Crossfield
CONSULTING
GEOTECHNICAL ENVIRONMENTAL

CHURCHILL RETIREMENT LIVING

LAND AT BOLTON ROAD BINGO HALL, BANBURY, OX16 0TH

GROUND INVESTIGATION REPORT

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CONTENTS

1. INTRODUCTION

A residential development is proposed on land at Bolton Road Bingo Hall, Banbury, Oxfordshire. The site is currently occupied by a bingo hall and associated car park and was historically occupied by a mixture of residential and commercial properties. The proposed development comprises an apartment block up to four storeys, together with car parking, and managed landscaping areas. Residents of the development will be of retirement age.

Crossfield Consulting Limited prepared a Desk Study Appraisal, as listed in the References, in July 2021 for the proposed development. Subsequent ground investigation work has been designed on the basis of the preliminary assessment provided in the Desk Study Appraisal.

Crossfield Consulting Limited has been commissioned by Churchill Retirement Living to undertake an investigation of the site to identify potential constraints to redevelopment relating to the ground conditions and including a risk-based environmental assessment and recommendations for remediation works, and recommendations regarding ground stability/support, and recommendations for foundations, road pavement design and general construction advice in the context of the above development proposals.

This report presents the information obtained from a ground investigation. Sections 2 to 5 of the report, together with the associated Figures and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007. This report should be read in conjunction with the Desk Study Appraisal.

A risk-based assessment of potential contamination is included in Section 7 of the report. This assessment makes reference to the desk study, ground investigation information and a Conceptual Site Model. It is considered that the report complies with National Planning Policy Framework and is in general accordance with guidance published by the Environment Agency, Cherwell District Council and NHBC. The ground investigation to inform the risk assessment of potential contamination is, due to current access constraints, an exploratory investigation, as defined in Environment Agency Land Contamination Risk Management (LCRM) (2020) and BS 10175:2011+A2:2017.

The report also includes a geotechnical assessment and the salient information, assessments and recommendations are presented in Sections 9 to 15 of the report, together with the associated Figures and Appendices.

The report has been prepared under the direction and supervision of a Chartered Civil Engineer and Registered SiLC. It is considered that the report is suitable for submission in support of a planning application and the report is appropriate to assist in an appraisal of development solutions and costs, together with the preparation of engineering designs for the development. The report also complies with the published guidance relating to the requirements of a Building Control authority.

2. THE SITE

2.1 Location

The site is located approximately 0.1 km to the northwest of the centre of Banbury, as shown on Figure 1. The National Grid Reference for the site is SP 4542 4073. The site is bounded to the north by Castle Street and to the west by North Bar Street (A361) as shown on Figure 2. Bolton Road forms the eastern site boundary together with a depot building to the southeast of the site. Residential properties and associated access/car parking are present to the south of the site.

2.2 Site Description

This site description is based on observations made during a ground investigation undertaken in July 2021.

The site is an irregular shaped parcel of land with an approximate area of 0.49 ha. The site and surrounding area slope gently down to the north and northwest.

A large two-storey building occupies the western and central part of the site. The remaining area in the east is occupied by a block paved and asphalt surfaced car park, and a concreted access road via Bolton Road to the south of the site. Minor landscaping areas are present along the northern elevation of the building adjacent to Castle Street and a brick-faced retaining wall and railings are present around the car parking area. The car park is at a higher level than Castle Street and steps down to Castle Street are present adjacent to the building. A pedestrian access path is present along the southern wall of the existing building.

Within the car parking area, a large skip is present in the southwest corner, a number of manhole covers and drains are present throughout and a line of lamp posts is present across the centre, running approximately north to south.

The adjacent car parking areas to the south of the site for the depot and residential properties are at a higher level than the main car park, with a brick retaining wall approximately 1 m in height present along the southern boundary of the car park.

2.3 Site History

A detailed history of the site, including historical map extracts and other pertinent information, is provided in the Desk Study Appraisal by Crossfield Consulting Limited. A summary of pertinent historical development at the site and in the surrounding area is provided below.

From the late 1800s the site had been occupied by predominately residential properties with some commercial buildings. By the mid-1960s an engineering works was present in the north of the site, along with other buildings occupying the central area, and a bowling green occupied the east (although this was no longer present by the late 1970s). In the early 1980s, all existing buildings were demolished and replaced with the existing building, which at this time was used as a warehouse, and associated car park.

Within the surrounding area, the land was predominantly residential with some commercial uses until the mid-1960s where a rise in industrial sites occurred, including garages and works. In the 1980s, several of the industrial sites were redeveloped to incorporate residential and commercial uses.

3. PUBLISHED GEOLOGY

Geological map data, published by the British Geological Survey (BGS), online and in print, on the 1:50,000 scale Sheet No. 201 (Banbury), indicate that superficial deposits are absent beneath the site. The solid strata are indicated to comprise the Jurassic Lower Lias, now termed the Charmouth Mudstone Formation and is described as mainly clay and includes mudstones and thin limestones.

Alluvium deposits are shown from approximately 200 m to the northeast of the site associated with the River Cherwell (located further to the east).

4. DESK STUDY ENQUIRIES

Detailed desk study information is presented in the Desk Study Appraisal by Crossfield Consulting Limited. A summary of relevant information is provided below.

The Groundsure Environmental Database indicates that there are no active or historical landfills recorded within 250 m of the site.

