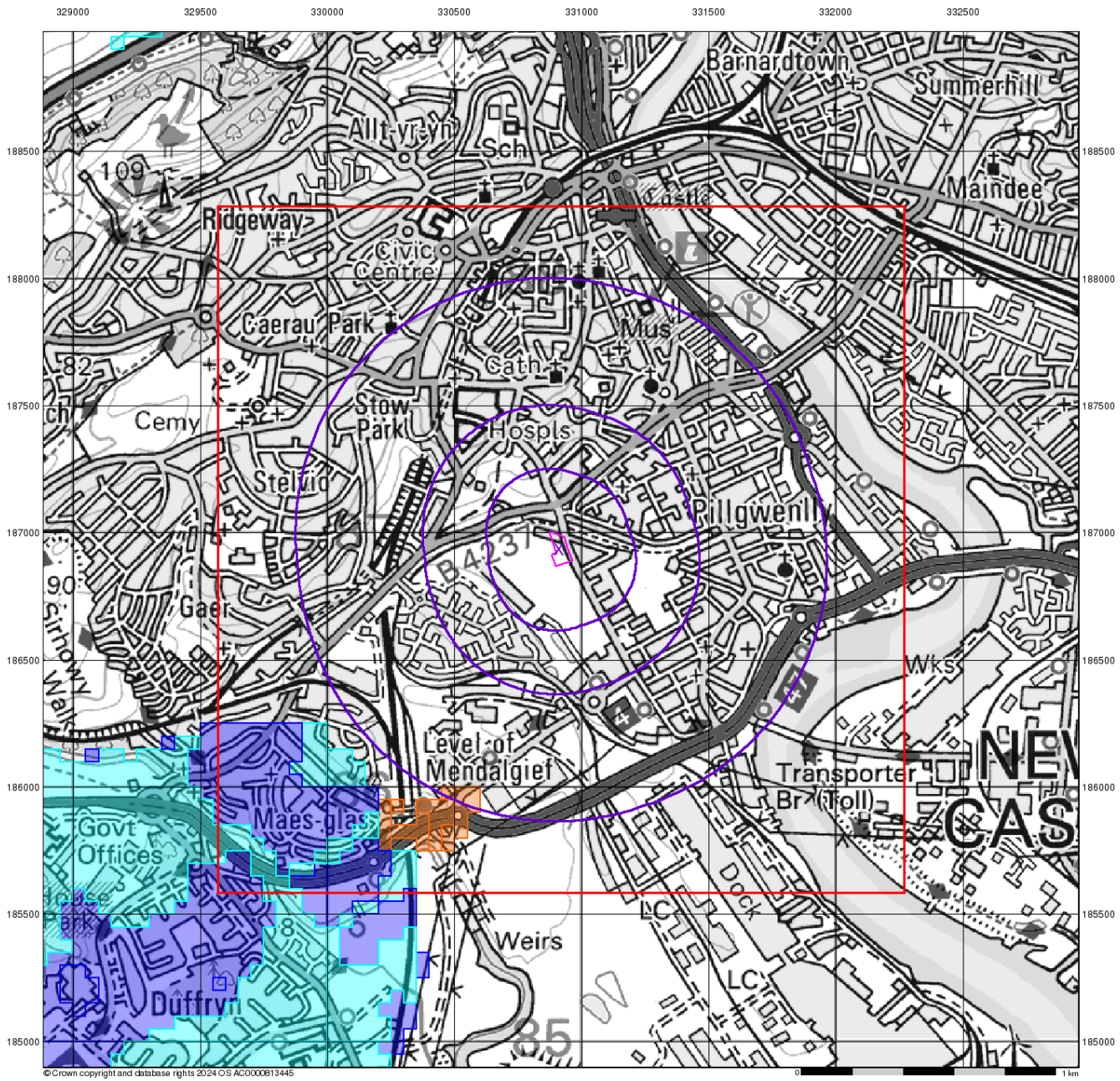

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BGS Flood GFS Data

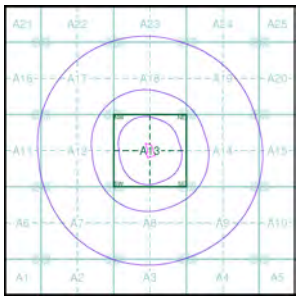
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



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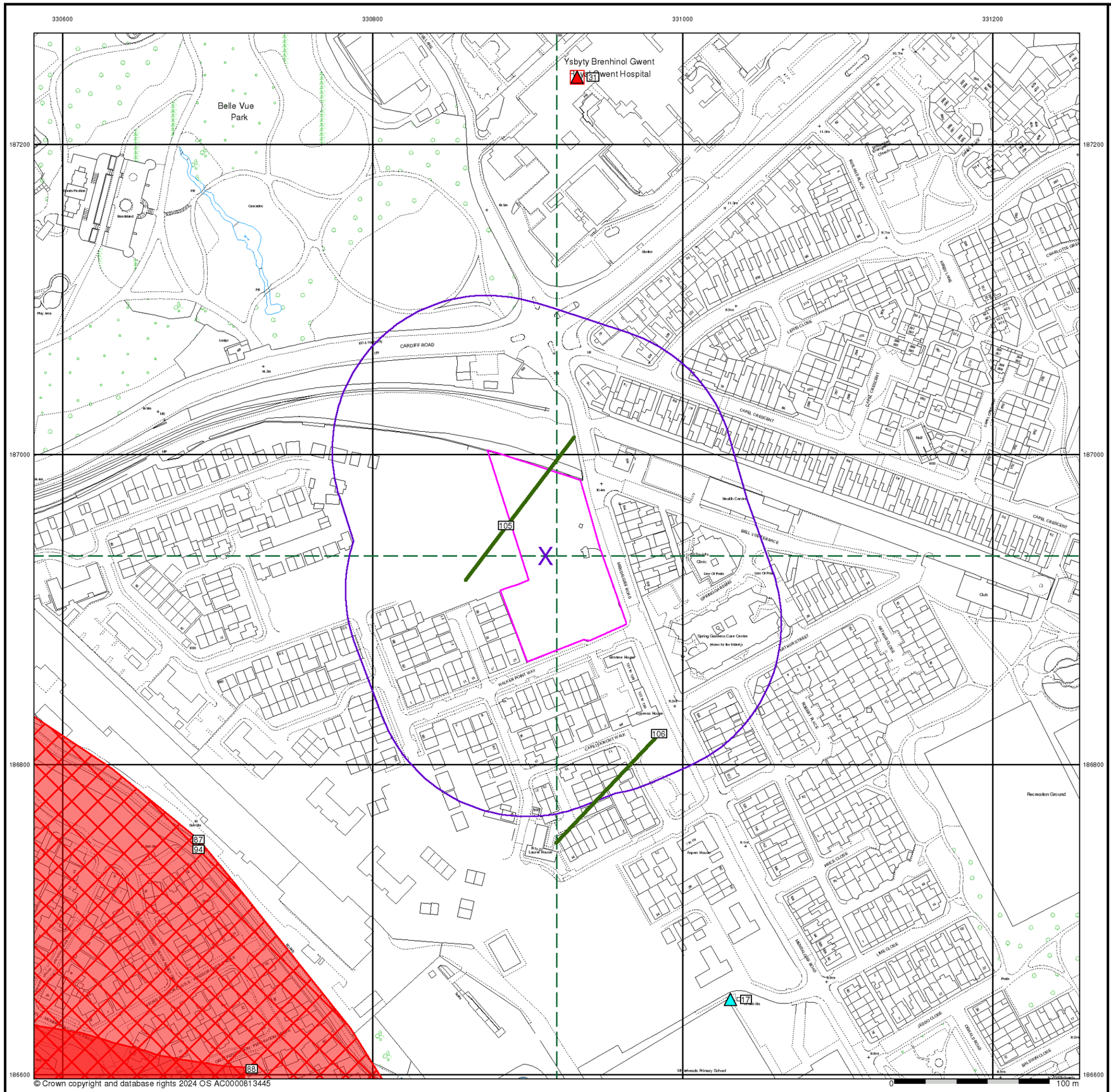

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location
- Pylon
- Overhead Transmission Line

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Historical Prosecutions
- Prosecutions
- Registered Radioactive Substance
- River Network or Water Feature
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

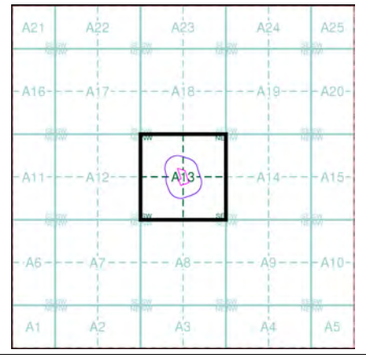
Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Geological

- BGS Recorded Mineral Site

Site Sensitivity Map - Segment A13



Order Details

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Plot Buffer (m):	100

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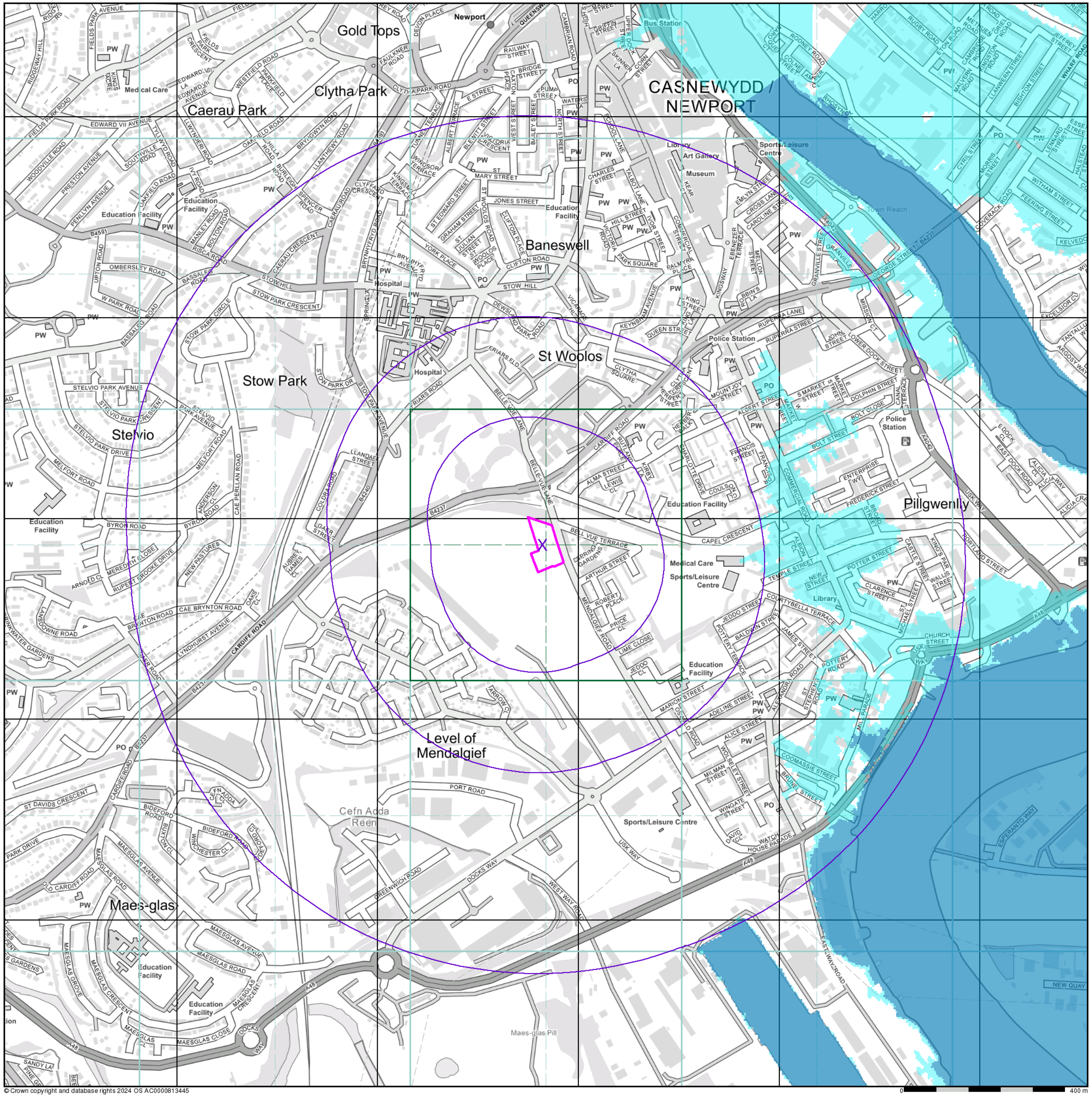


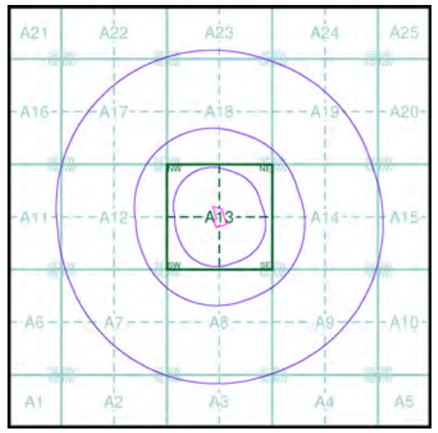
General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



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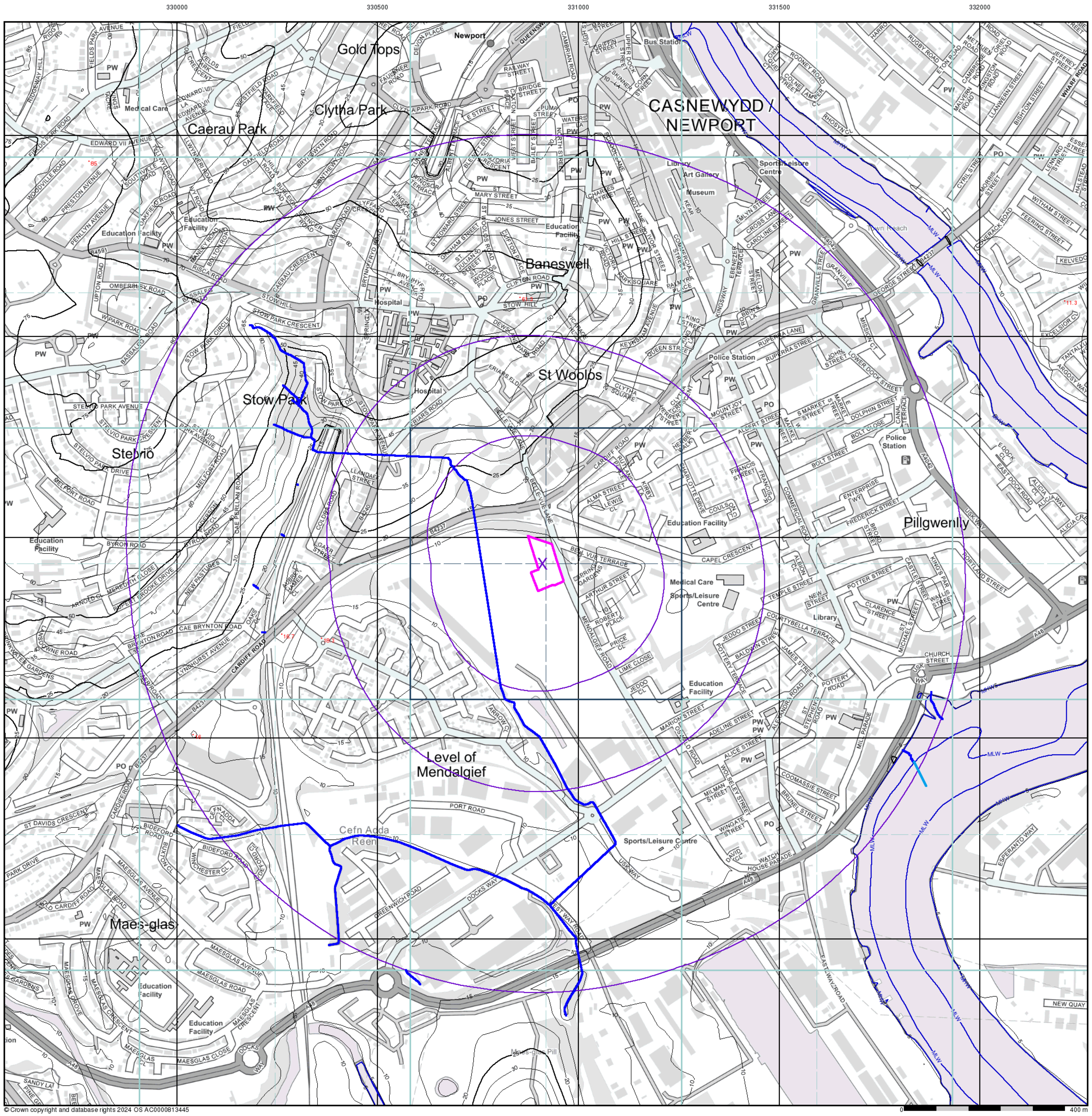
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

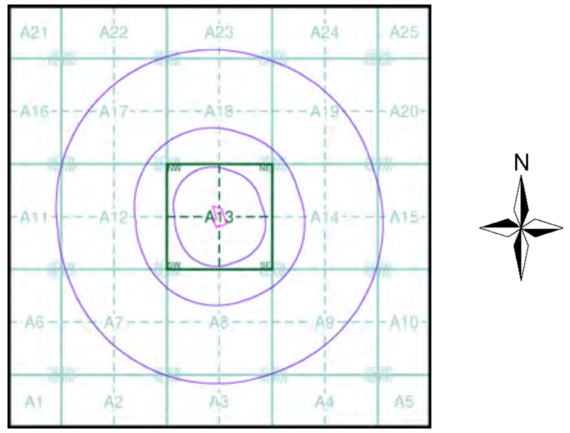
OS Water Network Data

Canal	Drain
Reservoir	Other
Foreshore	Lake
Marsh	Transfer
Tidal River	Lock Or Flight Of Locks
Inland River	Sea

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height 167.3
- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