Hydrogeological information indicates that there are no superficial deposits aquifer strata below the site. Bedrock aquifer strata underlying the site are classified as 'Secondary Undifferentiated' aquifer strata.

There are no records of surface or underground mineral workings within 1 km of the site and there are no records of mining or mining cavities within the same search radius.

Within the section of the site occupied by the building, the exploratory hole records in the Desk Study Appraisal report (obtained from the BGS) indicate a thickness of Made Ground up to 1.5 m depth. Beneath the Made Ground 'firm' brown clays are recorded that quickly become 'stiff' and grey with depth with occasional lenses of silt and becoming 'very stiff' with partings of mudstone below approximately 5 m depth.

BRE BR211 (2015) and the Groundsure report (based on BGS/Public Health England data) indicate that the site is within an area where radon precautions are not required in new buildings.

5. GROUND CONDITIONS AND GEOLOGICAL MODEL

5.1 Ground Investigation

Details of the rationale and scope of the ground investigation and laboratory testing, together with exploratory hole logs, monitoring, in situ and laboratory test results, are given in Appendix I. The investigation has identified the presence of the following, below the site.

5.2 Buried Foundations and Services

Concrete was encountered immediately below the block paving in the northwest corner and towards the south of the car parking (possibly associated with a historical yard area). No other buried obstructions or services were encountered during the investigation. However, services are known to be below the site and obstructions should be anticipated associated with current and historical structures.

5.3 Strata Encountered

Made Ground
Made Ground was encountered from ground level down to depths of between 1.0 m and 2.4 m. An initial layer of tarmac-surfacing (in the east of the car park), and block paving and localised concrete (in the west of the car park) was underlain by a layer of sandy gravel subbase with low to medium cobble content. Generally, beneath the subbase, variably sandy gravelly, locally organic, clay was encountered.

River Terrace Deposits
Predominantly within the eastern half of the site, River Terrace Deposits are present beneath the Made Ground, and are recorded to depths of between 2.7 m and 3.3 m. The deposits generally comprise soft to firm and firm consistency (low to medium strength) variably sandy and gravelly, silty clays with horizons of loose to medium

dense gravelly sand. With reference to the desk study information, these deposits appear to be largely absent from the western section of the site.

Charmouth Mudstone Formation
Charmouth Mudstone Formation strata are present beneath the Made Ground and/or River Terrace Deposits (where present) and are recorded down to the full depth of the investigation at approximately 5.0 m depth. These strata generally comprise firm to stiff and stiff consistency (medium to high strength), orange brown and greyish brown, locally sandy clays with some mudstone. At depth, generally below 4.7 m towards the east of the site, stiff consistency (high strength) grey silty clay was encountered.

Within the section of the site occupied by the building, the exploratory hole records in the Desk Study Appraisal report indicate a thickness of Made Ground up to 1.5 m depth. Beneath the Made Ground 'firm' brown clays are recorded that quickly become 'stiff' and grey with depth with occasional lenses of silt and becoming 'very stiff' with partings of mudstone below approximately 5 m depth.

5.4 Groundwater

Groundwater was encountered in two exploratory holes at depths of 4.1 m and 5.2 m. Localised perched water was encountered in one exploratory hole, an accurate measurement of the water level could not be obtained due to hole instability. It should also be noted that damp materials were recorded in the sample liners at depths of approximately 2.5 m, such that groundwater may also be located around this depth.

The groundwater conditions are based on observations made at the time of the fieldwork. It should be noted that groundwater levels may vary due to seasonal and other effects.

6. PROPOSED DEVELOPMENT

The proposed development includes the following buildings and other structures, as shown on Figure 3:

- Up to four-storey block of retirement apartments
- Car parking
- Managed soft landscaping
- Electrical substation

7. ASSESSMENT OF POTENTIAL CONTAMINATION AND GROUND GASES

7.1 Assessment Criteria

Assessment of potential contamination and ground gases has been undertaken using a risk assessment based approach, as recommended within the Environmental Protection Act (1990) (and subsequent amendments), Environment Agency LCRM (2020), CLEA Model (2004-2009), BS 10175:2011+A2:2017, CIRIA C552 (2001) and NHBC R&D Report 66 (2008). This approach considers the likely source of contamination, given the history and location of the site, and the possible migration pathways by which these potentially hazardous substances may reach likely receptors, such as end users of the site, controlled waters, or the wider environment, in the context of the proposed development.

Part IIA of the Environmental Protection Act (1990) states that

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

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) significant pollution of controlled waters is being caused or there is significant possibility of such pollution being caused;'

All risk assessments carried out as part of this investigation have been carried out with respect to the definition of 'contaminated land' within Part IIA of the Environmental Protection Act (1990) and have considered the site both before and on completion of the development. The basis of the risk assessment is the Conceptual Site Model, which is derived from the desk study and initial information and identifies potential contaminant linkages that could affect receptors relevant to the site and the wider environment. The Conceptual Site Model is presented in Table 1.

Based on the model, a ground investigation was designed to obtain relevant information to assess further the identified contaminant linkages. Where relevant, this included the recovery of representative samples and subsequent analytical laboratory testing. The rationale for the sampling and testing is set out in Appendix I. The results of the analytical testing are presented in Appendix I and summarised in Table 2. On the basis of the conceptual site model and the results of the analytical laboratory testing, together with any quantitative risk assessment, as presented in Appendix II, an assessment of the identified contaminant linkages is presented in Table 3.

7.2 Potential Sources of Contamination

Based on the available information, the site was associated with residential properties, a small works, and buildings of unknown use prior to construction of the existing building and car park in the early 1980s. The existing large building and car park are not considered to be associated with a significant potential source of contamination.

It is likely that the former buildings on site, present prior to 1900s, would have used coal-fired heating systems such that small volumes of ashy materials may have been scattered within garden/yard areas. Ashy materials can be associated with metals and polyaromatic hydrocarbons (PAHs).

Past demolition of site structures may have resulted in the retention of demolition materials within the site, including asbestos or asbestos containing materials (ACMs) which may have entered the ground.

The former small engineering works and later works was identified on the site between the 1960s and 1980s. In general terms, manufacturing and fabrication works are typically associated with potential sources of metals and organic compounds if solvents, sprays, oils, or greases were used on site. Such contaminant sources are likely to be of very limited quantities but less-regulated working practices in the past may have caused potential contaminants to enter the ground (such as through poorly maintained floors or external surfacing or through disposal via leaky drains). In respect of organic compounds associated with the works, such compounds are likely to be degraded. Smaller releases or potential contaminants are likely to have become fully adsorbed to shallow soils. The underlying low permeability clay strata is likely to have precluded migration down to groundwater of significant volumes if larger releases occurred.

With regards to off-site sources of potential contamination, the current land uses surrounding the site is all residential. Therefore, there should not be current potential off-site contaminants sources that could have an adverse effect on the site. In addition, it is considered that during redevelopment of any historical off-site

sources some remediation, compliant with regulatory requirements at the time, would have been undertaken. On this basis and given the underlying low permeability strata precluding significant horizontal or vertical migration, it is considered that no viable pathway to the site is indicated and therefore no valid contaminant linkage with regards to potential historical off-site sources.

Based on the available information, representative soil samples were recovered from the Made Ground materials encountered beneath the site and tested for the potential contaminants identified above. The test results are summarised in Table 2 and are presented against generic assessment criteria (GAC) and Category 4 Screening Levels (C4SL), relevant to the protection of human health in a residential development with managed landscaping. As can be seen from Table 2, the majority of the potential contaminant concentrations are recorded below the GAC (negligible risk to human health) and C4SL (low but acceptable risk to human health) and therefore, do not represent an unacceptable risk to end users. However, arsenic and lead concentrations have been recorded above the assessment criteria. Asbestos fibres and ACM have not been detected. Additional comments relevant to human health risk assessment are provided in Section 7.3.1.

Based on appropriate laboratory test data, risks to construction materials are assessed in Section 7.3.2.

No significant concentrations of potentially phytotoxic chemicals have been recorded. However, as the site is currently devoid of topsoil, a suitable thickness of topsoil is likely to be required to provide a growing medium in proposed soft landscaping areas. Further comment is provided in Section 7.3.3.

The ground conditions recorded at the site comprise predominantly clays, classified as practically impermeable (CIRIA C750:2016), such that groundwater flow and potential migration of substances will be significantly constrained. Potential contaminants that may be associated with the site are likely to be of low mobility and solubility. Therefore, it is considered that risks to controlled waters should be relatively low to negligible.

No putrescible material has been identified at the site and no significant thicknesses of Made Ground have been recorded. It is noted that the Made Ground materials are associated with a relatively low organic content. There are no recorded landfills within influencing distance and the site is not within an area where precautions against the ingress of radon gas are required in new dwellings. Therefore, it is considered that there are no sources of hazardous ground gases at the site, such that there is no evidence of a valid contaminant linkage regarding such gas emissions. On this basis, it is considered that ground gas precautions should not be necessary for the proposed development.

7.3 Contaminant Linkages – Solids and Liquids

Based on the Conceptual Site Model, consideration is given below to identified contaminant linkages and a risk evaluation is undertaken of each possible source-pathway-receptor linkage that may occur at the site. The risk evaluation considers the potential consequences and probability of occurrence in accordance with CIRIA C552 (2001). Where risks are identified as 'negligible', then by implication such risks are within normally accepted levels for the proposed development, and the further reduction of such risks by remediation works is considered unnecessary. Where risks are identified that are 'low' as defined in CIRIA C552 (2001), or worse, then consideration is given to the management of the identified risks, with appropriate recommended actions that may include engineering solutions/remediation works as described in the following sections.

7.3.1 Human Health

Potential contaminants associated with the site history have generally been identified at concentrations below relevant GAC and C4SL values and free asbestos fibres have not been identified. However, a possible pollutant linkage to site end users has been identified and relates to dermal contact and the ingestion and inhalation of materials (largely through dust exposure pathways but not through direct soil dermal contact exposure)

impacted by lead and arsenic, which have been detected on site at concentrations elevated above the GAC and/or C4SL values.

With respect to end users, an effective barrier, in the form of the proposed building footprint and hardstanding from road pavements and car parking, will be in place across the majority of the site. However, the proposed development also includes areas of managed soft landscaping. Within these locations, there are potential exposure pathways, following development. It is understood that residents will not be permitted to dig or cultivate the managed soft landscaped areas. However, root activity and earthworm activity could mix the existing ground with topsoil materials, thereby returning impacted soils to the near surface, if limited thicknesses of topsoil are placed.