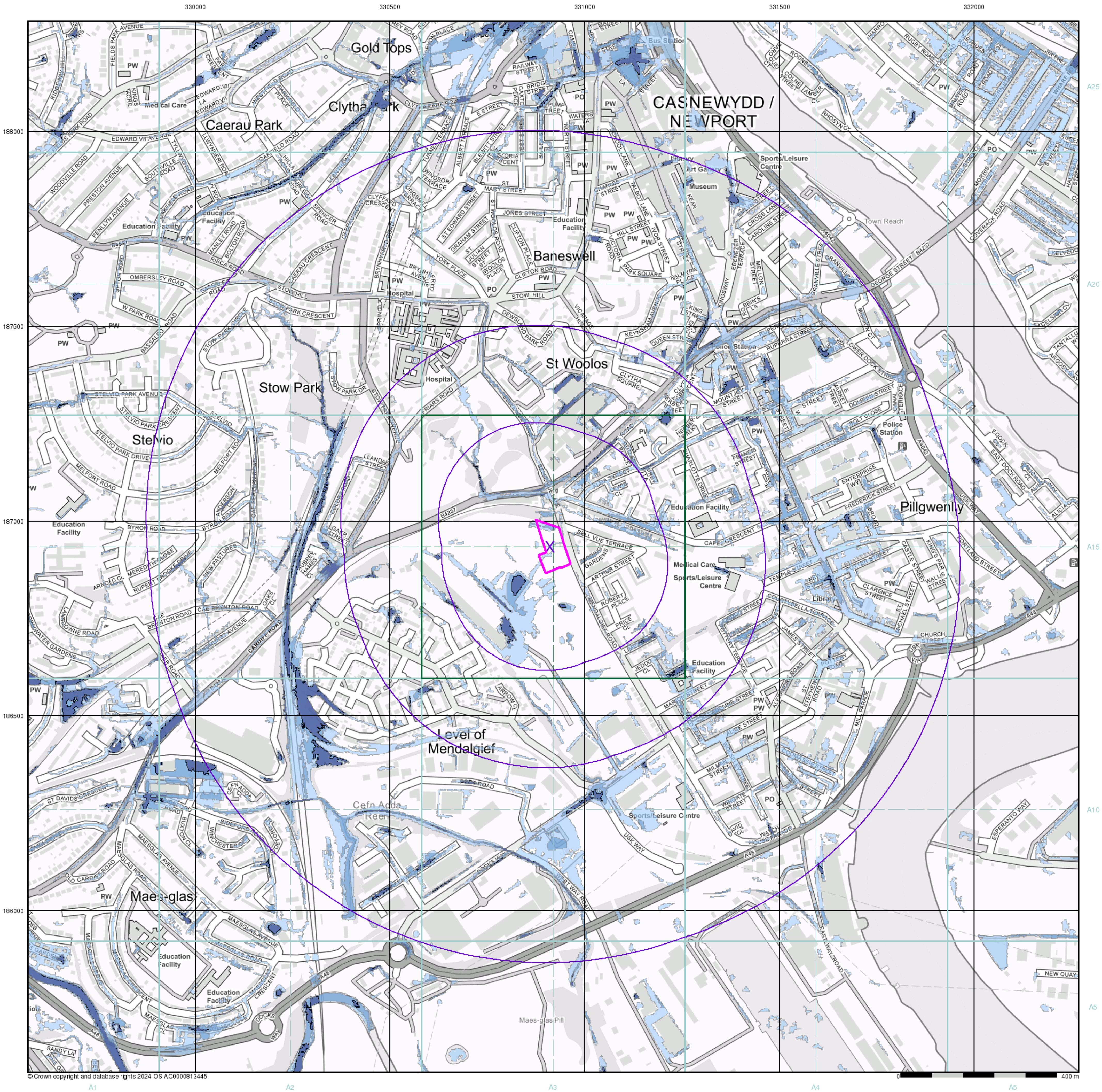
Order Details

Order Number: 363113560_1_1
Customer Ref: 5088
National Grid Reference: 330910, 186930
Slice: A
Site Area (Ha): 0.69
Search Buffer (m): 1000

Site Details

Victoria Court, Newport, NP20 2NJ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



LITHOS CONSULTING

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Risk of Flooding from Surface Water

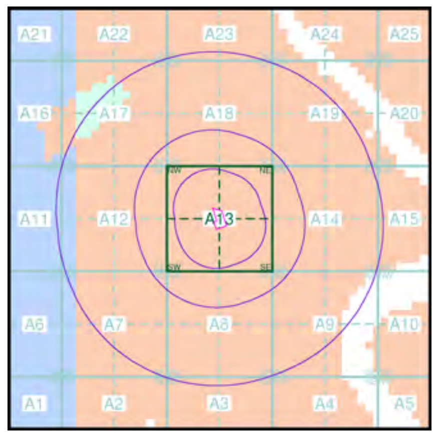
- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	363113560_1_1
Customer Ref:	5088
National Grid Reference:	330910, 186930
Slice:	A
Site Area (Ha):	0.69
Search Buffer (m):	1000

Site Details

Victoria Court, Newport, NP20 2NJ

GeoReports

British Geological Survey

Claire Handley
Lithos Consulting Ltd
Parkhill
Walton Road
Wetherby
LS22 5DZ

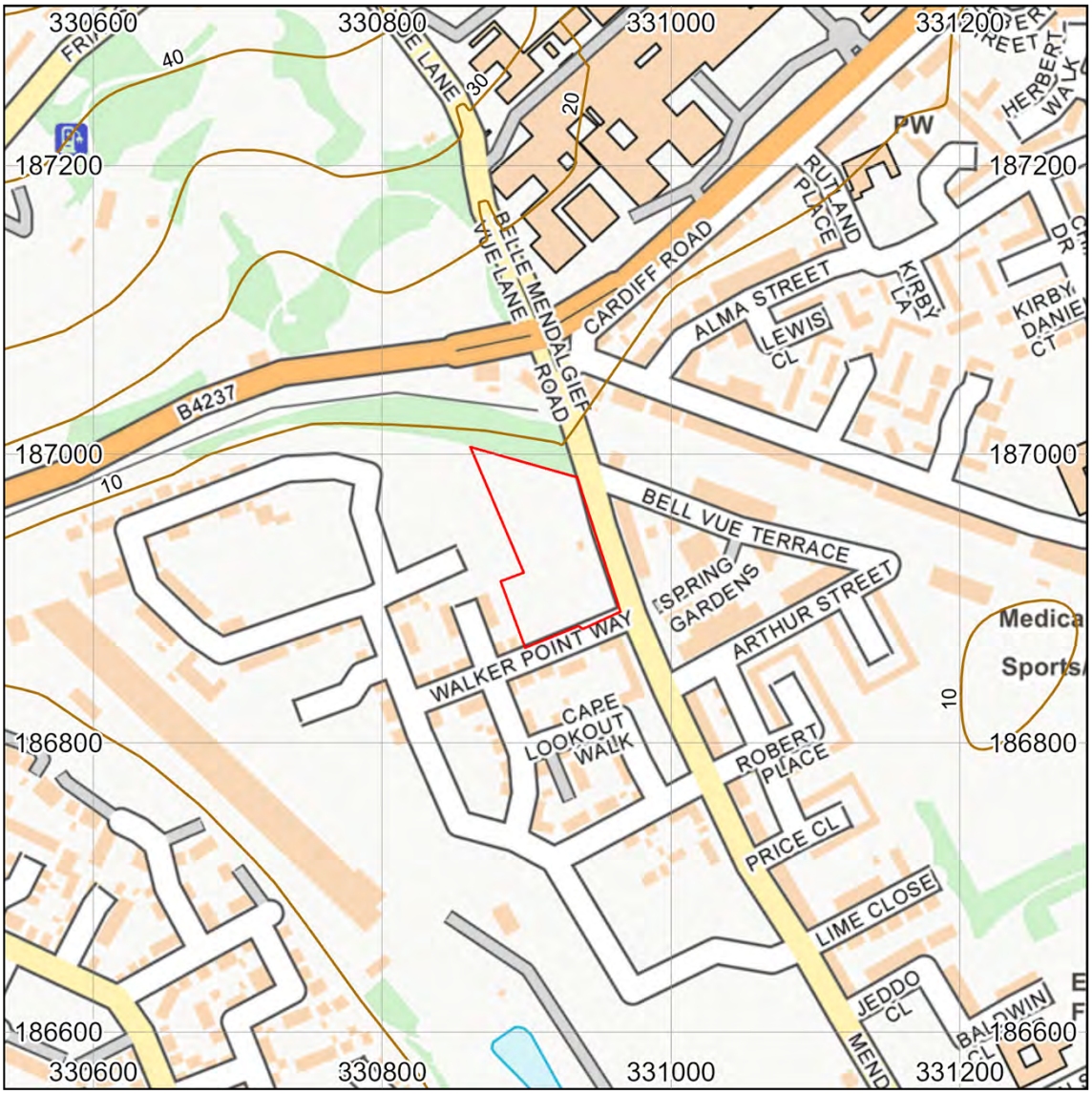
Radon Report

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: ***BGS_340707/57578***

Client reference: PO23324/CH/5088

Search location



Contains OS data © Crown Copyright and database right 2024. OS OpenMap Local: Scale: 1:5 000 (1cm = 50 m)
Search location indicated in red

This report describes a site located at National Grid Reference 330913, 186936. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Radon Report: UK

When extensions are made to existing buildings in high radon areas, or new buildings are constructed in these areas, the Building Regulations for England, Wales, Scotland and Northern Ireland require that protective measures are taken against radon entering the building.

This report provides information on whether radon protective measures are required. Depending on the probability of buildings having high radon levels, the Regulations may require either:

1. No protective measures
2. Basic protective measures
3. Full protective measures

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2023 edition), which also provides guidance on what to do if the* result *indicates that protective measures are required.*

Is the property in an area where radon protective measures are required for new buildings or extensions to existing ones as described in publication BR211 (2023 edition) Radon: Guidance on protective measures for new buildings?

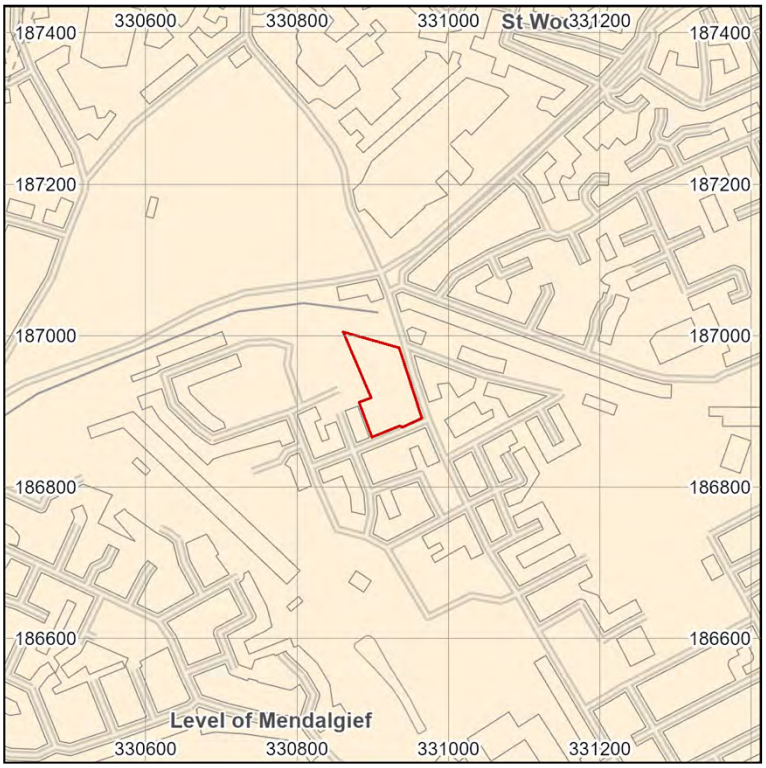
NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

More details of the protective measures required are available in *BR211 Radon: Guidance on protective measures for new buildings (2023 Edition)*.

Whether or not the radon level in a building is above or below the radon Action Level can only be established by having the building tested. The UKHSA provides a radon testing service which can be accessed at www.ukradon.org or by telephone (01235 822622).

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon Affected Area



	% Homes estimated to be at or above the action level
	0-1%
	1-3%
	3-5%
	5-10%
	10-30%
	30-100%

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Scale: 1:10 000 (1cm = 100 m)
Search area indicated in red

Is the property in a radon Affected Area as defined by the UK Health Security Agency (UKHSA) and if so what percentage of homes are estimated to be at or above the Action Level? NO

Additional Information

THE PROPERTY IS IN AN AREA WHERE LESS THAN 1% OF HOMES ARE ESTIMATED TO BE AT OR ABOVE THE ACTION LEVEL. THE PROPERTY IS NOT IN A RADON AFFECTED AREA.

The UKHSA recommends a radon 'Action Level' of 200 Becquerels per cubic metre of air (Bq m^{-3}) for the annual average of the radon gas concentration in a home. Where 1% or more of homes are estimated to be at or above the Action Level the area should be regarded as a radon Affected Area.

This report informs you whether the property is in a radon Affected Area and the percentage of homes that are estimated to be at or above the radon Action Level at this location. Being in an Affected Area does not necessarily mean there is a high radon level within the property; the only way to determine the radon level is to carry out a radon measurement.

The UKHSA advises that radon gas should be measured in all properties within radon Affected Areas and that homes with radon levels at or above the Action Level (200 Bq m^{-3}) should be remediated. Householders with levels between the Target Level (100 Bq m^{-3}) and Action Level should seriously consider reducing their radon level, especially if they are at greater risk, such as if they are current or ex smokers. Whether or not a home is in fact above or below the Action Level or Target Level can only be established by having the building tested. The UKHSA provides a validated radon testing service which can be accessed at www.ukradon.org.

The information in this report provides an answer to one of the standard legal enquiries on house purchase in England and Wales, known as Law Society CON29 Enquiries of the Local Authority (2016); 3.14 Radon Gas: Do records indicate that the property is in a “Radon Affected Area” as identified by the UKHSA. The data can also be used to advise house buyers and sellers in Scotland and Northern Ireland.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a radon Affected Area, you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were at or above the radon Action Level and if so, whether remedial measures were installed, radon levels were re-tested, and if the results of re-testing confirmed the effectiveness of the measures.

Further information on radon is available from the UKHSA at www.ukradon.org.

What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level is at or above the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations 2017 require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293)**: Radon in the workplace.** BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.uk website: www.brebookshop.com

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General Terms & Conditions

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Important notes about this Report

- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

Report issued by
BGS Enquiry Service

Appendix F

Trial Pit Logs

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP01**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.6 x 0.6 Depth 2.80	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J,K&T		0.20			MADE GROUND: Light brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including polystyrene, brick, concrete, wood and plastic. (COHESIVE MADE GROUND)
	0.25	J,K&T		0.30			MADE GROUND: Reddish brown slightly sandy angular to subangular fine to coarse GRAVEL of brick. (BRICKFILL)
	0.50	J,K&T					MADE GROUND: Dark brown sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, concrete, re-bar, clinker and mudstone. (GRANULAR MADE GROUND)
▼							*At 1.1m, ground is fully saturated.* *From 1.1m, high cobble content. Cobbles are angular to subangular of brick and concrete.* *Perched water has an organic (stagnant) odour.*
	2.70	D	HVP=55	2.60			Firm light reddish brown sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
				2.80			*Trial pit stopped at 2.8m due to spalling and collapse of trial pit walls.* End of pit at 2.80 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. Spalling and collapse of the sides of the trial pit at 2.8m depth during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP02**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.5 × 0.6, Depth 3.50	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20	J,K&T J,K&T					MADE GROUND: Dark greyish brown sandy clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including concrete, brick and plastic. (GRANULAR MADE GROUND)
				0.50			
	0.60	J,K&T					MADE GROUND: Firm reddish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of predominantly brick. (COHESIVE MADE GROUND)
▼				1.60			*At 1.6m, saturated ground.* MADE GROUND: Greyish brown sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies with a medium cobble content. Cobbles are angular of brick. (GRANULAR MADE GROUND)
	1.90 1.90	J,K&T J,K&T					
			HVP=56	2.90			Firm light grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
				3.50			End of pit at 3.50 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP03**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.4 × 0.6 Depth 3.60	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J,K&T		0.30			MADE GROUND: Dark brown gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including brick, wood, concrete and plastic. (COHESIVE MADE GROUND)
							MADE GROUND: Dark grey ashy sandy angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, concrete, mudstone, wood and clinker. (GRANULAR MADE GROUND)
▼	0.80	J,K&T					*Water seepage at 0.9m.*
							From 1.5m, cobbles of bricks and half bricks.
				2.00			Firm light grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
			HVP=80				
				3.60			End of pit at 3.60 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 0.9m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.5 × 0.6, Depth 3.20	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J,K&T		0.30			MADE GROUND: Dark brown gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including brick, concrete, plastic and re-bar. (COHESIVE MADE GROUND)
	0.60 0.60	J,K&T J,K&T					MADE GROUND: Dark grey ashy angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, concrete, glass, metal, rope, pottery and clinker. (GRANULAR MADE GROUND)
▼							*At 1.1m, saturated ground with stagnant organic odour.* *From 1.1m, high cobble content.*
				2.40			Firm light grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
	2.80	D	HVP=78				
				3.20			End of pit at 3.20 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.6 × 0.6, Depth 3.30	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	J,K&T		0.50			MADE GROUND: Dark brown sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including brick, concrete, wood, metal and rope. (COHESIVE MADE GROUND)
	0.80	J,K&T					MADE GROUND: Dark grey ashy angular to subangular fine to coarse GRAVEL of brick, concrete, glass and clinker with a medium cobble content. Cobbles are angular of brick and concrete. (GRANULAR MADE GROUND)
▼							*From 1.7m, saturated ground.*
	2.50	D	HVP=100	2.30			Stiff dark grey slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone. (COHESIVE TIDAL FLAT DEPOSITS)
				3.30			End of pit at 3.30 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP06**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.5 × 0.6, Depth 3.30	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.05	T		0.10			MADE GROUND: Dark grey MACADAM HARDSTAND. (MACADAM HARDSTAND)
							MADE GROUND: Dark grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of mixed lithologies including brick, concrete, plastic, wood, metal, glass and clinker with a medium cobble content. Cobbles are angular of brick and concrete. (GRANULAR MADE GROUND)
	1.00	J,K&T					
	1.00	J,K&T					
▼							*Water seepage at 1.7m.*
				2.10			Firm dark grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
			HVP=50				
	2.70	D					
				3.30			End of pit at 3.30 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 1.7m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP07**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.5 × 0.6, Depth 3.00	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	J,K&T		0.50			MADE GROUND: Dark brown gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies including brick, concrete and mudstone. (COHESIVE MADE GROUND)
	1.40	J,K&T					MADE GROUND: Dark grey ashy slightly clayey angular to subangular fine to coarse GRAVEL of mixed lithologies including brick, glass, concrete, clinker and wood. Medium cobble content. Cobbles are angular to subangular of brick and concrete. (GRANULAR MADE GROUND)
▼							*Water at 1.8m.*
			HVP=82	2.30			Stiff dark grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
				3.00			End of pit at 3.00 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 1.8m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP08**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport	Dimensions (m): Depth 3.50	2.6 × 0.6	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J,K&T					MADE GROUND: Dark brown gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies including brick, concrete, wood, plastic and rope. (COHESIVE MADE GROUND)
				0.50			MADE GROUND: Dark grey sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, concrete, metal wire, cloth and clinker. (GRANULAR MADE GROUND)
	0.80	J,K&T					
▼							*Water at 1.5m.*
				2.20			Firm becoming stiff dark grey gleyed reddish brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
	2.40	D	HVP=58				
			HVP=100				
				3.50			End of pit at 3.50 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 1.5m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP09**

Sheet 1 of 1

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: - Level:	Date 11/12/2024
Location: Newport		Dimensions (m): 2.7 × 0.6, Depth 3.10	Scale 1:20
Client: LNT Construction			Logged CC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	1.00	J,K&T					MADE GROUND: Dark grey sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick and concrete. (GRANULAR MADE GROUND)
▼				1.60			Firm dark grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS) *Water at 1.6m.*
	2.10	D	HVP=63				
				3.10			End of pit at 3.10 m

1 2 3 4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 1.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

Appendix G

Borehole Logs

LITHOS CONSULTING

Borehole Log

Borehole No. **BH01**

Sheet 1 of 2

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 09/12/2024 - 09/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND: Dark brownish grey sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies including brick, concrete, clinker and plastic. (COHESIVE MADE GROUND)
								Water at 0.8m in morning of 10/12/2024.
		1.00		N=23 (9,5/3,4,6,10)				
	▼	1.50	J,K&T					
		2.00		N=10 (4,3/3,1,3,3)				
					2.80			
		3.00		N=8 (2,2/1,2,2,3)				Firm light brown mottled grey slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone. (COHESIVE TIDAL FLAT DEPOSITS)
		3.00 - 3.45	D					*Becoming softer with depth from 2.8m.*
		4.00	D					
		4.00		N=0 (0,0/0,0,0,0)				*At 4.0m, self weight SPT with no recovery.*
		5.00		N=3 (0,1/0,1,1,1)				
		5.00 - 5.20	D					
		5.20 - 5.45	D		5.20			Spongy brown amorphous PEAT. (COHESIVE TIDAL FLAT DEPOSITS)
					5.80			
		6.00		N=15 (1,2/3,4,4,4) HVP=54				Soft light reddish brown sandy CLAY with occasional plant remains. (COHESIVE TIDAL FLAT DEPOSITS)
		6.50 - 6.95	D					
								Firm from 6.7m.
		8.00 - 8.45	U					*At 8.0m, UT100 33 blows 100% recovery.*
		8.45 - 8.60	D	HVP=42				
		9.50		N=7 (0,1/1,2,2,2)				
		9.50 - 9.95	D		9.60			Soft reddish brown sandy silty CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 1.5m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No. **BH01** Sheet 2 of 2