It is noted that the GAC values used for the assessment are conservative with respect to the proposed development as they consider young children as the critical receptor. Such a receptor is not applicable to this development as the long-term receptor will be people of retirement age. On this basis a site-specific assessment, using the Contaminated Land Exposure Assessment (CLEA) Model (version 1.071), has been undertaken with respect to the elevated concentration of substances. The full CLEA results and parameters used are presented in Appendix II. With respect to the relevant exposure pathways, the maximum recorded soil concentrations of lead and arsenic are below the site-specific assessment criteria (SSAC) for the proposed development.

Landscaping contractors employed to manage the landscaping areas should only be involved in works to maintain the decorative landscaping and some replanting works involving limited digging into topsoil materials. Therefore, it is considered that there should be no unacceptable risks to this site user group following completion of this development.

Based on the recorded ground conditions, groundworkers involved in the construction of the new development are unlikely to be exposed to short-term (acute) risks. However, in line with good practice, it is recommended that appropriate personal protective equipment (PPE) be worn, and high levels of personal hygiene be maintained by groundworkers. To minimise soils at the site becoming airborne and moving beyond the site boundaries during earth moving operations, it is recommended that appropriate soil dampening equipment be maintained on site during dry periods to minimise dust generation and this would also mitigate exposure risks to neighbouring properties and the general public during construction.

7.3.2 Durability of Buried Structures and Services

In view of the low soluble sulphate content and near-neutral soil conditions, there are no special precautions required for the protection of good quality buried foundation concrete. Based on guidance within *BRE Special Digest 1* (2005), the specified DC Class of concrete for buried structures and foundations should be suitable for an ACEC site classification of AC-1.

There is no evidence that the site has been used for past fuel and/or chemical storage (or land in close proximity has been associated with such storage). Therefore, the site would not be considered to be 'brownfield' under the definition provided by UKWIR (2010) with respect to the assessment of ground for water supply pipes. Based on the guidance provided by UKWIR, conventional plastic materials may be used for potable water supply pipes without any requirements for specific testing.

It should be noted that individual water companies may have in-house requirements for the assessment of ground conditions for potable water supply pipes and these requirements may be in addition to, or may contradict, the guidance provided by UKWIR. Therefore, it is recommended that the relevant water supply company be consulted prior to finalising the potable water supply design.

7.3.3 Landscape

No significant concentrations of potentially phytotoxic chemicals have been recorded. However, as the site is currently devoid of topsoil, a suitable thickness of topsoil is likely to be required to provide a growing medium in proposed areas of managed soft landscaping. As part of the development proposals, it will be necessary to import and place topsoil to provide a suitable growing medium in proposed garden areas. Any soils that are imported into soft landscaped areas should be undertaken in compliance with the published policies of NHBC (to demonstrate and document that imported materials are suitable for use in a residential development).

7.6 Recommended Remedial Works

On the basis of the foregoing information and risk assessment, it is evident that there are no valid contaminant linkages such that remediation works should not be necessary for the proposed development.

It is appreciated that access for the ground investigation was restricted, such that when development layouts and areas of proposed soft landscaping are finalised, it may be appropriate to carry out a supplementary investigation and assessment to confirm that the remaining areas of the site comprise ground conditions compatible with the foregoing assessment. In view of the limited Made Ground thickness indicated within such areas, and in the context of the small areas of soft landscaping currently proposed, the current risk assessment is expected to be applicable.

As usual for brownfield land, and to address the above limitations of the current data, it is recommended that a Discovery Strategy be implemented during the period of groundworks at the site. This provides a straightforward procedure for the site team to report unexpected materials that might be associated with a potential source of contamination, such that those materials are then inspected/investigated and any necessary risk assessment or further works undertaken, with all necessary documentation issued to the local planning authority and, if applicable NHBC, in compliance with published requirements.

7.7 Construction Management/Best Practice

- In view of the ground conditions recorded at the site, it is recommended that soils should be kept damp during groundworks undertaken in dry weather to minimise the potential of aerial migration of dust to neighbouring properties and public.
- As the site is currently devoid of topsoil, a suitable thickness of topsoil is likely to be required to provide a growing medium in proposed soft landscaping areas. Such soil import should be tested/documented in compliance with published NHBC requirements, as outlined in Section 7.3.3

7.8 Potential Liabilities

Based on the available data and risk assessment, it is considered that there should be no significant environmental liabilities associated with the ground conditions and site ownership. Provided the work out lined in Section 7.6 is undertaken, there should be no such liabilities following completion of the development.

8. ASSESSMENT OF MINING, QUARRYING AND OVERALL GROUND STABILITY

The site is not within an area of recorded underground mining or other such mineral extraction. Therefore, it is considered that the development should not be constrained by ground stability issues relating to mining or quarrying activities.

9. GEOTECHNICAL ASSESSMENT

9.1 Assessment of Foundation Solutions

The ground conditions generally comprise block paving/asphalt-surfacing overlying a horizon of Made Ground down to depths of between 1.0 m and 2.4 m. Predominantly in the eastern half of the site, River Terrace Deposits are present beneath the Made Ground down to depths of between 2.7 m and 3.3 m and comprise low to medium strength, variably sandy and gravelly clays with localised gravelly sand horizons. Charmouth Mudstone Formation is present beneath the Made Ground and/or River Terrace Deposits (where present) and generally comprise medium to high strength, orangish brown and greyish brown, locally sandy clays with mudstone grading into high strength, grey, silty clays.

It is considered that the Made Ground and lower strength River Terrace Deposits beneath the site are currently not suitable as founding strata for the proposed development due to the potential for significant and unpredictable differential settlements in such materials.

It appears feasible to treat the Made Ground/River Terrace Deposits using vibro-replacement ground improvement (installation of stone columns) and support the structure on reinforced shallow strip foundations supported by stone columns that extend to medium to high strength Charmouth Mudstone Formation. This solution minimises excavation volumes (and associated waste disposal).

Alternatively, subject to additional assessment of temporary works, consideration could be given to the use of deep trench-fill footings founded in the medium to high strength Charmouth Mudstone Formation. It should be appreciated that significant temporary works may be associated with this solution, as the Made Ground materials include loose materials that are unlikely to provide stable near-vertical excavation sides. In addition, it will also be necessary to consider groundwater control, as there is evidence of groundwater seepages that are likely to be above suitable founding levels. It would be necessary to undertake trial pits/trial excavation to provide the necessary data for the assessment of temporary works requirements (and access for such works is unlikely to be available for some time). It may be prudent not to rely on use of this solution until the temporary works requirements can be clarified and designed.

9.2 Recommended Foundation Design Parameters

9.2.1 Vibro-Replacement Ground Improvement

On the basis of the foregoing assessment, vibro-replacement ground treatment in conjunction with shallow reinforced strip footings may provide the most appropriate foundation solution for the proposed building.

Reinforced strip footings may be constructed at shallow depth and supported by vibro-replacement ground treatment (stone columns) that extend to high strength strata within the underlying Charmouth Mudstone Formation. It is likely that an allowable bearing pressure of 125 kN/m^2 may be provided by this solution, subject to detailed design by a specialist contractor. These vibro works would be classified as 'full depth' treatment, as defined by NHBC.

The strip footings are expected to include reinforcement in both top and bottom faces, subject to detailed design in conjunction with the vibro design.

An allowance should be included for the removal of obstructions, as relating to buried concrete and other buried structures. It may also be necessary to use bottom-feed equipment. It will also be necessary to carefully review potential vibration effects, as vibro works may be constrained near to existing/adjoining building structures. Hence, consultation with a vibro specialist would be advisable at an early stage.

Reference should be made to the requirements of NHBC in relation to vibro ground treatment, as set out in NHBC (2021) Standards. It will also be necessary for specific consideration to be given to a possible requirement for the use of bottom-feed and/or pre-boring equipment at the site.

9.2.2 Trench-Fill Footings

Prior to the detailed consideration of trench-fill footings as a foundation solution for the whole development, additional investigation and assessment is recommended, as outlined in Sections 9.1 and 14. This investigation is considered necessary to enable temporary works requirements to be assessed and to confirm the specific bearing strata. This investigation should also clarify areas of the site where high strength soils may be located at shallow depth, such that the omission of vibro ground treatment might be considered, with reinforced strip footings supported directly by high strength natural strata.

Subject to additional assessment following the recommended ground investigation, preliminary consideration may be given to the use of strip or trench-fill footings as designed with a nett allowable bearing pressure of 125 kN/m^2.

9.3 Floor Slab Recommendations

Due to the thickness of Made Ground, consideration should be given to suspended ground floor slabs for the proposed building. Within influencing distance of trees, it is recommended that an underfloor void of at least 250 mm be incorporated below the floor slab, in accordance with NHBC Standards (2021).

9.4 Building Near Trees

Laboratory testing results indicate the clayey horizons at the site comprise "medium volume change" potential soils, as defined in NHBC Standards (2021). Within the influence zones of existing or proposed trees, suitable foundation precautions should be adopted, as outlined in NHBC Standards (2021).

9.5 Buried Concrete

Based on guidance published within BRE Special Digest 1 (2005), the specified DC Class of concrete for buried structures and foundations should be suitable for an ACEC site classification of AC-1, in view of the low soluble sulphate content, near neutral soil conditions, and mobile groundwater conditions.

9.6 General Construction Advice

An allowance should be included for breaking out/removal of obstructions.

Following completion of any ground treatment/vibro works, excavations should be designed and undertaken so as to ensure that areas of ground treatment/stone columns are not loosened or disturbed.

Ground treatment works should be undertaken and monitored in conjunction with a suitable specification.

All formations should be cleaned, and subsequently inspected by a suitably qualified engineer prior to placing foundation concrete and vibro "stone columns" should be confirmed to be correctly positioned (in compliance with the design and foundation requirements).

Foundation concrete, or alternatively, a blinding layer of concrete, should be placed immediately after excavation and inspection in order to protect the formation against softening and disturbance.

Care should be taken to ensure that any existing services encountered are carefully and satisfactorily blocked to prevent water seeping through the drains and into any excavations.

10. TEMPORARY WORKS

Conventional plant is considered appropriate for shallow excavation works at the site. However, the use of hydraulic breakers may be required to break up any remaining buried concrete materials or buried hard surfacing or other obstructions that may remain from previous developments.