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 09/12/2024 - 09/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00 11.00 - 11.45	D	N=12 (1,1/2,3,3,4)	11.00			Firm reddish brown sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies. (COHESIVE TIDAL FLAT DEPOSITS)	11
		12.00	D						12
		12.50		50 (8,8/50 for 225mm)	12.70			Weak reddish brown MUDSTONE. (ST MAUGHANS FORMATION) *Can break with hands from 12.7m.*	13
		13.50	D						
		14.00 14.00 - 14.28	D	50 (11,14/50 for 135mm)	14.28			End of borehole at 14.28 m	14
									15
									16
									17
									18
									19
									20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 1.5m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No. **BH02**

Sheet 1 of 2

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 11/12/2024 - 11/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		1.00		N=43 (9,10/12,11,10,10)				MADE GROUND: Dark grey sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, concrete, clinker and mudstone. (GRANULAR MADE GROUND)
		2.00		N=11 (3,1/2,3,3,3)				
		2.40	J,K&T		2.30			
		2.40	J,K&T					Firm dark grey gleyed brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
				HVP=42				
		3.00 - 3.45	U					*UT100 at 3.0m, 30 blows 100% recovery.*
		3.00 - 4.00	B					
		3.60	D					
		4.00		N=4 (1,1/1,1,1,1)				
		4.00 - 4.45	D					
		4.30 - 5.00	B		4.30			Spongy dark brown pseudo-fibrous PEAT. (COHESIVE TIDAL FLAT DEPOSITS)
		5.00	D		5.00			
				HVP=35				Firm light grey slightly sandy CLAY with pockets of plant material. (COHESIVE TIDAL FLAT DEPOSITS)
		5.00 - 5.45	U					*UT100 at 5.0m, 21 blows 100% recovery.*
	▼							
		6.50		N=9 (0,1/1,2,3,3)	6.40			Firm reddish brown slightly sandy CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
		6.50 - 6.95	D					
		8.00	D					
		8.00 - 8.45	U					*UT100 at 8.0m, 25 blows 100% recovery.*
		8.60	D					
		9.50		N=11 (2,2/2,3,3,3)				
		9.50 - 9.95	D		9.70			Firm reddish brown sandy CLAY.
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 6m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

AGS

Borehole Log

Borehole No. **BH02**

Sheet 2 of 2

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 11/12/2024 - 11/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								(COHESIVE TIDAL FLAT DEPOSITS)
					10.80			
		11.00 11.00 - 11.45	D	N=16 (2,1/3,4,4,5)				Firm reddish brown very sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies. (COHESIVE TIDAL FLAT DEPOSITS)
					12.40			
		12.50 12.50 - 12.83	D	50 (9,11/50 for 180mm)				Weak reddish brown MUDSTONE. (ST MAUGHANS FORMATION)
		13.50		50 (11,14/50 for 170mm)				
					13.82			End of borehole at 13.82 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 6m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

LITHOS CONSULTING			Borehole No. **BH03** Sheet 1 of 2
Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 12/12/2024 - 12/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
	▼	1.00		N=24 (5,9/6,6,6,6)				MADE GROUND: Dark grey sandy slightly clayey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brown, concrete, glass, clinker and wood. (GRANULAR MADE GROUND)
		2.00		N=19 (5,4/4,4,7,4)				
		2.60	J,K&T		2.50			
		2.60	J,K&T	HVP=34				Firm dark grey gleyed brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone. (COHESIVE TIDAL FLAT DEPOSITS)
		3.00 - 3.45	U					
		3.40 - 4.00	B		3.40			
		3.45 - 3.60	D					Soft light grey slightly sandy CLAY with frequent plant remains. (COHESIVE TIDAL FLAT DEPOSITS)
		4.00		N=2 (0,0/0,0,1,1)				
					4.60			Soft reddish brown sandy slightly gravelly CLAY. (COHESIVE TIDAL FLAT DEPOSITS)
		5.00 - 5.45	U					
		5.45 - 5.60	D					
		5.50 - 6.50	B					
		6.50		N=13 (2,1/3,2,4,4)				
		8.00 - 8.45	U					*At 8.0m, clay is silty.*
		8.45 - 8.60	D					
		9.50		N=18 (1,2/2,3,5,8)	9.50			
		9.50 - 9.95	D					Reddish brown slightly clayey SAND. (GRANULAR TIDAL FLAT DEPOSITS)
		10.00 - 11.00	B					

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 1.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No. **BH03**

Sheet 2 of 2

Project Name: Royal Victoria Court	Project No. 5088	Co-ords: -	Hole Type CP
Location: Newport		Level:	Scale 1:50
Client: LNT Construction		Dates: 12/12/2024 - 12/12/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		11.00 11.00 - 11.45	D	N=13 (2,3/3,4,3,3)				
					11.80			Reddish brown sandy rounded to subrounded fine to coarse GRAVEL of mixed lithologies. (GRANULAR TIDAL FLAT DEPOSITS)
					12.20			Weak reddish brown MUDSTONE. (ST MAUGHANS FORMATION)
		12.50 12.50 - 12.80	D	50 (11,14/50 for 145mm)				
		13.40 13.40 - 13.69	D	50 (25 for 145mm/50 for 150mm)	13.69			End of borehole at 13.69 m

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 1.0m depth during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

AGS

Appendix H

Chemical Results

Certificate of Analysis

Certificate Number	24-27602	*Issued:*	07-Jan-25

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference	24-27602
Client Reference ~	5088
Order No ~	PO23501
Contract Title ~	Royal Victoria Court
Description	27 Soil samples, 6 Leachate prepared by DETS samples.
Date Received	17-Dec-24
Date Started	18-Dec-24
Date Completed	07-Jan-25
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

ilac-MRA UKAS TESTING 2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

	Lab No	2442285	2442286	2442287	2442288	2442289	2442290	2442291
	Sample ID ~	TP01	TP07	TP01	TP02	TP03	TP04	TP05
	Depth ~	0.25	0.30	0.10	0.60	0.20	0.20	0.30
	Other ID ~	2T	1T	1T	2T	1T	1T	1T
	Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date ~	11/12/2024	10/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Preparation								
Stones >10mm	DETSC 1003*	1	% m/m	58	18	< 1.0	8.0	11	9.0	16
Moisture Content	DETSC 1004	0.1	%	3.5	17	22	12	17	18	13
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	5.4	18	9.5	7.8	8.5	9.6	9.0
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.5	1.9	2.8	0.7	1.6	1.7	1.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.5	2.1	0.2	0.7	1.2	0.7
Chromium	DETSC 2301#	0.15	mg/kg	17	80	44	22	49	64	39
Chromium III	DETSC 2301*	0.15	mg/kg	17	80	44	22	49	64	39
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	9.3	70	83	23	42	61	52
Lead	DETSC 2301#	0.3	mg/kg	13	140	70	36	44	88	44
Mercury	DETSC 2325#	0.05	mg/kg	0.07	0.42	0.35	0.15	0.17	0.17	0.13
Nickel	DETSC 2301#	1	mg/kg	5.0	31	35	20	22	23	19
Selenium	DETSC 2301#	0.5	mg/kg	0.9	0.5	1.3	0.8	0.6	0.8	1.0
Vanadium	DETSC 2301#	0.8	mg/kg	16	73	33	31	35	44	37
Zinc	DETSC 2301#	1	mg/kg	48	1300	300	100	210	250	170
Inorganics								
pH	DETSC 2008#		pH	10.1	11.0	10.2	10.4	10.7	10.3	11.1
Total Organic Carbon	DETSC 2084#	0.5	%	6.9	6.1	2.9	2.0	3.3	2.9	2.5
Petroleum Hydrocarbons								
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	11	< 10	< 10	< 10
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10	39	< 10	85	< 10	< 10	< 10
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10	85	< 10	210	< 10	< 10	< 10
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	130	< 10	320	< 10	< 10	< 10
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	0.03	0.09	< 0.03	< 0.03	0.04
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.10	< 0.03	0.11	< 0.03	< 0.03	0.04
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	0.12	0.03	0.10	< 0.03	0.03	0.04
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.90	0.26	0.53	0.12	0.21	0.24
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.23	0.06	0.15	0.03	0.06	0.06
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	1.5	0.41	0.91	0.19	0.44	0.45
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	1.3	0.33	0.74	0.16	0.37	0.38
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.66	0.19	0.35	0.08	0.24	0.22
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.55	0.16	0.37	0.07	0.19	0.24
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.70	0.28	0.41	0.11	0.32	0.27
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.27	0.10	0.13	0.04	0.11	0.09
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.51	0.17	0.28	0.07	0.22	0.18

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

Lab No				2442285	2442286	2442287	2442288	2442289	2442290	2442291
Sample ID ~				TP01	TP07	TP01	TP02	TP03	TP04	TP05
Depth ~				0.25	0.30	0.10	0.60	0.20	0.20	0.30
Other ID ~				2T	1T	1T	2T	1T	1T	1T
Sample Type ~				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~				11/12/2024	10/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Sampling Time ~				n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.26	0.12	0.14	0.05	0.13	0.11
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.07	0.03	0.04	< 0.03	0.04	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.28	0.12	0.14	0.05	0.13	0.11
Naphthalene	DETSC 3301	0.1	mg/kg							
Acenaphthylene	DETSC 3301	0.1	mg/kg							
Acenaphthene	DETSC 3301	0.1	mg/kg							
Fluorene	DETSC 3301	0.1	mg/kg							
Phenanthrene	DETSC 3301	0.1	mg/kg							
Anthracene	DETSC 3301	0.1	mg/kg							
Fluoranthene	DETSC 3301	0.1	mg/kg							
Pyrene	DETSC 3301	0.1	mg/kg							
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg							
Chrysene	DETSC 3301	0.1	mg/kg							
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg							
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg							
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg							
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg							
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg							
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg							
Coronene	DETSC 3301*	0.1	mg/kg							
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	7.5	2.2	4.5	0.93	2.4	2.5
PAH 16 Total	DETSC 3301	1.6	mg/kg							

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

	Lab No	2442292	2442293	2442295	2442297	2442298	2442300	2442302
	Sample ID ~	TP08	BH02	BH03	TP01	TP02	TP02	TP03
	Depth ~	0.20	2.40	2.60	0.50	0.20	1.90	0.80
	Other ID ~	1T	1T	1T	3T	1T	4T	2T
	Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date ~	11/12/2024	11/12/2024	12/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Preparation								
Stones >10mm	DETSC 1003*	1	% m/m	19	< 1.0	< 1.0	56	22	27	33
Moisture Content	DETSC 1004	0.1	%	12	20	18	8.4	11	21	10
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	5.2	11	7.0	4.8	2.1	7.9	6.4
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.7	2.1	0.5	1.9	1.1	1.2	1.1
Cadmium	DETSC 2301#	0.1	mg/kg	2.4	< 0.1	0.1	0.2	< 0.1	0.2	0.3
Chromium	DETSC 2301#	0.15	mg/kg	33	31	30	27	13	110	27
Chromium III	DETSC 2301*	0.15	mg/kg	33	31	30	27	13	110	27
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	33	14	18	18	6.3	24	20
Lead	DETSC 2301#	0.3	mg/kg	56	37	18	21	9.9	44	70
Mercury	DETSC 2325#	0.05	mg/kg	0.13	0.05	0.17	< 0.05	< 0.05	0.07	0.12
Nickel	DETSC 2301#	1	mg/kg	16	29	34	19	4.4	11	8.6
Selenium	DETSC 2301#	0.5	mg/kg	0.6	< 0.5	0.5	0.7	0.8	1.8	0.5
Vanadium	DETSC 2301#	0.8	mg/kg	25	42	38	24	10	330	43
Zinc	DETSC 2301#	1	mg/kg	360	2300	130	88	46	82	300
Inorganics								
pH	DETSC 2008#		pH	12.1	8.3	8.8	11.9	11.7	11.2	11.5
Total Organic Carbon	DETSC 2084#	0.5	%	6.2	0.5	0.5	3.2	3.4	3.8	3.2
Petroleum Hydrocarbons								
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	25	19	< 10	18
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	210	54	< 10	120
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	860	190	< 10	370
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	35	11	< 10	32
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	1100	280	< 10	540
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.06	< 0.03	0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.06	< 0.03	0.06
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03	0.06
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.12	< 0.03	< 0.03	0.14	0.24	0.15	0.50
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.05	0.06	0.03	0.14
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.19	< 0.03	< 0.03	0.48	0.37	0.24	1.1
Pyrene	DETSC 3303#	0.03	mg/kg	0.16	< 0.03	< 0.03	0.67	0.31	0.20	0.97
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.09	< 0.03	< 0.03	0.40	< 0.03	0.10	0.58
Chrysene	DETSC 3303	0.03	mg/kg	0.07	< 0.03	< 0.03	0.37	0.13	0.09	0.44
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.11	< 0.03	< 0.03	0.56	0.22	0.12	0.83
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	0.19	0.08	0.04	0.26
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03	< 0.03	0.33	0.16	0.08	0.58

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

	Lab No	2442292	2442293	2442295	2442297	2442298	2442300	2442302
	Sample ID ~	TP08	BH02	BH03	TP01	TP02	TP02	TP03
	Depth ~	0.20	2.40	2.60	0.50	0.20	1.90	0.80
	Other ID ~	1T	1T	1T	3T	1T	4T	2T
	Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date ~	11/12/2024	11/12/2024	12/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	0.20	0.10	0.04	0.33
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06	< 0.03	< 0.03	0.10
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	0.21	0.10	0.04	0.36
Naphthalene	DETSC 3301	0.1	mg/kg							
Acenaphthylene	DETSC 3301	0.1	mg/kg							
Acenaphthene	DETSC 3301	0.1	mg/kg							
Fluorene	DETSC 3301	0.1	mg/kg							
Phenanthrene	DETSC 3301	0.1	mg/kg							
Anthracene	DETSC 3301	0.1	mg/kg							
Fluoranthene	DETSC 3301	0.1	mg/kg							
Pyrene	DETSC 3301	0.1	mg/kg							
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg							
Chrysene	DETSC 3301	0.1	mg/kg							
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg							
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg							
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg							
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg							
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg							
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg							
Coronene	DETSC 3301*	0.1	mg/kg							
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.93	< 0.10	< 0.10	3.7	1.9	1.1	6.3
PAH 16 Total	DETSC 3301	1.6	mg/kg							

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

	Lab No	2442304	2442305	2442307	2442308	2442309	2442310	2442311
	Sample ID ~	TP04	TP05	TP06	TP07	TP08	TP09	TP06
	Depth ~	0.60	0.80	1.00	1.40	0.80	1.00	0.05
	Other ID ~	3T	2T	3T	2T	2T	1T	1T
	Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date ~	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Preparation								
Stones >10mm	DETSC 1003*	1	% m/m	42	23	8.0	34	68	31	
Moisture Content	DETSC 1004	0.1	%	11	11	15	14	9.4	14	
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	6.9	6.5	9.2	4.0	4.9	7.5	
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	1.0	1.0	1.4	1.2	1.1	1.0	
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.1	0.5	0.3	0.3	0.3	
Chromium	DETSC 2301#	0.15	mg/kg	110	16	58	15	200	99	
Chromium III	DETSC 2301*	0.15	mg/kg	110	16	58	15	200	99	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	37	40	53	16	33	60	
Lead	DETSC 2301#	0.3	mg/kg	57	50	94	60	45	99	
Mercury	DETSC 2325#	0.05	mg/kg	0.06	0.06	0.15	0.08	< 0.05	0.10	
Nickel	DETSC 2301#	1	mg/kg	16	14	20	5.9	11	14	
Selenium	DETSC 2301#	0.5	mg/kg	1.2	< 0.5	0.7	0.8	2.8	1.9	
Vanadium	DETSC 2301#	0.8	mg/kg	74	14	51	19	170	140	
Zinc	DETSC 2301#	1	mg/kg	500	140	310	120	800	1200	
Inorganics								
pH	DETSC 2008#		pH	11.6	11.0	11.0	11.6	11.6	11.3	
Total Organic Carbon	DETSC 2084#	0.5	%	7.0	8.1	6.9	3.0	5.2	8.6	
Petroleum Hydrocarbons								
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	
EPH (C12-C16)	DETSC 3311	10	mg/kg	46	38	22	< 10	39	20	
EPH (C16-C21)	DETSC 3311	10	mg/kg	260	190	46	< 10	280	99	
EPH (C21-C35)	DETSC 3311	10	mg/kg	620	390	170	< 10	800	390	
EPH (C35-C40)	DETSC 3311	10	mg/kg	27	25	43	< 10	55	41	
EPH (C10-C40)	DETSC 3311#	10	mg/kg	950	650	290	< 10	1200	550	
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	0.15	0.19	0.20	0.04	0.06	0.08	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	0.09	0.11	0.05	0.03	0.04	0.07	
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.43	0.64	0.17	0.08	0.22	0.17	
Fluorene	DETSC 3303	0.03	mg/kg	0.45	0.61	0.22	0.09	0.23	0.19	
Phenanthrene	DETSC 3303#	0.03	mg/kg	3.1	4.0	1.3	0.56	1.8	1.2	
Anthracene	DETSC 3303	0.03	mg/kg	0.93	1.2	0.38	0.15	< 0.03	0.36	
Fluoranthene	DETSC 3303#	0.03	mg/kg	6.0	7.2	2.3	1.2	4.6	2.7	
Pyrene	DETSC 3303#	0.03	mg/kg	5.0	6.0	1.9	1.1	4.2	2.4	
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	2.9	3.8	1.1	0.76	2.6	1.3	
Chrysene	DETSC 3303	0.03	mg/kg	2.2	2.8	0.78	0.55	1.9	0.99	
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	3.4	4.4	1.2	0.94	2.9	1.6	
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	1.1	1.6	0.41	0.33	0.86	0.54	
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	2.5	3.3	0.89	0.66	2.1	1.2	

Summary of Chemical Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

			Lab No	2442304	2442305	2442307	2442308	2442309	2442310	2442311
			Sample ID ~	TP04	TP05	TP06	TP07	TP08	TP09	TP06
			Depth ~	0.60	0.80	1.00	1.40	0.80	1.00	0.05
			Other ID ~	3T	2T	3T	2T	2T	1T	1T
			Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date ~	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.97	1.3	0.36	0.32	0.77	0.50	
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.36	0.49	0.13	0.12	0.29	0.17	
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	1.2	1.6	0.44	0.39	0.95	0.62	
Naphthalene	DETSC 3301	0.1	mg/kg							< 2.0
Acenaphthylene	DETSC 3301	0.1	mg/kg							< 2.0
Acenaphthene	DETSC 3301	0.1	mg/kg							< 2.0
Fluorene	DETSC 3301	0.1	mg/kg							< 2.0
Phenanthrene	DETSC 3301	0.1	mg/kg							< 2.0
Anthracene	DETSC 3301	0.1	mg/kg							< 2.0
Fluoranthene	DETSC 3301	0.1	mg/kg							< 2.0
Pyrene	DETSC 3301	0.1	mg/kg							< 2.0
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg							< 2.0
Chrysene	DETSC 3301	0.1	mg/kg							< 2.0
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg							< 2.0
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg							< 2.0
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg							< 2.0
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg							< 2.0
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg							< 2.0
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg							< 2.0
Coronene	DETSC 3301*	0.1	mg/kg							< 2.0
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	31	39	12	7.3	24	14	
PAH 16 Total	DETSC 3301	1.6	mg/kg							< 1.6

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id BH02 2T 2.40

Sample Numbers 2442294 2442312
Date Analysed 03/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	< 0.5	3	5	6
DETSC 2003# Loss On Ignition	%	4.7	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	8.0	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	1.1	0.01	0.5	2	25
DETSC 2306 Barium as Ba	37	0.4	20	100	300
DETSC 2306 Cadmium as Cd	0.23	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	3.7	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	3.2	0.03	2	50	100
DETSC 2306 Mercury as Hg	0.029	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	7.9	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	2.8	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	2.5	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	7.2	0.07	0.06	0.7	5
DETSC 2306 Selenium as Se	1.8	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	32	0.32	4	50	200
DETSC 2055 Chloride as Cl	4100	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	590	5.9	10	150	500
DETSC 2055 Sulphate as SO4	82000	820	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	140000	1400	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	6.6
DETSC 2009 Conductivity uS/cm	203.0
* Temperature*	18.0
Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.095
Stage 1	
Volume of Leachant L2*	0.926
Volume of Eluate VE1*	0.878

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id BH03 2T 2.60

Sample Numbers 2442296 2442313
Date Analysed 03/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	< 0.5	3	5	6
DETSC 2003# Loss On Ignition	%	4.0	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	9.6	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	2.5	0.03	0.5	2	25
DETSC 2306 Barium as Ba	14	0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.7	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	2.4	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.31	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	0.49	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	0.72	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	1900	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	< 100	< 0.1	10	150	500
DETSC 2055 Sulphate as SO4	9500	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	32000	320	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	6.9
DETSC 2009 Conductivity uS/cm	45.0
* Temperature*	18.0

Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.098

Stage 1

Volume of Leachant L2*	0.958
Volume of Eluate VE1*	0.91

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WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id TP02 2T 0.20

Sample Numbers 2442299 2442314
Date Analysed 03/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	3.2	3	5	6
DETSC 2003# Loss On Ignition	%	4.3	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	240.0	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	2.5	100	n/a	n/a
DETSC 2008# pH	pH Units	11.4	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	2.9	0.03	0.5	2	25
DETSC 2306 Barium as Ba	17	0.2	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	1.6	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	3.8	0.04	2	50	100
DETSC 2306 Mercury as Hg	0.011	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	2.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	0.65	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	6.7	0.07	0.5	10	50
DETSC 2306 Antimony as Sb	1.7	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	0.68	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	8.4	0.08	4	50	200
DETSC 2055 Chloride as Cl	1300	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	< 100	< 0.1	10	150	500
DETSC 2055 Sulphate as SO4	15000	150	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	57000	570	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	8.0
DETSC 2009 Conductivity uS/cm	80.9
* Temperature*	18.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.097

Stage 1

Volume of Leachant L2*	0.956
Volume of Eluate VE1*	0.906

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id TP02 5T 1.90

Sample Numbers 2442301 2442315
Date Analysed 02/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	4.0	3	5	6
DETSC 2003# Loss On Ignition	%	4.3	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	2.2	100	n/a	n/a
DETSC 2008# pH	pH Units	11.1	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	2.2	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	7.2	0.07	0.5	2	25
DETSC 2306 Barium as Ba	18	0.2	20	100	300
DETSC 2306 Cadmium as Cd	0.037	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	1.3	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	3.2	0.03	2	50	100
DETSC 2306 Mercury as Hg	0.048	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	5.4	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	0.71	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	6.7	0.07	0.5	10	50
DETSC 2306 Antimony as Sb	1.9	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	0.47	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	7.9	0.08	4	50	200
DETSC 2055 Chloride as Cl	1700	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	< 100	< 0.1	10	150	500
DETSC 2055 Sulphate as SO4	8200	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	120000	1200	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.7
DETSC 2009 Conductivity uS/cm	176.0
* Temperature*	18.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.095

Stage 1

Volume of Leachant L2*	0.937
Volume of Eluate VE1*	0.881

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id TP04 2T 0.60

Sample Numbers 2442303 2442316
Date Analysed 02/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	6.2	3	5	6
DETSC 2003# Loss On Ignition	%	6.0	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	0.17	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	1500.0	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	47.0	100	n/a	n/a
DETSC 2008# pH	pH Units	11.2	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	1.8	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	7.8	0.08	0.5	2	25
DETSC 2306 Barium as Ba	18	0.2	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	3.9	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	22	0.22	2	50	100
DETSC 2306 Mercury as Hg	0.11	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	3.8	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	3.6	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	25	0.25	0.5	10	50
DETSC 2306 Antimony as Sb	7.5	0.08	0.06	0.7	5
DETSC 2306 Selenium as Se	1.5	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	110	1.1	4	50	200
DETSC 2055 Chloride as Cl	4000	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	110	1.1	10	150	500
DETSC 2055 Sulphate as SO4	23000	230	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	150000	1500	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	9.2
DETSC 2009 Conductivity uS/cm	216.0
* Temperature*	18.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.099

Stage 1

Volume of Leachant L2*	0.984
Volume of Eluate VE1*	0.93

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-27602
Client Ref 5088
Contract Title Royal Victoria Court
Sample Id TP06 2T 1.00

Sample Numbers 2442306 2442317
Date Analysed 02/01/2025

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	6.1	3	5	6
DETSC 2003# Loss On Ignition	%	6.6	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311* Mineral Oil (C10 - C40)	mg/kg	650.0	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	36.0	100	n/a	n/a
DETSC 2008# pH	pH Units	10.7	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	1.4	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	WAC Limit Values (Limit values for LS10 Leachate): Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	10	0.1	0.5	2	25
DETSC 2306 Barium as Ba	17	0.2	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	2.6	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	13	0.13	2	50	100
DETSC 2306 Mercury as Hg	0.091	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	8.7	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	3.2	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	9.5	0.1	0.5	10	50
DETSC 2306 Antimony as Sb	9.6	0.1	0.06	0.7	5
DETSC 2306 Selenium as Se	1.6	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	30	0.3	4	50	200
DETSC 2055 Chloride as Cl	3000	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	160	1.6	10	150	500
DETSC 2055 Sulphate as SO4	32000	320	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	71000	710	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	4100	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	8.7
DETSC 2009 Conductivity uS/cm	102.0
* Temperature*	18.0
Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.094
Stage 1	
Volume of Leachant L2*	0.922
Volume of Eluate VE1*	0.879

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-27602
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2442285	TP01 2T 0.25	SOIL	NAD	none	Ben Rose
2442286	TP07 1T 0.30	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2442287	TP01 1T 0.10	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2442288	TP02 2T 0.60	SOIL	NAD	none	Ben Rose
2442289	TP03 1T 0.20	SOIL	NAD	none	Ben Rose
2442290	TP04 1T 0.20	SOIL	NAD	none	Ben Rose
2442291	TP05 1T 0.30	SOIL	NAD	none	Ben Rose
2442292	TP08 1T 0.20	SOIL	NAD	none	Ben Rose
2442293	BH02 1T 2.40	SOIL	NAD	none	Ben Rose
2442295	BH03 1T 2.60	SOIL	NAD	none	Ben Rose
2442297	TP01 3T 0.50	SOIL	Amosite	Amosite present as fibre bundles and in microscopic insulation debris	Ben Rose
2442298	TP02 1T 0.20	SOIL	NAD	none	Ben Rose
2442300	TP02 4T 1.90	SOIL	NAD	none	Ben Rose
2442302	TP03 2T 0.80	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2442304	TP04 3T 0.60	SOIL	NAD	Chrysotile present as fibre bundles	Ben Rose
2442305	TP05 2T 0.80	SOIL	NAD	none	Ben Rose
2442307	TP06 3T 1.00	SOIL	NAD	none	Ben Rose
2442308	TP07 2T 1.40	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2442309	TP08 2T 0.80	SOIL	Chrysotile	Chrysotile present as fibre bundles	Ben Rose
2442310	TP09 1T 1.00	SOIL	Amosite	Amosite present as fibre bundles	Ben Rose

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 24-27602
Client Ref ~ 5088
Contract ~ Royal Victoria Court

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2442285	TP01 0.25 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442286	TP07 0.30 SOIL	10/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442287	TP01 0.10 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442288	TP02 0.60 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442289	TP03 0.20 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442290	TP04 0.20 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442291	TP05 0.30 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442292	TP08 0.20 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442293	BH02 2.40 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442294	BH02 2.40 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442295	BH03 2.60 SOIL	12/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442296	BH03 2.60 SOIL	12/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442297	TP01 0.50 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442298	TP02 0.20 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442299	TP02 0.20 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442300	TP02 1.90 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442301	TP02 1.90 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442302	TP03 0.80 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442303	TP04 0.60 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442304	TP04 0.60 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442305	TP05 0.80 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442306	TP06 1.00 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442307	TP06 1.00 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442308	TP07 1.40 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442309	TP08 0.80 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442310	TP09 1.00 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442311	TP06 0.05 SOIL	11/12/24	PT 1L		Naphthalene, PAH FID
2442312	BH02 2.40 LEACHATE	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442313	BH03 2.60 LEACHATE	12/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442314	TP02 0.20 LEACHATE	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442315	TP02 1.90 LEACHATE	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442316	TP04 0.60 LEACHATE	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2442317	TP06 1.00 LEACHATE	11/12/24	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Information in Support of the Analytical Results

Our Ref 24-27602
Client Ref ~ 5088
Contract ~ Royal Victoria Court

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

Our Ref 24-27602
Client Ref ~ 5088
Contract ~ Royal Victoria Court

Key:
~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

Certificate of Analysis

Certificate Number 25-00383 *Issued:* 15-Jan-25

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 25-00383

Client Reference ~ 5088

Order No ~ PO23501

Contract Title ~ Royal Victoria Court

Description 8 Soil samples.

Date Received 17-Dec-24

Date Started 09-Jan-25

Date Completed 15-Jan-25

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

2139

Summary of Asbestos Analysis

Samples

Our Ref 25-00383
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

Lab No	Sample ID	Sample Location	Material Type	Result	Comment*	Analyst

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis
Soil Samples

Our Ref 25-00383
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

Lab No		2446713	2446714	2446715
Sample ID ~		TP07	TP01	TP01
Depth ~		0.30	0.10	0.50
Other ID ~		1T	1T	3T
Sample Type ~				
Sampling Date ~		10/12/2024	11/12/2024	11/12/2024
Sampling Time ~				
Test	**Method**	**Units**		
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %		**0.001**	**0.005**	**0.010**
Gravimetric Quantification (a)	DETSC 1102	Mass %		na	na	0.006
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %		0.001	0.005	0.004
Quantification by PCOM (c)	DETSC 1102	Mass %		na	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g		na	na	na
Breakdown of Gravimetric Analysis (a)						
Mass of Sample		g		635.67	582.40	645.05
ACMs present*		type				Insulation
Mass of ACM in sample		g				0.0419
% ACM by mass		%				0.006
% asbestos in ACM		%				85
% asbestos in sample		%				0.006
Breakdown of Detailed Gravimetric Analysis (b)						
% Amphibole bundles in sample		Mass %		na	na	0.004
% Chrysotile bundles in sample		Mass %		0.001	0.005	na
Breakdown of PCOM Analysis (c)						
% Amphibole fibres in sample		Mass %		na	na	na
% Chrysotile fibres in sample		Mass %		na	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)						
Amphibole fibres		Fibres/g		na	na	na
Chrysotile fibres		Fibres/g		na	na	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Summary of Asbestos Quantification Analysi

Soil Samples

Our Ref 25-00383
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

		Lab No	2446716	2446717	2446718	2446719
		Sample ID ~	TP03	TP04	TP07	TP08
		Depth ~	0.80	0.60	1.40	0.80
		Other ID ~	2T	3T	2T	2T
		Sample Type ~				
		Sampling Date ~	11/12/2024	11/12/2024	11/12/2024	11/12/2024
		Sampling Time ~				
Test	**Method**	**Units**				
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	**0.003**	**0.006**	**0.001**	**0.001**
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	na	na	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.003	0.006	0.001	0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na	na	na
Breakdown of Gravimetric Analysis (a)						
Mass of Sample		g	764.21	917.10	858.65	783.46
ACMs present*		type				
Mass of ACM in sample		g				
% ACM by mass		%				
% asbestos in ACM		%				
% asbestos in sample		%				
Breakdown of Detailed Gravimetric Analysis (b)						
% Amphibole bundles in sample		Mass %	na	na	na	na
% Chrysotile bundles in sample		Mass %	0.003	0.006	0.001	0.001
Breakdown of PCOM Analysis (c)						
% Amphibole fibres in sample		Mass %	na	na	na	na
% Chrysotile fibres in sample		Mass %	na	na	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)						
Amphibole fibres		Fibres/g	na	na	na	na
Chrysotile fibres		Fibres/g	na	na	na	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Summary of Asbestos Quantification Analysi

Soil Samples

Our Ref 25-00383
Client Ref ~ 5088
Contract Title ~ Royal Victoria Court

Lab No	2446720
Sample ID ~	TP09
Depth ~	1.00
Other ID ~	1T
Sample Type ~	
Sampling Date ~	11/12/2024
Sampling Time ~	

Test	Method	Units	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	**0.007**
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.007
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na
Breakdown of Gravimetric Analysis (a)			
Mass of Sample		g	809.56
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	
Breakdown of Detailed Gravimetric Analysis (b)			
% Amphibole bundles in sample		Mass %	0.007
% Chrysotile bundles in sample		Mass %	na
Breakdown of PCOM Analysis (c)			
% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na
Breakdown of Potentially Respirable Fibre Analysis (d)			
Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Information in Support of the Analytical Results

Our Ref 25-00383
Client Ref ~ 5088
Contract ~ Royal Victoria Court

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2446713	TP07 0.30 SOIL	10/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446714	TP01 0.10 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446715	TP01 0.50 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446716	TP03 0.80 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446717	TP04 0.60 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446718	TP07 1.40 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446719	TP08 0.80 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		
2446720	TP09 1.00 SOIL	11/12/24	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

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Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

Appendix I

Geotechnical Test Results

LABORATORY REPORT

Contract Number: PSL24/9370

Report Date:	15 January 2025
Client's Reference:	5088
Client Name:	Lithos Consulting Parkhill Walton Road Wetherby North Yorkshire LS22 5DZ
For the attention of:	**Charlotte Copley**
Contract Title:	Royal Victoria Court
Date Received:	18/12/2024
Date Commenced:	18/12/2024
Date Completed:	15/1/2025
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:

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01	3	D	4.00		Brown mottled grey slightly sandy slightly gravelly CLAY.
BH01	6	D	6.50		Reddish brown slightly sandy slightly gravelly CLAY.
BH01	7	U	8.00		Firm reddish brown sandy slightly gravelly CLAY.
BH01	9	D	9.50		Reddish brown slightly clayey SAND.
BH02	12	U	8.00		Soft brown sandy slightly gravelly CLAY.
BH02	13	D	8.60		Reddish brown sandy slightly gravelly CLAY.
BH02	3	U	3.00		Soft brown slightly sandy slightly gravelly CLAY.
BH02	4	D	3.60		Brown mottled grey slightly sandy slightly gravelly CLAY.
BH02	5	B	3.00		Brown slightly sandy slightly gravelly CLAY.
BH02	7	B	4.30		Brown slightly sandy slightly gravelly CLAY.
BH02	8	D	5.00		Brown organic CLAY.
BH02	9	U	5.00		Soft brown organic CLAY.
BH03	4	D	3.50		Brown slightly sandy slightly gravelly CLAY with some organic material.
BH03	5	B	3.40		Brown slightly sandy slightly gravelly CLAY.
BH03	6	U	5.00		Soft reddish brown slightly sandy slightly gravelly CLAY.
BH03	7	D	5.50		Reddish brown slightly sandy slightly gravelly CLAY.
BH03	9	U	8.00		Firm reddish brown sandy silty CLAY.
TP01	4	D	2.70		Brown slightly sandy slightly gravelly CLAY.
TP04	4	D	2.80		Brown mottled grey slightly sandy slightly gravelly CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP05	3	D	2.50		Brown slightly sandy slightly gravelly CLAY.
TP06	4	D	2.70		Brown mottled grey slightly sandy slightly gravelly CLAY.
TP08	3	D	2.40		Reddish brown slightly sandy slightly gravelly CLAY.
BH03	11	D	9.50		Reddish brown slightly clayey SAND.
BH03	12	B	10.00		Reddish brown silty SAND.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Royal Victoria Court

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SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
BH01	3	D	4.00		27.8			45	22	23	96	Medium Plasticity CIM
BH01	6	D	6.50		19.1			37	19	18	98	Medium Plasticity CIM
BH01	9	D	9.50		14.7				NP			
BH02	13	D	8.60		17.1			29	15	14	95	Low Plasticity CIL
BH02	4	D	3.60		29.1			57	25	32	97	High Plasticity CIH
BH02	8	D	5.00		69.6			126	47	79	100	Organic Plasticity CIHO
BH03	4	D	3.50		56.0			77	32	45	98	Very High Plasticity CIV
BH03	7	D	5.50		18.1			33	16	17	93	Low Plasticity CIL
BH03	9	U	8.00		20.5			31	15	16	100	Low Plasticity CIL
TP01	4	D	2.70		25.2			43	20	23	97	Medium Plasticity CIM
TP04	4	D	2.80		33.1			61	26	35	98	High Plasticity CIH
TP05	3	D	2.50		31.9			51	24	27	95	High Plasticity CIH
TP06	4	D	2.70		25.7			55	24	31	98	High Plasticity CIH
TP08	3	D	2.40		24.2			40	21	19	100	Medium Plasticity CIM
BH03	11	D	9.50		21.5				NP			

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

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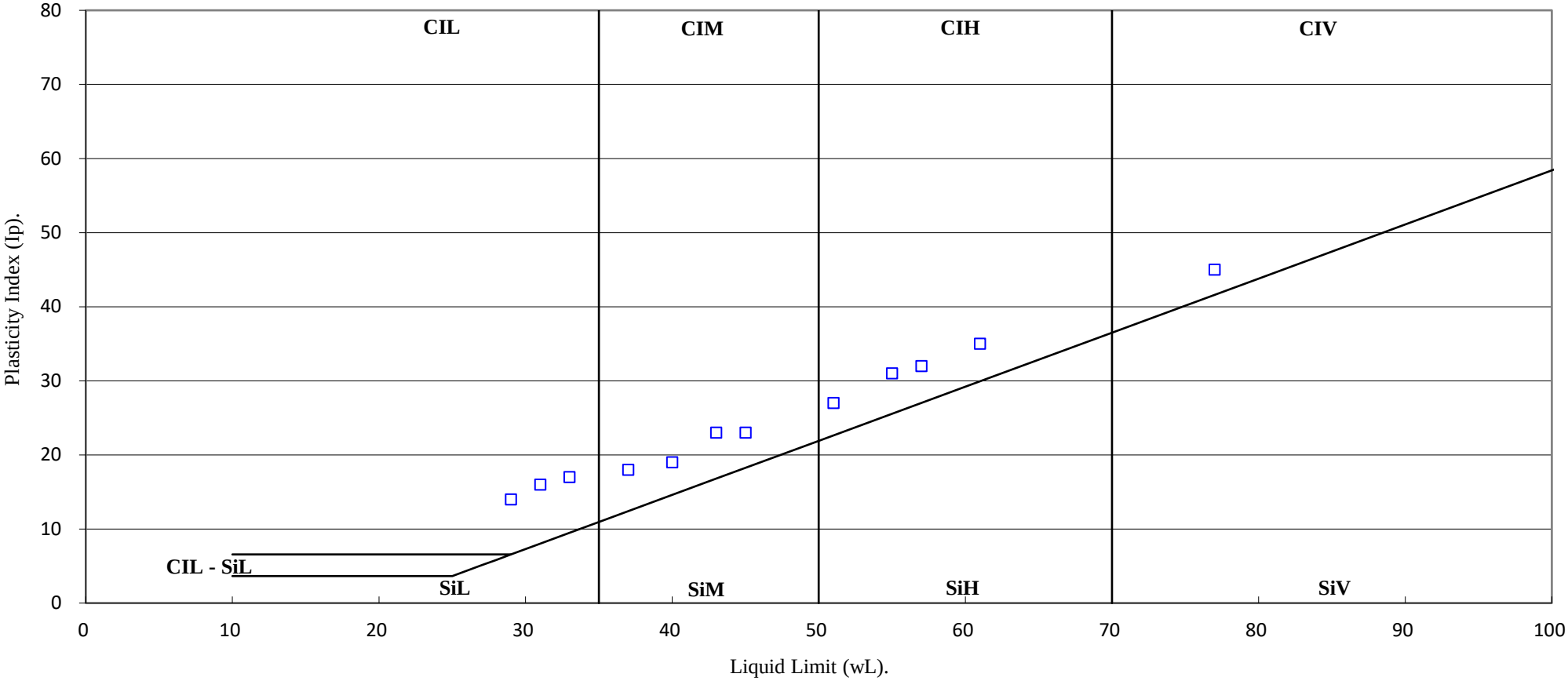
PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