Shallow excavations may remain stable in the short term, although some loose Made Ground materials have been encountered, and additional investigation and review of temporary works/support requirements is recommended. Instability should be anticipated in any excavations left open for extended periods of time, particularly during inclement weather. Support should be provided, or the sides battered back, in any excavations requiring man entry, in compliance with a suitable risk assessment. Likewise, support is likely to be necessary in deeper excavations and where groundwater seepages occur.

Groundwater may be encountered within assumed excavation depths for the development and, there is a possibility that perched water may locally be encountered. If water does enter excavations, sump pumping may be required. As outlined above, additional review of temporary works requirements is recommended following the additional investigation outlined in Section 14.

If large plant is proposed (including vibro equipment) then a temporary working platform should be provided for the specific plant to be used, in compliance with the requirements of FPS (2002) and BRE BR470 (2004).

11. ASSESSMENT OF SOAKAWAY DRAINAGE

Based on the presence of low permeability strata beneath the site, together with relatively deep Made Ground and evidence of shallow groundwater, and with reference to the guidance published in BRE DG365 (2016) and CIRIA C753 (2015), it is considered that soakaway drainage is not suitable for the proposed development and an alternative SuDS drainage solution should be identified.

12. ROAD PAVEMENTS

Based on an examination of soils present at the site, it is considered that an equilibrium design value of 3% may be considered for road pavement design. Where Made Ground materials are present at shallow depth, allowance should be included for material inspection and proof-rolling of formation strata. It is considered that the shallow soils are likely to be frost susceptible.

13. ASSESSMENT OF MATERIALS FOR WASTE DISPOSAL

There is no requirement to remove soils from site and, therefore, development levels should be set such that soils can be retained and reused on site where possible. Providing development levels are set to accommodate soil arisings (for example, from foundation excavations), such materials would not be classified as waste if retained and re-used on site. However, if materials are excess to requirements, they should be taken to an appropriately permitted waste facility.

If material is identified for removal to a waste facility, it will be necessary to provide a description of the material and laboratory test data to the receiving facility. This information is included in Appendix III. It should be noted that additional testing, either for classification purposes or for waste acceptance criteria (WAC) testing to confirm acceptability of the waste may be required (as noted below).

The available analytical laboratory test data has been used to provide preliminary waste disposal advice. It should be noted that these test results may not specifically relate to materials that are, or will be, scheduled for removal from site. However, the results are appropriate for preliminary guidance and costing purposes.

A preliminary assessment of potential waste classification for materials on site has been undertaken in accordance with the Environment document Guidance on the Classification and Assessment of Waste WM3 (2015). The assessment indicates that the following preliminary waste classification advice would be appropriate.

- Tarmac surfacing should be taken to a recycling facility. Such materials are unlikely to meet WAC for disposal at landfill.
- Based on the testing to date, the Made Ground materials are likely to be classified as 'inert' waste for disposal to landfill. However, it would be prudent to include an allowance for some Made ground arisings to be classified as 'non-hazardous' waste (subject to review following the recommended additional ground invetisgation).
- Natural strata, providing they have not been impacted by potential contaminants associated with the site usages, would be classified as 'inert' waste without any requirement for laboratory testing.

Waste requires pre-treatment prior to disposal at landfill and this may take the form of physical or chemical treatment to reduce hazards and/or waste volumes. The segregation and screening of waste soils into separate, and appropriately classified, waste streams would satisfy the pre-treatment criteria by ensuring that volumes of each waste category are minimised. Segregation of waste streams is also important to prevent materials being classified within a worse-case category and, therefore, incurring higher disposal costs. Mixing of different waste streams to dilute hazardous properties is not permitted.

It should be noted that the above assessment is provided in accordance with current waste disposal and environmental permitting legislation and guidance documents. However, individual landfills and other waste disposal facilities may have variances in their permit that differs from standard guidance. Waste facilities may also make decisions with respect to accepting waste on a commercial basis. Therefore, landfills or other waste

facilities should be approached to confirm that they will accept waste materials prior to finalising waste disposal proposals.

14. RECOMMENDATIONS FOR FURTHER GROUND INVESTIGATIONS

As supplemented by the desk study information, the ground investigation work completed to date provides data across the site. However, when suitable access is available, it is recommended that additional groud investigation be undertaken to address the limited data currently available in relation to temporary works design and possible consideration of trench-fill foundation solutions. This phase of investigation should incorporate trial pits, to enable ground conditions and buried structures to be better identified, and also to provide data on excavation stability and possible shallow groundwater seepages. This would also enable additional assessment of specific vibro processes/plant, together with a review of excavation stability/temporary works requirements for trench-fill footings excavation.

In compliance with the published requirements of NHBC and to aid the detailed design of vibro ground treatment works, it is also recommended that boreholes be undertaken to provide confirmatory data on the deeper ground conditions.

15. RECOMMENDED SUPERVISION AND MONITORING

In compliance with the requirements in BS EN 1997-1:2004 and BE EN 1997-2:2007, construction and workmanship of the engineering solutions recommended in this report shall be supervised. In particular, issues listed in Section 9.6 General Construction Advice shall be considered in the implementation of the works and design of any necessary temporary works set out in Section 10.

In relation to the foundation solution(s) and ground floor slab recommendations in Section 9, the following supervision and monitoring is recommended.