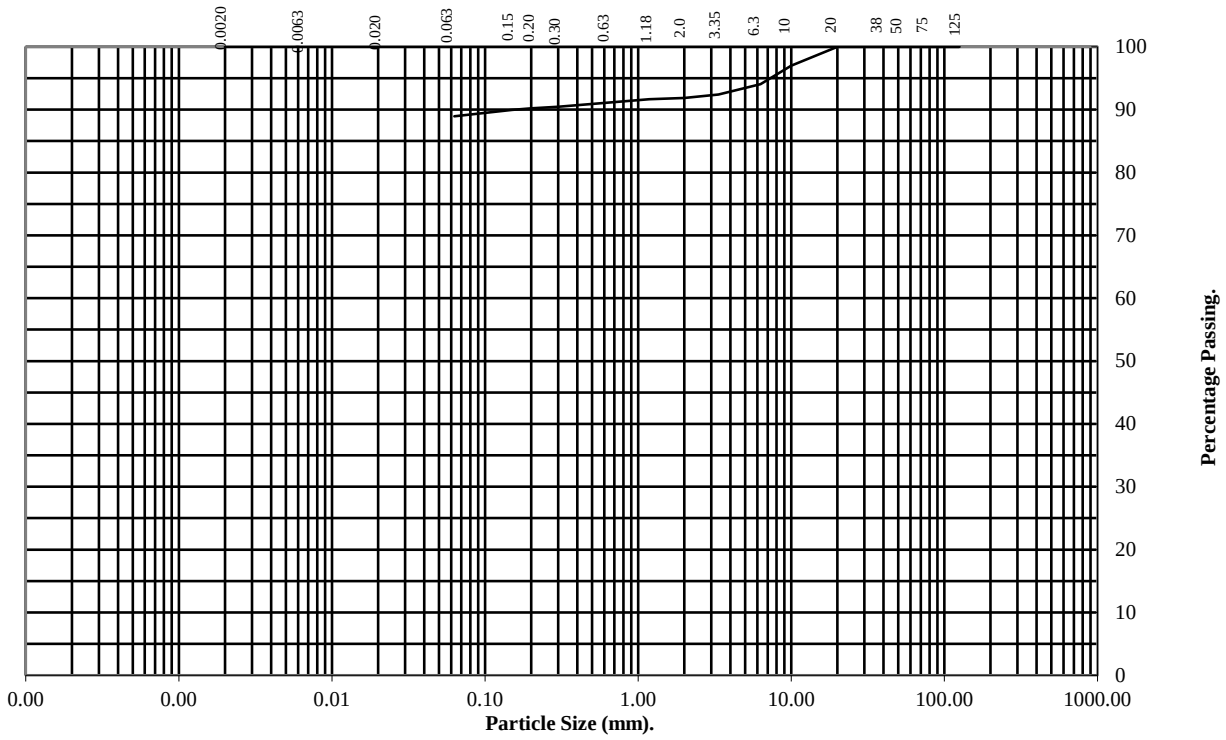
UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Royal Victoria Court**	**Contract No:**
		PSL24/9370
		Client Ref:
		5088

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number:	**BH02**	**Top Depth (m):**	**3.00**
Sample Number:	**5**	**Base Depth (m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	100
10	97
6.3	94
3.35	92
2	92
1.18	92
0.63	91
0.3	90
0.2	90
0.15	90
0.063	89

Soil Fraction	Total Percentage
Cobbles	0
Gravel	8
Sand	3
Silt/Clay	89

Remarks:

See Summary of Soil Descriptions

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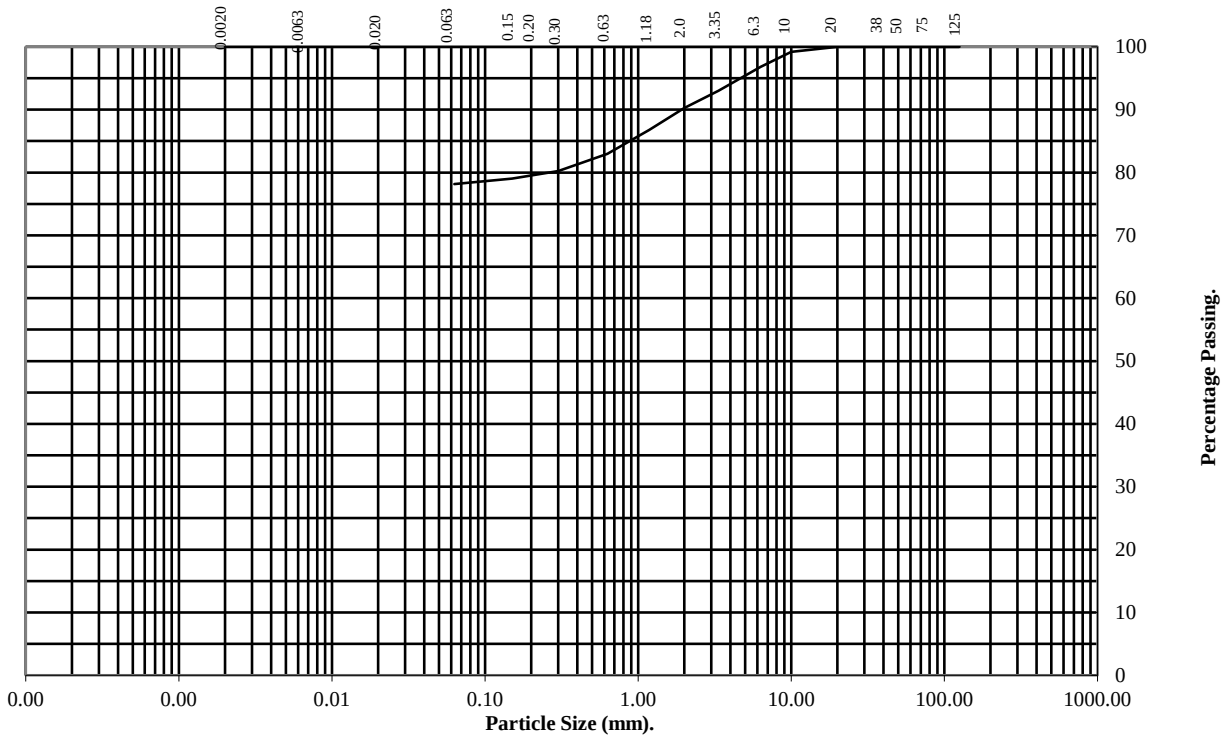
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number:	**BH02**	**Top Depth (m):**	**4.30**
Sample Number:	**7**	**Base Depth (m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	100
10	99
6.3	97
3.35	93
2	90
1.18	87
0.63	83
0.3	80
0.2	80
0.15	79
0.063	78

Soil Fraction	Total Percentage
Cobbles	0
Gravel	10
Sand	12
Silt/Clay	78

Remarks:

See Summary of Soil Descriptions

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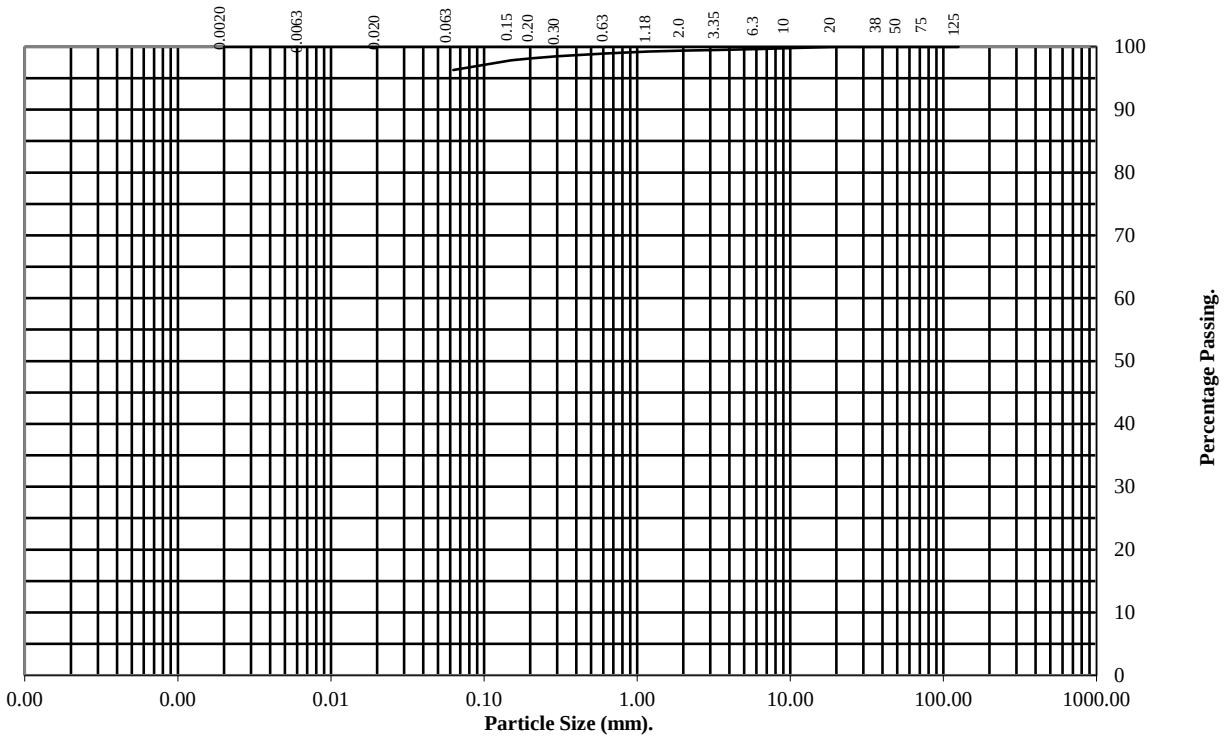
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number:	**BH03**	**Top Depth (m):**	**3.40**
Sample Number:	**5**	**Base Depth (m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	99
0.63	99
0.3	99
0.2	98
0.15	98
0.063	96

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	3
Silt/Clay	96

Remarks:

See Summary of Soil Descriptions

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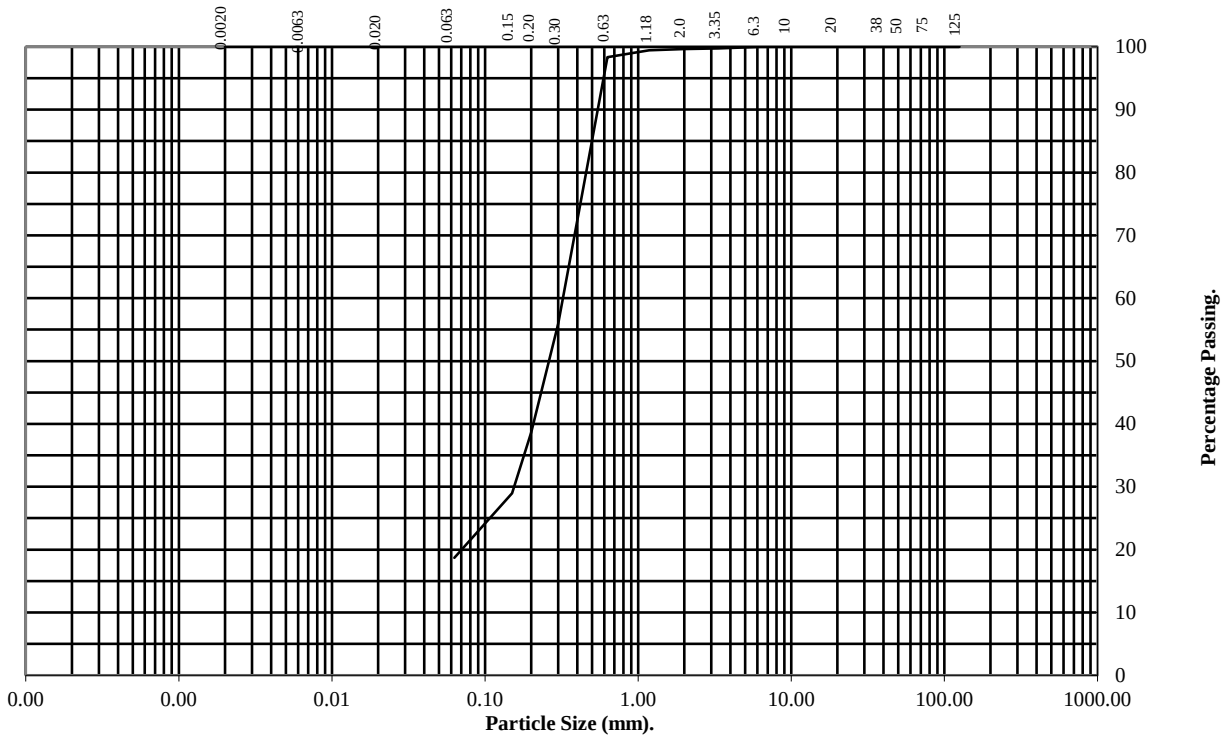
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number:	**BH03**	**Top Depth (m):**	**10.00**
Sample Number:	**12**	**Base Depth (m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.63	98
0.3	56
0.2	39
0.15	29
0.063	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	81
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions

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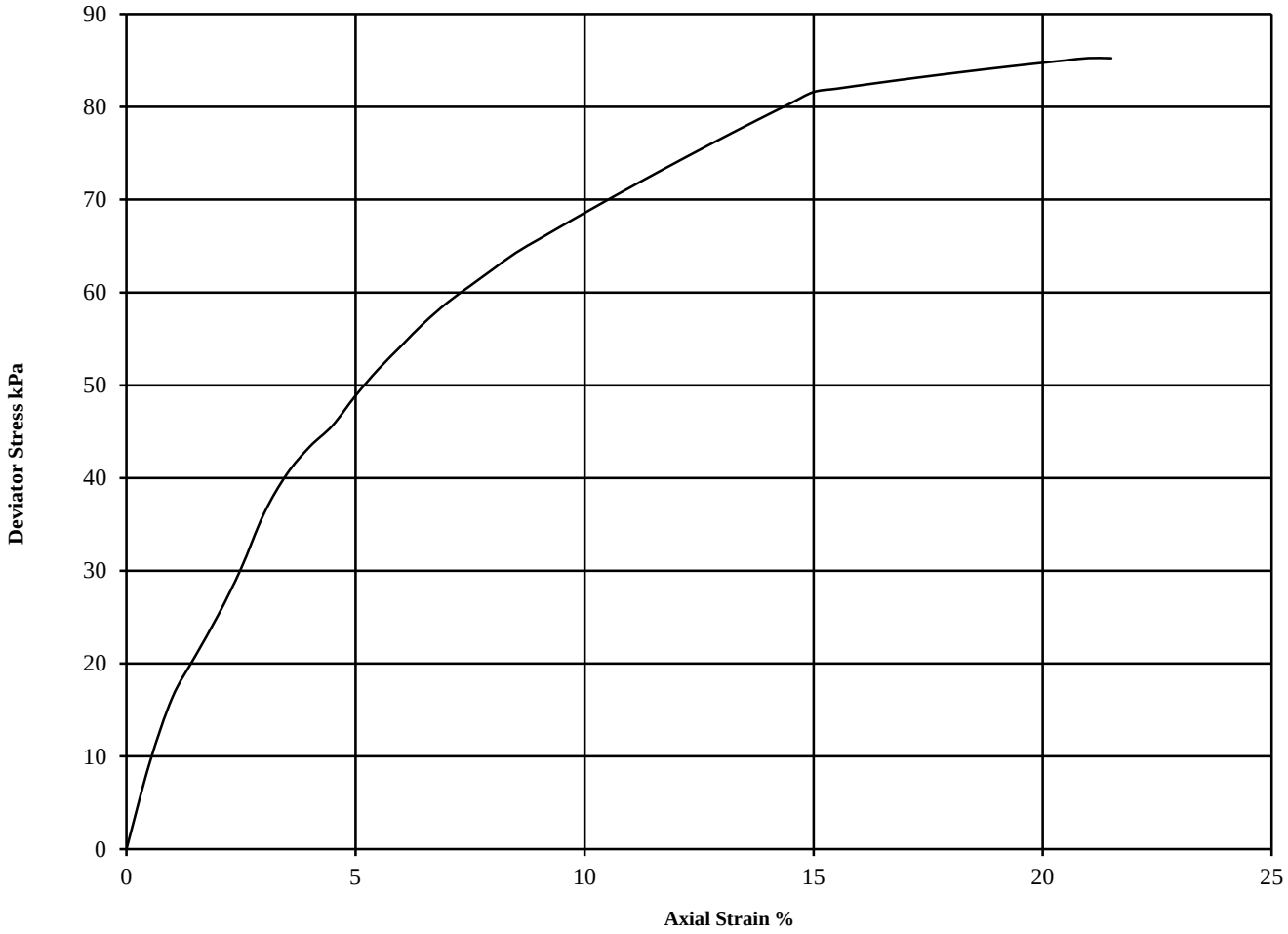
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH01**	**Top Depth (m):**	**8.00**
Sample Number	**7**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	19.8	2.10	1.76	160	85	43	20.5	Plastic	

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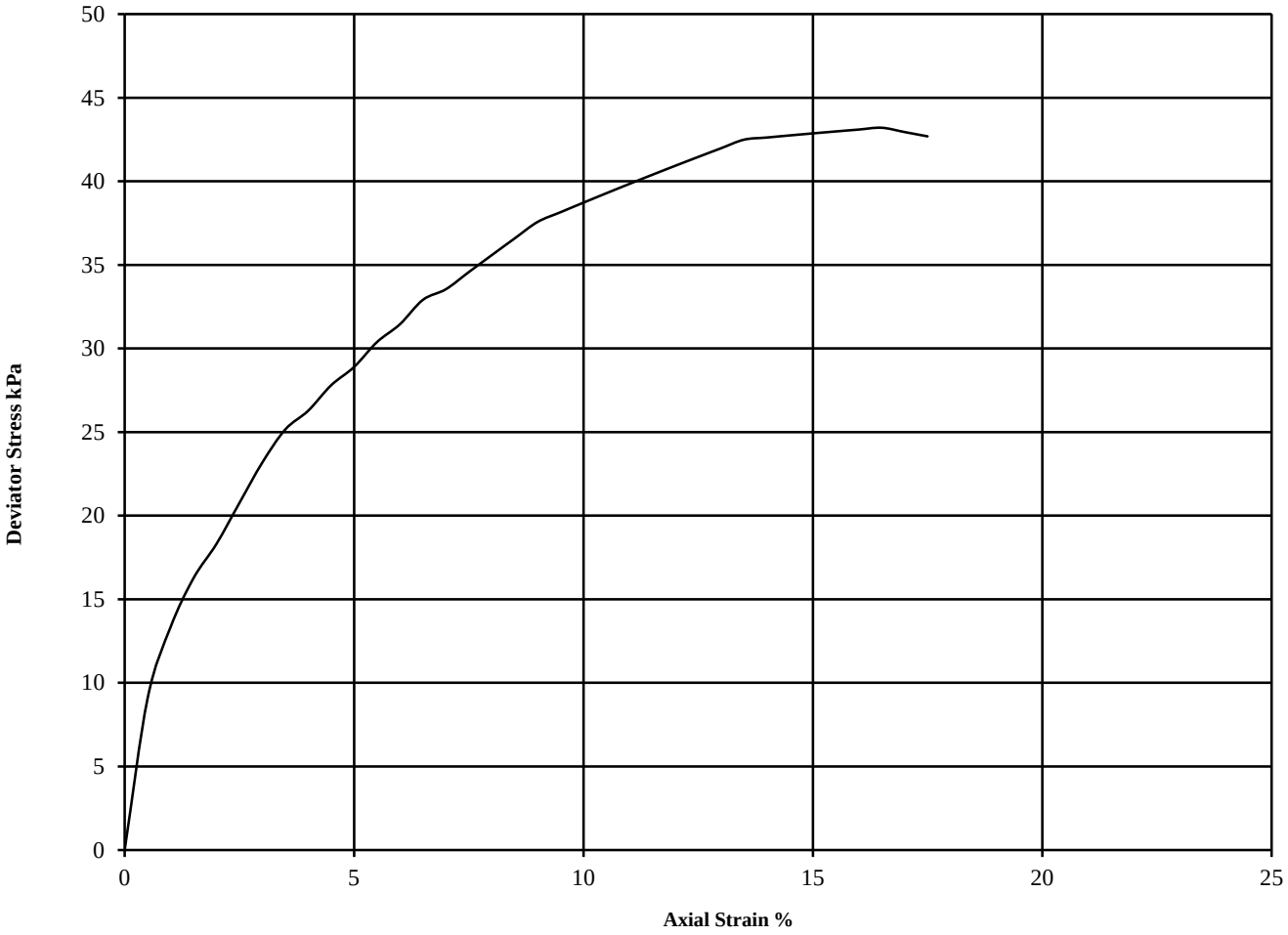
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH02**	**Top Depth (m):**	**8.00**
Sample Number	**12**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	20.9	2.04	1.69	160	43	22	16.0	Plastic	

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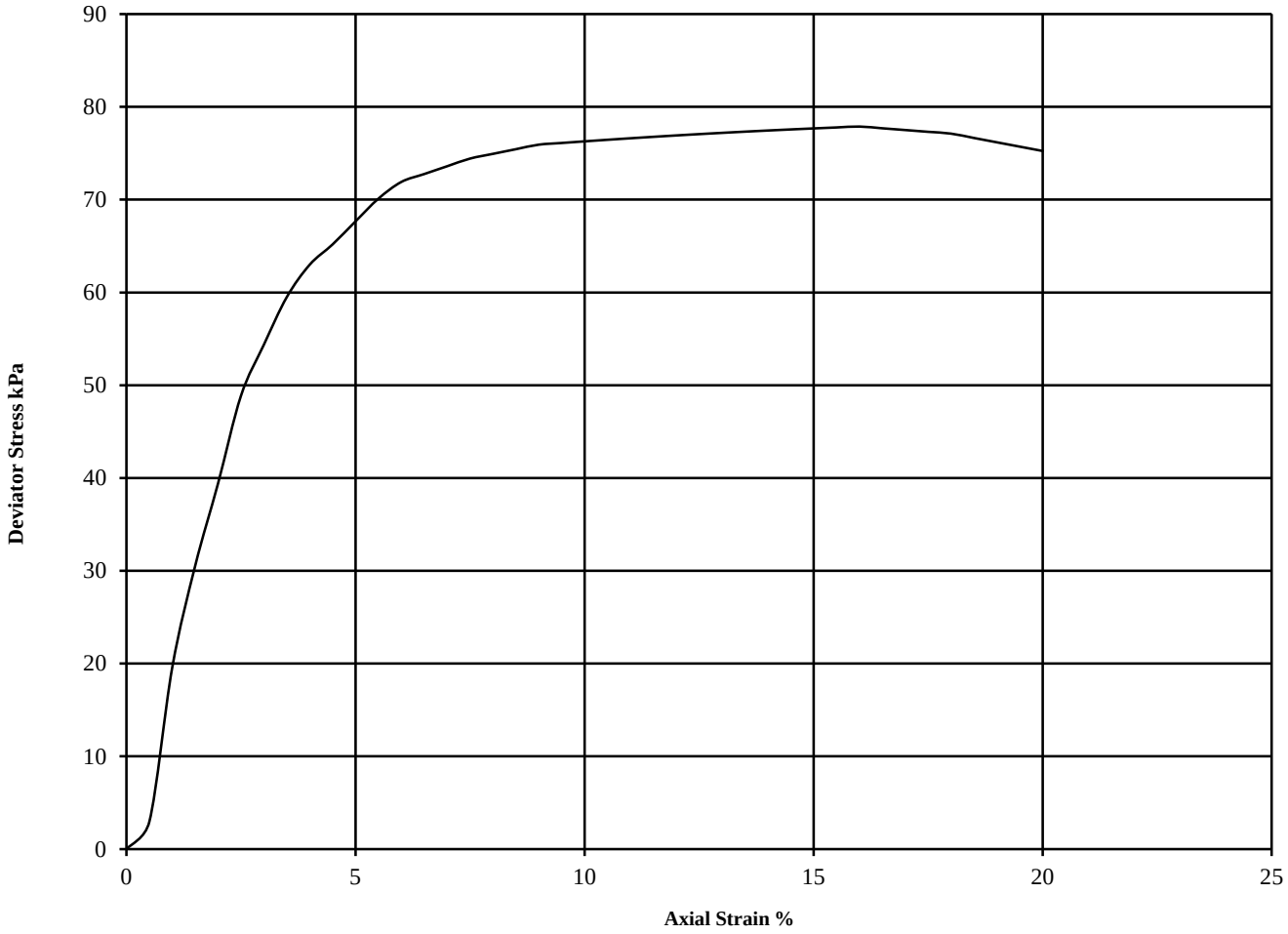
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH02**	**Top Depth (m):**	**3.00**
Sample Number	**3**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	34.2	1.92	1.43	60	78	39	15.5	Plastic	

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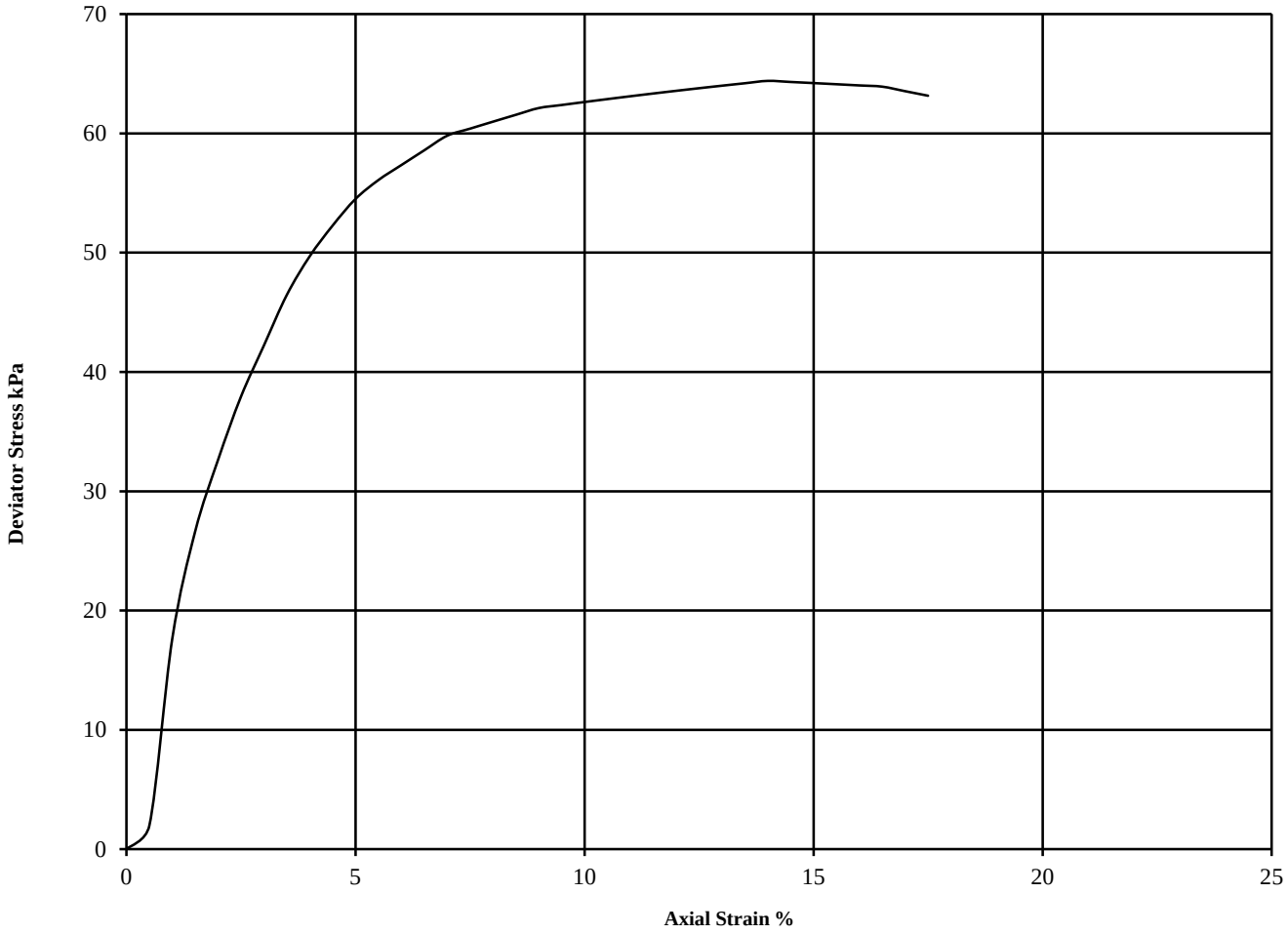
BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH02**	**Top Depth (m):**	**5.00**
Sample Number	**9**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	74.4	1.67	0.96	100	64	32	13.5	Plastic	

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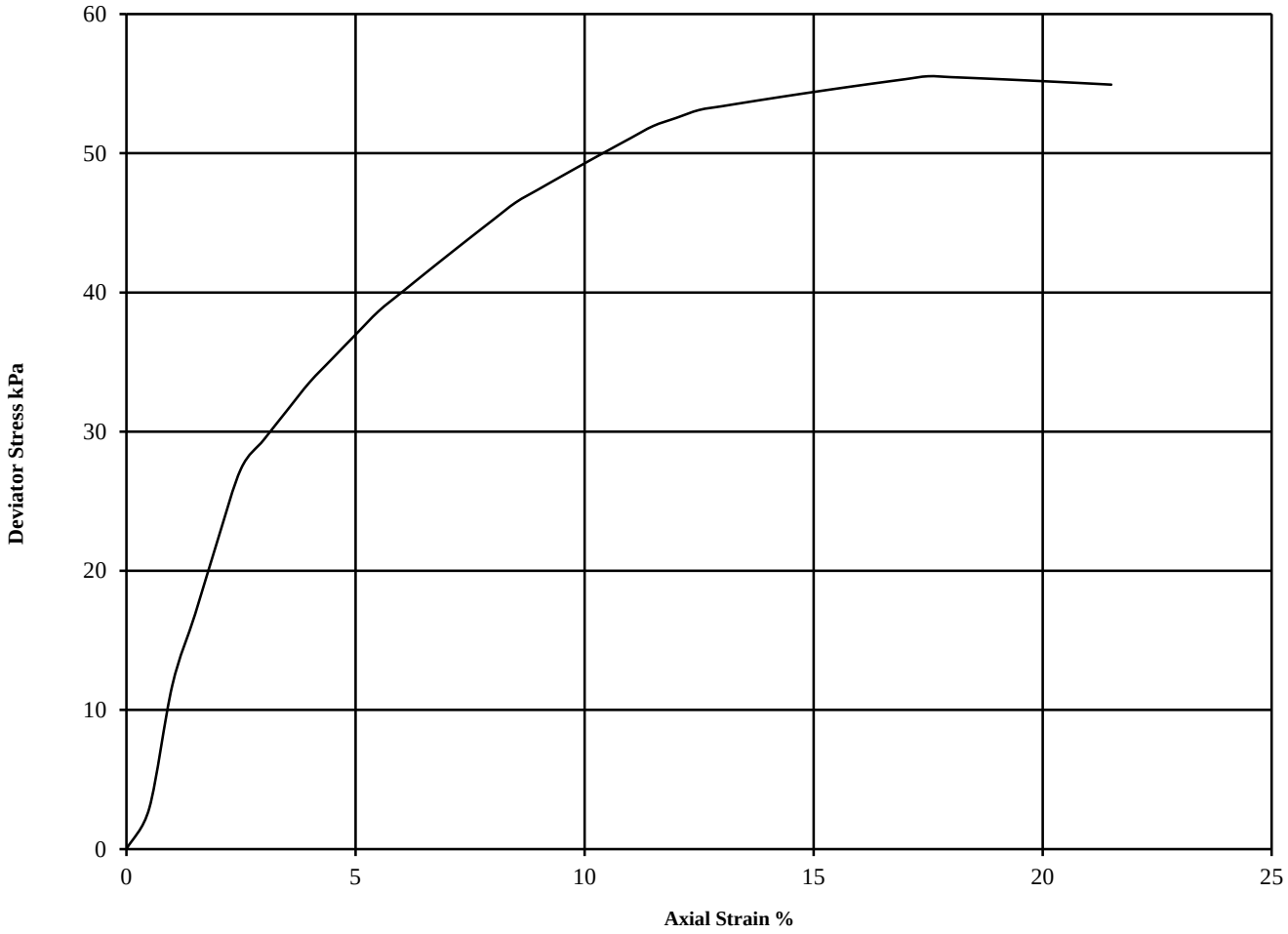
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH03**	**Top Depth (m):**	**5.00**
Sample Number	**6**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	19.6	2.06	1.73	100	56	28	17.0	Plastic	

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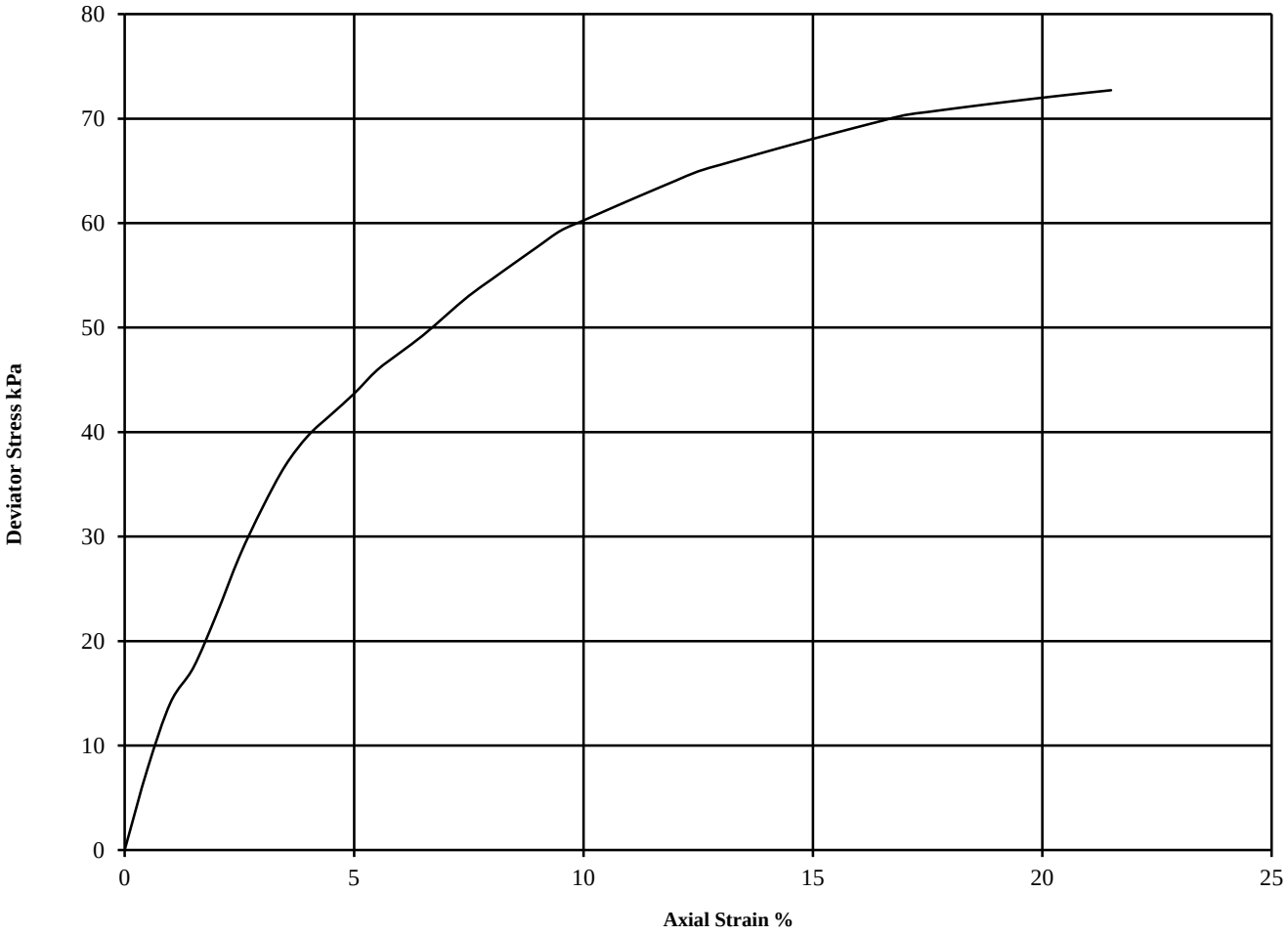
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

BS 1377 - Part 2 : 2022 : Clause 28 in accordance with BS EN ISO 17892 - 8 : 2018

Hole Number:	**BH03**	**Top Depth (m):**	**8.00**
Sample Number	**9**	**Base Depth (m):**	
Sample Type	**U**		



Diameter (mm):		102	Height (mm):		204	Test:	UU Single Stage		Remarks:
Specimen	Water Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)		Undisturbed Sample Sample taken from top of tube Rate of strain = 0.9 %/min See summary of soil descriptions
1	20.5	2.11	1.75	160	73	36	21.5	Plastic	

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INCREMENTAL LOADING OEDOMETER TEST