- Verification testing (in situ testing) subject to the detailed design and specification of the vibro ground treatment works.
- Inspection and confirmation that vibro-replacement treatment points (stone columns) are installed at locations compatible with the foundation.
- Relevant records of the completed works should be provided, together with confirmation that the detailed ground treatment is compatible with the ground conditions and foundation or ground beam design in compliance with NHBC requirements (as outlined in NHBC Standards 2021).
- Inspections of formation strata in excavations for trench-fill/strip footings.

16. SUMMARY

A residential development is proposed on land at Bolton Road Bingo Hall, Banbury, Oxfordshire. The site is currently occupied by a bingo hall and associated car park and was historically occupied by a mixture of residential and commercial properties. The proposed development comprises an apartment block up to four storeys, together with car parking, and managed landscaping areas. Residents of the development will be of retirement age.

The ground conditions generally comprise block paving/asphalt-surfacing overlying a horizon of Made Ground down to depths of between 1.0 m and 2.4 m. Predominantly in the eastern half of the site, River Terrace Deposits are present beneath the Made Ground down to depths of between 2.7 m and 3.3 m and comprise low

to medium strength, variably sandy and gravelly clays with localised gravelly sand horizons. Charmouth Mudstone Formation is present beneath the Made Ground and/or River Terrace Deposits (where present) and generally comprise medium to high strength, orangish brown and greyish brown, locally sandy clays with mudstone grading into high strength, grey, silty clays.

The ground investigation has identified elevated concentrations of certain contaminants. Following a site-specific quantitative risk assessment, all concentrations were below the SSAC in relation to risks to human health. Hence, the current data indicates that there are no valid contaminant linkages in relation to human health. Likewise, there is no evidence of valid contaminant linkages in relation to controlled waters or ground gas emissions. On this basis, it is considered that remediation works should not be necessary for the proposed development.

In view of the brownfield nature of the site, it would be prudent to include a Discovery Strategy in the procedures applicable to groundworks, to address the usual possibility of unrecorded ground conditions.

It will be necessary to import suitable topsoil to form a growing medium in soft landscaping areas. Such works should be compliant with the published requirements of NHBC.

It is considered that vibro-replacement ground treatment (stone-columns), founded in the medium to high strength Charmouth Mudstone Formation, in conjunction with shallow reinforced strip footings may provide the most appropriate foundation solution for the proposed building.

Alternatively, consideration could be given to the use of deep trench-fill footings that extend through the Made Ground and lower strength superficial deposits into competent Charmouth Mudstone Formation. However, it is expected that significant temporary works may be associated with this solution, and additional ground investigation would be necessary to confirm such temporary works requirements. It may be prudent not to rely on use of this solution until the temporary works requirements can be clarified and designed.

Foundation precautions will be necessary near to trees.

It is recommended that an allowance is made for a suspended floor slab together with an underfloor void.

Based on the presence of low permeability strata beneath the site, relatively deep Made Ground and evidence of shallow groundwater, it is considered that soakaway drainage is not suitable for the proposed development and an alternative drainage solution should be identified.

When suitable access is available, a supplementary phase of ground investigation is recommended. Such work should use trial pits to confirm the ground conditions and excavation stability and boreholes to inform vibro-replacement ground treatment design.

REFERENCES

Site Specific References

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GENERAL NOTES

1. The report is limited to the site boundaries and is specific to the development proposals as identified by the Client (or Client's advisor) and confirmed within this report. The report should not be used in a different context. Where the report is identified as a site appraisal, further geoenvironmental assessment, and detailed investigations, will be required prior to finalisation of ground related assessment and designs. Other reports may recommend additional investigation or other works that would be considered essential prior to the preparation of final assessments and associated designs.

2. This report has been prepared by Crossfield Consulting Limited with all reasonable skill, care and diligence within the terms of the Appointment/Proposal Terms and Conditions (as applicable) and with the resources agreed with the Client. Responsibility for any matters outside the agreed scope is not accepted.

3. Where any data supplied by the Client or by other external sources, including previous site investigation data, have been used it has been assumed that the information is correct unless otherwise stated. No responsibility can be accepted by Crossfield Consulting Limited for inaccuracies within the data supplied by others.

4. Any borehole data from the British Geological Survey sources are included on the following basis: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation.

5. Any assessments made in this report are based on the ground conditions indicated by the factual records included and/or referenced in the report, namely, trial pits and/or boreholes, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant site data/desk study information which may have been obtained for the site. Variations in ground conditions may occur between exploratory hole locations and there may be special conditions appertaining to the site that have not been revealed by the investigation and that have not been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.

6. Exploratory hole locations provided in the report are generally established by tape measurement (or similar measurement) from existing features or boundaries. Ground levels stated in the report are based on site survey plans as provided. Hole locations are not accurately surveyed and ground levels at these locations are not obtained unless specifically included in the agreed scope of services.

7. Unless stated otherwise, no consultations with regulatory authorities, funders or other third parties have been carried out; hence, definitive assurance that such third parties will accept the findings of this report cannot be provided.

8. This report is only valid when used in its entirety. Any information or advice should not be relied upon if removed from the report or not considered in the context of the whole document. Crossfield Consulting Limited cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared.

9. The report is provided for the sole use by the Client or its assignees and is confidential to the Client's professional advisers. No responsibility whatsoever for the contents of this report will be accepted to any person other than the Client or its assignees.

10. The Client cannot place reliance on the report until full payment has been made for the report and all associated works.