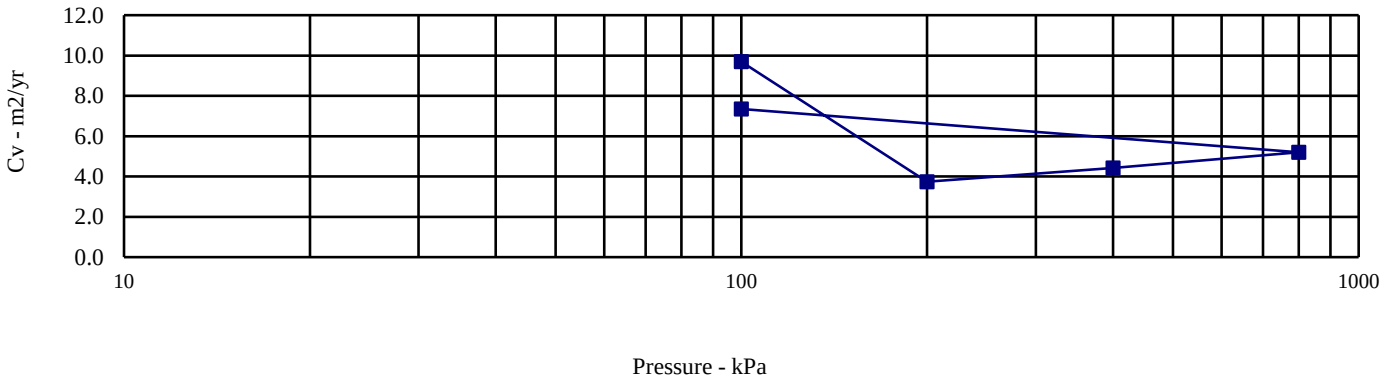
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

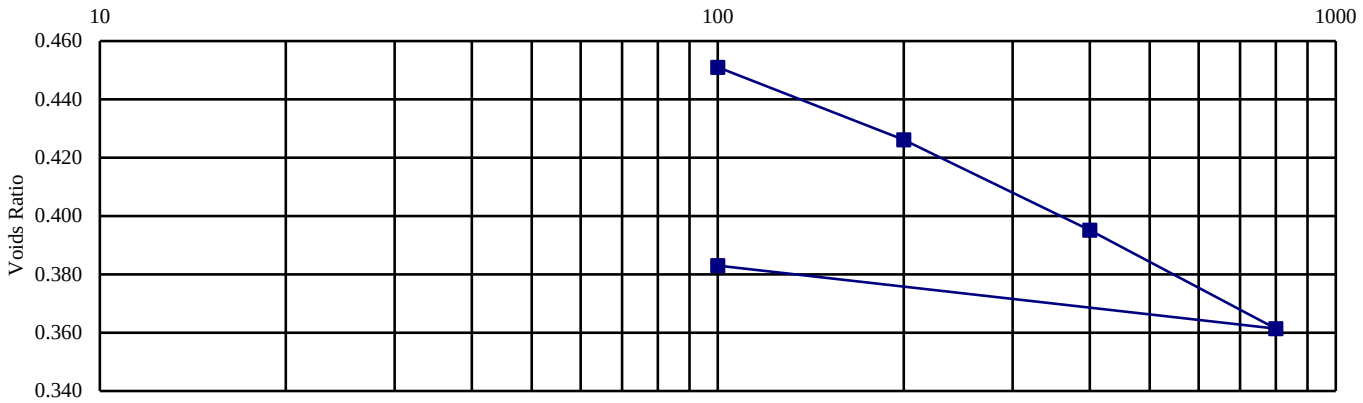
Hole Number: **BH01** **Top Depth (m):** **8.00**

Sample Number: **7** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	21.0						
Bulk Density (Mg/m3):	2.08	0	100	0.608	9.691	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	1.72	100	200	0.172	3.742		
Voids Ratio:	0.545	200	400	0.109	4.420	Method used to determine CV:	T90
Degree of saturation:	102.2	400	800	0.060	5.198		
Height (mm):	20.008	800	100	0.023	7.351	Nominal temperature during test ' C:	20
Diameter (mm)	75.015						
Particle Density (Mg/m3): Assumed	2.65					Results correct against equipment deformation	Yes





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INCREMENTAL LOADING OEDOMETER TEST

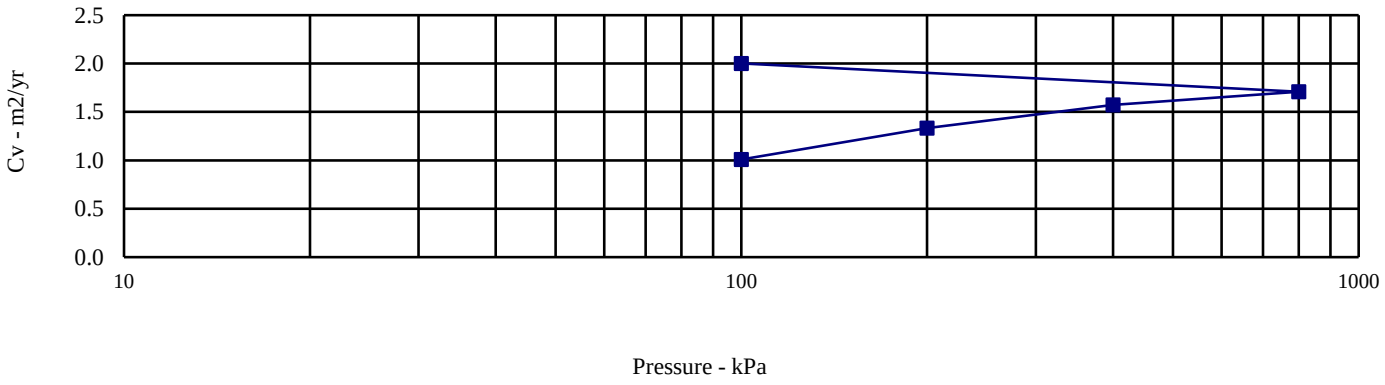
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

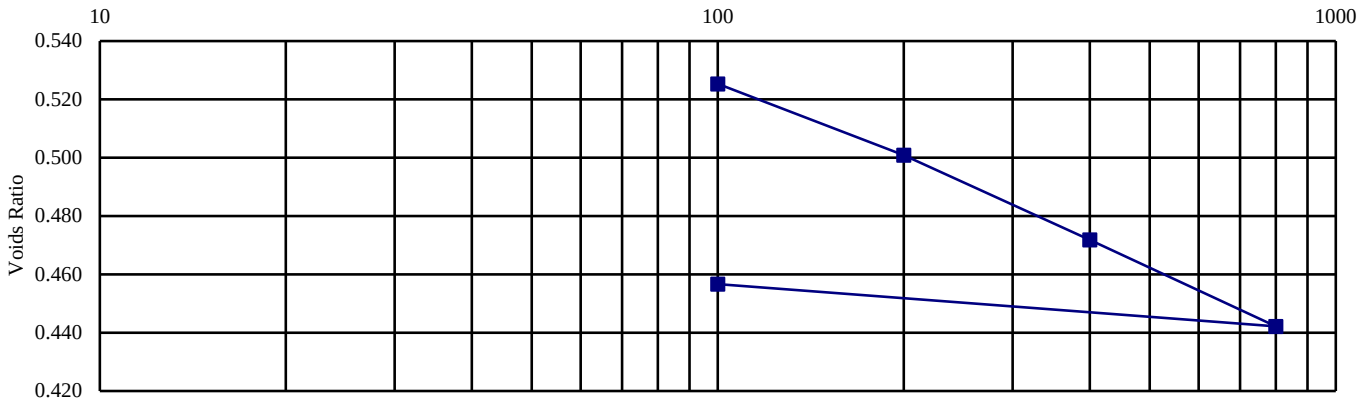
Hole Number: **BH02** **Top Depth (m):** **8.00**

Sample Number: **12** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	21.9						
Bulk Density (Mg/m3):	2.02	0	100	0.460	1.009	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	1.66	100	200	0.160	1.334		
Voids Ratio:	0.599	200	400	0.097	1.572	Method used to determine CV:	T90
Degree of saturation:	96.9	400	800	0.050	1.708		
Height (mm):	20.014	800	100	0.014	2.002	Nominal temperature during test ' C:	20
Diameter (mm)	75.02						
Particle Density (Mg/m3): Assumed	2.65					Results correct against equipment deformation	Yes





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INCREMENTAL LOADING OEDOMETER TEST

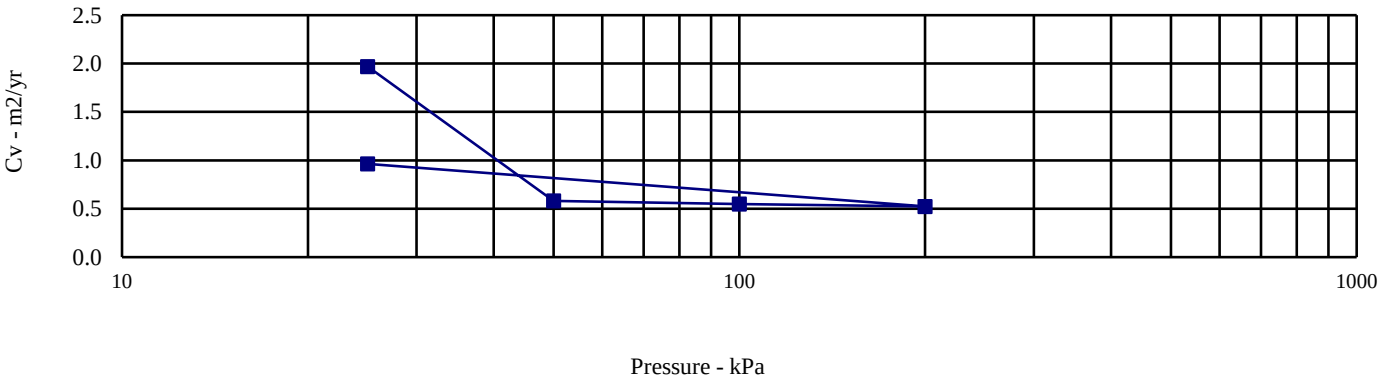
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

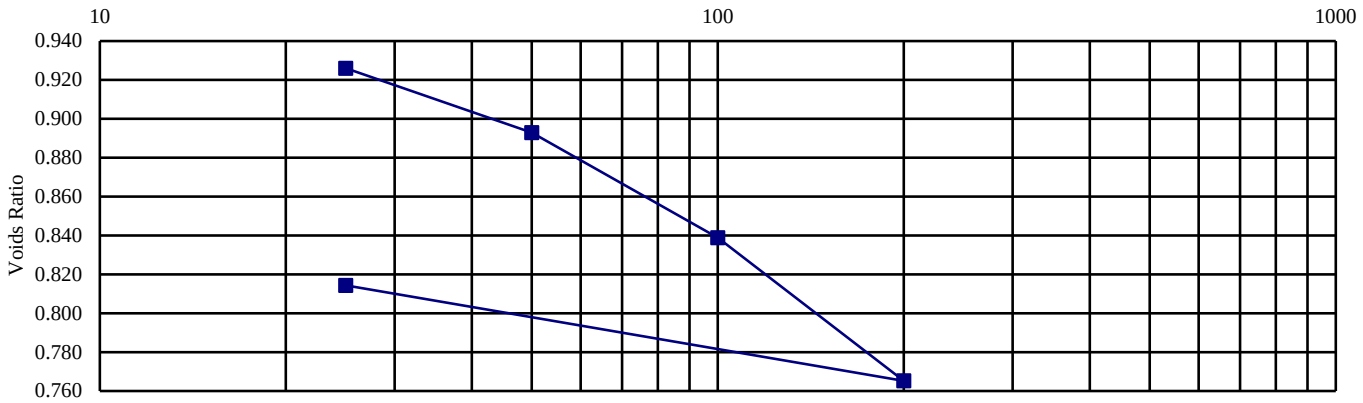
Hole Number: **BH02** **Top Depth (m):** **3.00**

Sample Number: **3** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	35.4						
Bulk Density (Mg/m3):	1.84	0	25	0.482	1.969	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	1.36	25	50	0.688	0.579		
Voids Ratio:	0.950	50	100	0.571	0.548	Method used to determine CV:	T90
Degree of saturation:	98.8	100	200	0.400	0.524		
Height (mm):	20.014	200	25	0.159	0.963	Nominal temperature during test ' C:	20
Diameter (mm)	75.038						
Particle Density (Mg/m3): Assumed	2.65					Results correct against equipment deformation	Yes





UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Royal Victoria Court

Contract No:
PSL24/9370
Client Ref:
5088

INCREMENTAL LOADING OEDOMETER TEST

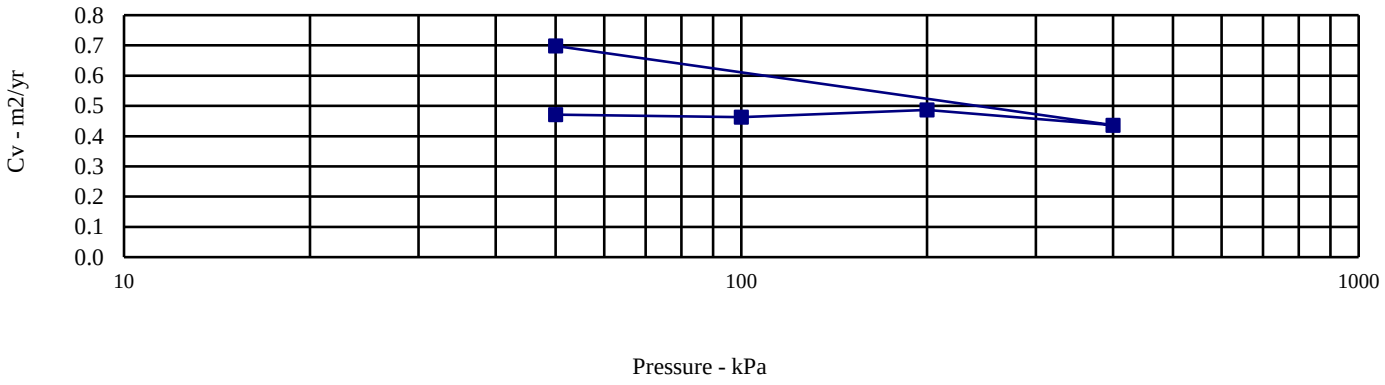
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

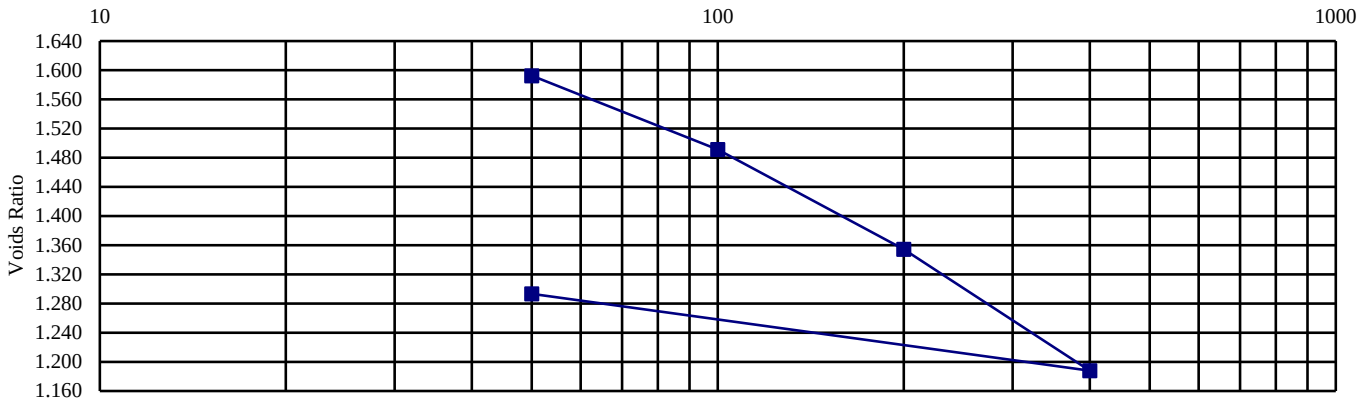
Hole Number: **BH02** **Top Depth (m):** **5.00**

Sample Number: **9** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	76.7						
Bulk Density (Mg/m3):	1.53	0	50	1.367	0.471	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	0.87	50	100	0.782	0.463		
Voids Ratio:	1.783	100	200	0.549	0.487	Method used to determine CV:	T90
Degree of saturation:	103.7	200	400	0.354	0.436		
Height (mm):	20.004	400	50	0.138	0.698	Nominal temperature during test ' C:	20
Diameter (mm)	75.035						
Particle Density (Mg/m3): Assumed	2.41					Results correct against equipment deformation	Yes





UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Royal Victoria Court

Contract No: **PSL24/9370**

Client Ref: **5088**

INCREMENTAL LOADING OEDOMETER TEST

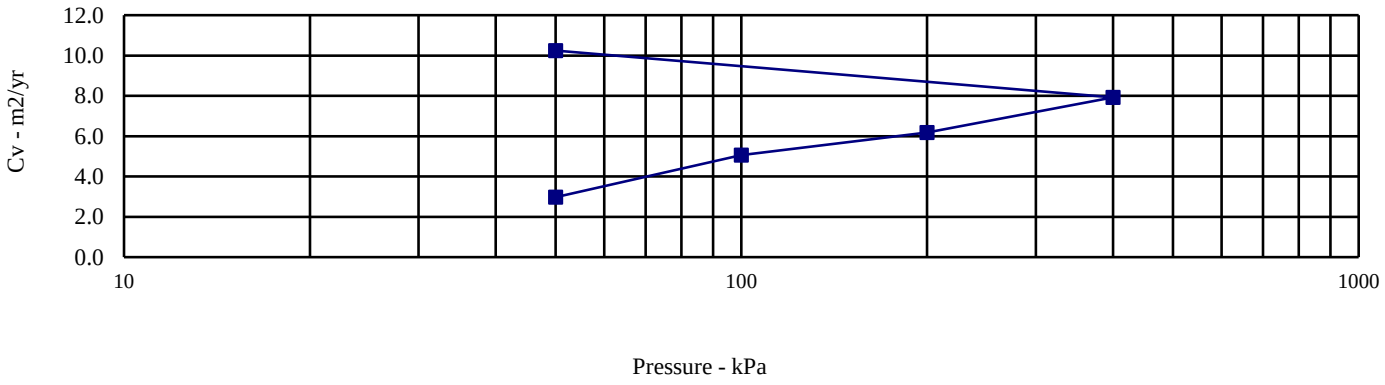
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

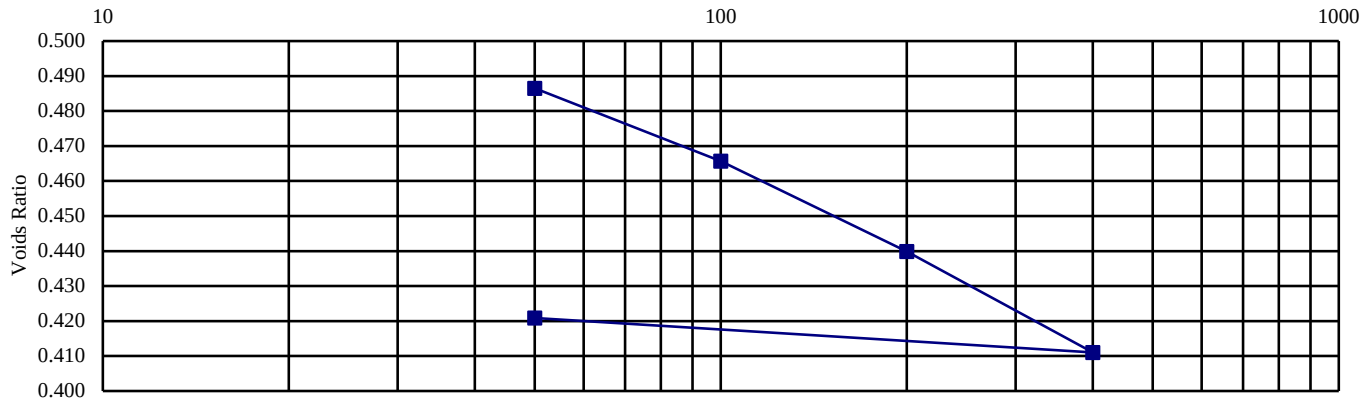
Hole Number: **BH03** **Top Depth (m):** **5.00**

Sample Number: **6** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	20.5						
Bulk Density (Mg/m3):	2.06	0	50	0.779	2.972	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	1.71	50	100	0.281	5.057		
Voids Ratio:	0.547	100	200	0.176	6.188	Method used to determine CV:	T90
Degree of saturation:	99.3	200	400	0.100	7.924		
Height (mm):	20.02	400	50	0.020	10.245	Nominal temperature during test ' C:	20
Diameter (mm)	75.02						
Particle Density (Mg/m3): Assumed	2.65					Results correct against equipment deformation	Yes





UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Royal Victoria Court**	**Contract No:** **PSL24/9370** **Client Ref:** **5088**

INCREMENTAL LOADING OEDOMETER TEST

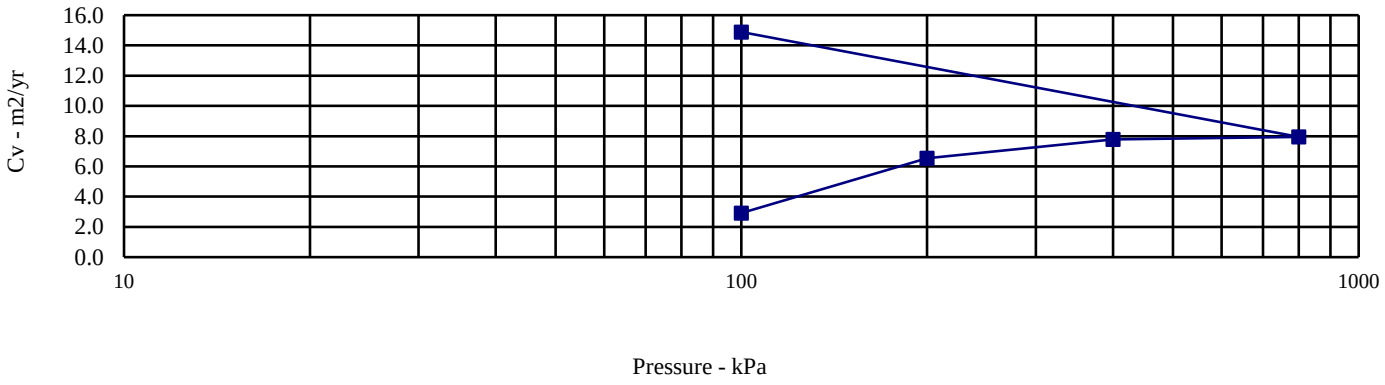
BS 1377 - Part 2 : 2022 : Clause 16 in accordance with BS EN ISO 17892 - 5 : 2017

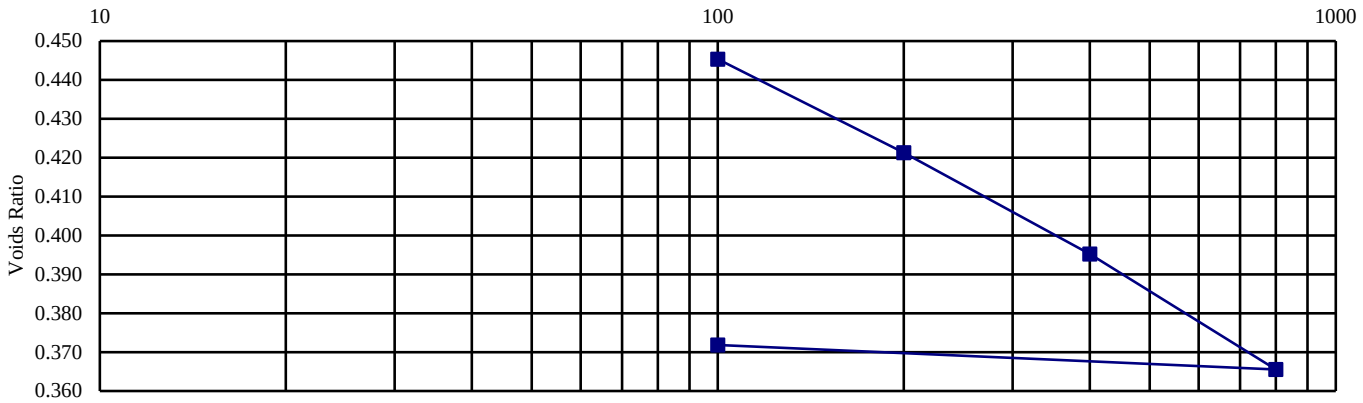
Hole Number: **BH03** **Top Depth (m):** **8.00**

Sample Number: **9** **Base Depth (m) :**

Sample Type: **U**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top Vertical
Water Content (%):	21.2						
Bulk Density (Mg/m3):	2.07	0	100	0.702	2.915	Method of preparation:	Trimmed from extruded material
Dry Density (Mg/m3):	1.70	100	200	0.167	6.537		
Voids Ratio:	0.555	200	400	0.092	7.788	Method used to determine CV:	T90
Degree of saturation:	101.5	400	800	0.053	7.960		
Height (mm):	20.022	800	100	0.007	14.888	Nominal temperature during test ' C:	20
Diameter (mm)	75.028						
Particle Density (Mg/m3): Assumed	2.65					Results correct against equipment deformation	Yes





UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Royal Victoria Court**	**Contract No:** **PSL24/9370** **Client Ref:** **5088**

Professional Soils Laboratory
5/7 Hexthorpe Road
Hexthorpe
Doncaster
DN4 0AR

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: L25/00194/PSL - 25-54999

Your Project Reference:	**PSL24/9370 Royal Victoria Court**		
Your Order Number:	PSL24/9370	Samples Received / Instructed:	10/01/2025 / 10/01/2025
Report Issue Number:	1	Sample Tested:	10/01 to 16/01/2025
Samples Analysed:	19 sample(s)	Report issued:	16/01/2025

Signed

James Gane
Analytical Services Manager
CTS

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

This report shall not be reproduce except in full

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

Date of Issue: 08.01.2025

Issued by: J. Gane

Issue No: 4

Rev No: 22

7 - 11 Harding Street
Leicester
LE1 4DH

L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Analytical Test Results - Chemical Analysis

Lab Reference			434887	434888	434889	434890	434891	434892
Client Sample ID			-	-	-	-	-	-
Client Sample Location			BH01	BH01	BH01	BH02	BH02	BH02
Client Sample Type			D	D	D	D	D	D
Client Sample Number			3	6	9	13	4	8
Depth - Top (m)			4.00	6.50	9.50	8.60	3.60	5.00
Depth - Bottom (m)			4.00	6.50	9.50	8.60	3.60	5.00
Date of Sampling			12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	160	54	13	44	730	1800
pH Value	pH Units	MCERTS	8.9	9.0	9.2	9.2	7.8	7.4

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Analytical Test Results - Chemical Analysis

Lab Reference			434893	434894	434895	434896	434897	434898
Client Sample ID			-	-	-	-	-	-
Client Sample Location			BH03	BH03	BH03	TP01	TP04	TP05
Client Sample Type			D	D	U	D	D	D
Client Sample Number			4	7	9	4	4	3
Depth - Top (m)			3.50	5.50	8.00	2.70	2.80	2.50
Depth - Bottom (m)			3.50	5.50	8.00	2.70	2.80	2.50
Date of Sampling			12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	100	20	14	93	430	140
pH Value	pH Units	MCERTS	7.7	7.8	7.8	7.3	7.6	7.7

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Analytical Test Results - Chemical Analysis

Lab Reference			434899	434900	434901	434902	434903	434904
Client Sample ID			-	-	-	-	-	-
Client Sample Location			TP06	TP08	TP09	BH01	BH01	BH03
Client Sample Type			D	D	D	D	D	D
Client Sample Number			4	3	2	12	13	14
Depth - Top (m)			2.70	2.40	2.10	13.50	14.00	12.50
Depth - Bottom (m)			2.70	2.40	2.10	13.50	14.00	12.50
Date of Sampling			12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	64	130	90	< 10	< 10	15
pH Value	pH Units	MCERTS	8.5	8.1	8.3	8.7	8.8	8.7

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Analytical Test Results - Chemical Analysis

Lab Reference			434905
Client Sample ID			-
Client Sample Location			BH03
Client Sample Type			D
Client Sample Number			15
Depth - Top (m)			13.40
Depth - Bottom (m)			13.40
Date of Sampling			12/12/2024
Time of Sampling			-
Sample Matrix			Clay
Determinant	**Units**	**Accreditation**	
Water soluble sulphate (as SO_4)	(mg/l)	u	32
pH Value	pH Units	MCERTS	8.7

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Project Reference - PSL24/9370 Royal Victoria Court

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
434887	-	BH01	D	3	Grey silty clay	-	-	100
434888	-	BH01	D	6	Reddish brown silty clay	-	-	100
434889	-	BH01	D	9	Reddish brown silty clay	-	-	100
434890	-	BH02	D	13	Reddish brown silty clay	-	-	100
434891	-	BH02	D	4	Grey silty clay	-	-	100
434892	-	BH02	D	8	Dark grey silty clay	-	-	100
434893	-	BH03	D	4	Brown silty clay	-	-	100
434894	-	BH03	D	7	Reddish brown silty clay	-	-	100
434895	-	BH03	U	9	Brown silty clay	-	-	100
434896	-	TP01	D	4	Brown slightly gravelly silty clay	-	-	100
434897	-	TP04	D	4	Grey slightly gravelly silty clay	-	-	100
434898	-	TP05	D	3	Grey silty clay	-	-	100
434899	-	TP06	D	4	Grey silty clay	-	-	100
434900	-	TP08	D	3	Reddish brown silty clay	-	-	100
434901	-	TP09	D	2	Grey silty clay	-	-	100
434902	-	BH01	D	12	Reddish brown silty clay	-	-	100
434903	-	BH01	D	13	Reddish brown silty clay	-	-	100
434904	-	BH03	D	14	Reddish brown silty clay	-	-	100
434905	-	BH03	D	15	Reddish brown silty clay	-	-	100

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
434887	-	BH01	D	3	
434888	-	BH01	D	6	
434889	-	BH01	D	9	
434890	-	BH02	D	13	
434891	-	BH02	D	4	
434892	-	BH02	D	8	
434893	-	BH03	D	4	
434894	-	BH03	D	7	
434895	-	BH03	U	9	
434896	-	TP01	D	4	
434897	-	TP04	D	4	
434898	-	TP05	D	3	
434899	-	TP06	D	4	
434900	-	TP08	D	3	
434901	-	TP09	D	2	
434902	-	BH01	D	12	
434903	-	BH01	D	13	
434904	-	BH03	D	14	
434905	-	BH03	D	15	

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

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L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
W - No time of sampling provided for water sample
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
434887	-	BH01	D	3	MS - CL - Anions by Aquakem (2:1Extract)	RX
434887	-	BH01	D	3	MS - CL - pH in Soils	RX
434888	-	BH01	D	6	MS - CL - Anions by Aquakem (2:1Extract)	RX
434888	-	BH01	D	6	MS - CL - pH in Soils	RX
434889	-	BH01	D	9	MS - CL - Anions by Aquakem (2:1Extract)	RX
434889	-	BH01	D	9	MS - CL - pH in Soils	RX
434890	-	BH02	D	13	MS - CL - Anions by Aquakem (2:1Extract)	RX
434890	-	BH02	D	13	MS - CL - pH in Soils	RX
434891	-	BH02	D	4	MS - CL - Anions by Aquakem (2:1Extract)	RX
434891	-	BH02	D	4	MS - CL - pH in Soils	RX
434892	-	BH02	D	8	MS - CL - Anions by Aquakem (2:1Extract)	RX
434892	-	BH02	D	8	MS - CL - pH in Soils	RX
434893	-	BH03	D	4	MS - CL - Anions by Aquakem (2:1Extract)	RX
434893	-	BH03	D	4	MS - CL - pH in Soils	RX
434894	-	BH03	D	7	MS - CL - Anions by Aquakem (2:1Extract)	RX
434894	-	BH03	D	7	MS - CL - pH in Soils	RX
434895	-	BH03	U	9	MS - CL - Anions by Aquakem (2:1Extract)	RX
434895	-	BH03	U	9	MS - CL - pH in Soils	RX
434896	-	TP01	D	4	MS - CL - Anions by Aquakem (2:1Extract)	RX
434896	-	TP01	D	4	MS - CL - pH in Soils	RX
434897	-	TP04	D	4	MS - CL - Anions by Aquakem (2:1Extract)	RX
434897	-	TP04	D	4	MS - CL - pH in Soils	RX
434898	-	TP05	D	3	MS - CL - Anions by Aquakem (2:1Extract)	RX
434898	-	TP05	D	3	MS - CL - pH in Soils	RX
434899	-	TP06	D	4	MS - CL - Anions by Aquakem (2:1Extract)	RX
434899	-	TP06	D	4	MS - CL - pH in Soils	RX
434900	-	TP08	D	3	MS - CL - Anions by Aquakem (2:1Extract)	RX
434900	-	TP08	D	3	MS - CL - pH in Soils	RX
434901	-	TP09	D	2	MS - CL - Anions by Aquakem (2:1Extract)	RX
434901	-	TP09	D	2	MS - CL - pH in Soils	RX

7 - 11 Harding Street
Leicester
LE1 4DH

L25/00194/PSL - 25-54999

Project Reference - PSL24/9370 Royal Victoria Court

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
W - No time of sampling provided for water sample
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
434902	-	BH01	D	12	MS - CL - Anions by Aquakem (2:1Extract)	RX
434902	-	BH01	D	12	MS - CL - pH in Soils	RX
434903	-	BH01	D	13	MS - CL - Anions by Aquakem (2:1Extract)	RX
434903	-	BH01	D	13	MS - CL - pH in Soils	RX
434904	-	BH03	D	14	MS - CL - Anions by Aquakem (2:1Extract)	RX
434904	-	BH03	D	14	MS - CL - pH in Soils	RX
434905	-	BH03	D	15	MS - CL - Anions by Aquakem (2:1Extract)	RX
434905	-	BH03	D	15	MS - CL - pH in Soils	RX

Appendix J

Gas Monitoring Results

GAS MONITORING RESULTS

Visit 1

Job Title:				Job No:
Royal Victoria Court				5088
Client:				Sheet :
LNT				1 of 4
Date:	Arrival Time:	Depart Time:	Operator:	
21/12/2024	11:15	12:00	George	

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	18.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
BH01	1.14	-	-	-	-	-	-	-	-	2.79	Bailed 8L 11:37 - 11:40
BH02	1.33	-	-	-	-	-	-	-	-	5.91	Bailed 12L 11:28 - 11:33
BH03	0.93	-	-	-	-	-	-	-	-	4.83	Bailed 12L 11:47 - 11:52

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	27/03/2025

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Firbank-weather Station)					
	Temp (°C):	7.3 > 8.2		Barometric Pressure Trend:			Falling		
Time:	11:15	11:30	12:00	00:01	09:15	11:15	11:30	12:00	14:00
Pressure (mb):	1017	1017	1017	1023	1020	1019	1018	1018	1016

	CH_4	CO_2	O_2
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Weather Conditions:	Raining, Cold, Overcast, Windy
Surface Ground Conditions:	Wet, Boggy

Remarks: Firbank weather station is located approximately 2 miles north-east from the site (Royal Victoria Court, Newport)

GAS MONITORING RESULTS

Visit 1 Bailed

Job Title:				Job No:
Royal Victoria Court				5088
Client:				Sheet :
LNT				2 of 4
Date:	Arrival Time:	Depart Time:	Operator:	
21/12/2024	11:15	12:00	George	

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	18.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
BH01	1.67	ND	ND	ND	ND	18.4	ND	ND	120.0	2.79	Bailed 8L 11:37 - 11:40
BH02	3.65	ND	ND	ND	ND	18.4	8.0	1.5	120.0	5.91	Bailed 12L 11:28 - 11:33
BH03	3.75	ND	ND	ND	ND	18.4	4.5	3.2	120.0	4.83	Bailed 12L 11:47 - 11:52

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	27/03/2025

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Firbank-weather Station)							CH_4	CO_2	O_2
	Temp (°C):	7.3 > 8.2		Barometric Pressure Trend:			Falling						
Time:	11:15	11:30	12:00	00:01	09:15	11:15	11:30	12:00	14:00	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1017	1017	1017	1023	1020	1019	1018	1018	1016	Trigger level 2	5.0	10.0	10.0

Weather Conditions:	Raining, Cold, Overcast, Windy
Surface Ground Conditions:	Wet, Boggy

Remarks:	Firbank weather station is located approximately 2 miles north-east from the site (Royal Victoria Court, Newport)

GAS MONITORING RESULTS

Visit 2

Job Title:				Job No:
Royal Victoria Court				5088
Client:				Sheet :
LNT				3 of 4
Date:	Arrival Time:	Depart Time:	Operator:	
22/01/2025	16:00	17:00	George Costley	

Gas Monitoring Results:						
Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	16.2

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
BH01	1.68	-	-	-	-	-	-	-	-	2.78	Bailed 6L 16:37 - 16:41, GW remonitored 16:53 = 2.11
BH02	1.90	-	-	-	-	-	-	-	-	5.94	Bailed 12L 16:12 - 16:14, GW remonitored 16:22 = 3.70, 16:33 = 3.69
BH03	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Couldn't locate well

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	27/03/2025

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Firbank-weather Station)					
	Temp (°C):	5.7 > 5.2		Barometric Pressure Trend:			Falling		
Time:	16:00	16:30	17:00	00:00	14:00	16:00	16:30	17:00	19:00
Pressure (mb):	1002	1001	1001	1008	1004	1004	1004	1004	1005
	Weather Conditions:		Overcast, Cold						
	Surface Ground Conditions:		Wet, Boggy						

	CH_4	CO_2	O_2
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Remarks:	
	Firbank weather station is located approximately 2 miles north-east from the site (Royal Victoria Court, Newport)

GAS MONITORING RESULTS

Visit 2 Bailed

Job Title:				Job No:
Royal Victoria Court				5088
Client:				Sheet :
LNT				4 of 4
Date:	Arrival Time:	Depart Time:	Operator:	
22/01/2025	16:00	17:00	George Costley	

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	16.2

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
BH01	2.14	ND	0.2	ND	0.2	16.4	27.6	3.6	120.0	2.78	Bailed 6L 16:37 - 16:41, GW remonitored 16:53 = 2.11
BH02	3.72	ND	ND	ND	ND	16.8	12.9	ND	120.0	5.94	Bailed 12L 16:12 - 16:14, GW remonitored 16:22 = 3.70, 16:33 = 3.69
BH03	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Couldn't locate well

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	27/03/2025

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Firbank-weather Station)					
	Temp (°C):	5.7 > 5.2		Barometric Pressure Trend:			Falling		
Time:	16:00	16:30	17:00	00:00	14:00	16:00	16:30	17:00	19:00
Pressure (mb):	1002	1001	1001	1008	1004	1004	1004	1004	1005

	CH_4	CO_2	O_2
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Weather Conditions:	Overcast, Cold
Surface Ground Conditions:	Wet, Boggy

Remarks:	
	Firbank weather station is located approximately 2 miles north-east from the site (Royal Victoria Court, Newport)

Appendix K

Site Investigation Photos

Trial Pit TP01 – Pit and groundwater level

Trial Pit TP01 – Made Ground arising

Trial Pit TP03 - Excavation

Trial Pit TP06 – Natural Ground arisings

Trial Pit TP05 - Excavation

Trial Pit TP05 – Made Ground arisings

Trial Pit TP08 – Natural Ground arisings

Trial Pit TP09 – Excavation