11. New information, improved methods, changes in published guidance, codes of practice, policies and legislation can occur at any time and may necessitate an alteration to the report in whole, or in part, after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Crossfield Consulting Limited for re-assessment and, if necessary, re-appraisal.

TABLES

CONCEPTUAL SITE MODEL

	Potential Contaminant Source	Potential Contaminants	Potential Pathway	Receptors and Assessed Contaminant Linkage
On-Site Solid	Former residential properties – likely to have used coal-fired heating systems such that small volumes of ashes may have been retained in garden areas Small works and unknown building usage – unknown operations but possible storage of small volumes of oils, liquid chemicals/solvents (likely to be adsorbed to soils). Other organic and inorganic contaminants possible associated with manufacturing/fabrication Demolition materials from historical buildings may remain within the site Current building and car park usage considered not to be associated with a significant contaminant source Natural strata (Lower Lias – Charmouth Mudstone Formation)	Toxic metals Phytotoxic metals Petroleum hydrocarbons (likely to be degraded) Polyaromatic hydrocarbons Asbestos fibres/ACM n/a Sulphates	Dermal and oral exposure pathways (including air-borne migration) are present during construction phase but will generally not be present following development due to building and hardstanding effective barriers. Limited landscaping areas after development represent possible dust exposure pathways. Although likely to be degraded, organic compound penetration of plastic construction materials should be considered Adverse chemical reactions may occur between sulphates and buried concrete ***Release into Liquid Phase*** Metals, PAHs, and degraded petroleum hydrocarbons have generally low solubility and, therefore, limited leaching potential. Potential for plant uptake of metals.	**Human Health** *End Users:* Possible contaminant linkage *Groundworkers:* Possible contaminant linkage *Neighbouring Properties/General Public:* Possible contaminant linkage ***Buried Structures & Services*** *Buried concrete:* Possible contaminant linkage *Potable water pipes:* Possible contaminant linkage *Other buried structures:* No contaminant linkage **Landscape Areas** Possible contaminant linkage
Off-Site Solid	Historical nearby land uses included a factory and two garages. However, none of these facilities were adjacent to the site, such that there is no valid mechanism for materials to have been moved to the site. – Hence no source.	n/a (no source)	***Release into Vapour Phase*** n/a (degraded sources, if present, unlikely to be associated with volatiles)	
On-Site Liquid	Historical works and unknown building usage may have been associated with small scale liquid storage but leaks and spillages likely to be adsorbed to soils such that a remaining liquid source is unlikely.	n/a (no source)	Fully adsorbed sources would have potential pathways and exposure routes as listed above.	
Off-Site Liquid	Historical garages to northwest and west appear to have included petrol filling stations. However, these facilities were decommissioned and redeveloped some time ago such that they should not now be associated with a valid source of potential contamination.	n/a (no source)	n/a (source not realistic) It is also noted that the very low permeability/effectively impermeable clays recorded in the vicinity would effectively preclude a viable migration pathway for off-site sources to the site ***Release into Vapour Phase*** n/a (degraded sources, if present, unlikely to be associated with volatiles)	
On Site Liquid	Historical works and unknown building usage may have been associated with small scale liquid storage but leaks and spillages of such small volumes likely to be adsorbed to soils such that a remaining liquid source is unlikely. Leaching from solid source	Petroleum hydrocarbons. Due to their age, free phase source unlikely to remain and a degraded, fully adsorbed source is more realistic. If shallow groundwater is present then dissolved phase source may have existed historically but is also likely to be degraded and not a realistic current source Metals (limited potential source) Polyaromatic hydrocarbons (limited potential source) Petroleum hydrocarbons (limited potential source)	n/a (source not realistic) Hard standing and low permeability clay/mudstone strata likely to preclude migration to groundwater and migration of impacted groundwater off site.	**Controlled Waters** *Groundwater:* Secondary Undifferentiated aquifer, no groundwater source protection zone: No contaminant linkage *Surface Water*: Oxford Canal 240 m northeast of site: No contaminant linkage
Ground Gases	No recorded historical/active landfills Not a radon affected area (no source) Made Ground (no evidence to suggest significant thickness of Made Ground or putrescible materials – no source)	n/a n/a n/a	n/a (no source) n/a (no source) n/a (no source)	**Human Health** *End Users:* No contaminant linkage

NOTES

1. The above conceptual model is based on CIRIA C552 (2001) and BS 10175:2011+A2:2017, BS EN ISO 21365:2020 and Environment Agency Land Contamination Risk Management (LCRM) (2020).
2. The Conceptual Site Model is prepared from available desk study information. Where a site walkover or ground investigation identifies information that was not known at the desk study stage, such information is used to modify the Model.
3. Where a pollutant linkage is identified, any subsequent ground investigation is designed to obtain relevant information to assess the pollutant linkage. See Table 3 for a summary of pollutant linkage assessments.

SUMMARY OF ANALYTICAL TEST DATA: SOILS
RISKS TO HUMAN HEALTH

Determinand	Units	No of Tests	Concentration (mg/kg)		Generic Assessment Criteria (mg/kg) Residential Without Plant Uptake		Category 4 Screening Level (mg/kg) Residential Without Plant Uptake	
			Min	Max	Value	No>GAC	Value	No>C4SL
Arsenic	mg/kg	6	13	56	40[1]	4	40[3]	4
Cadmium	mg/kg	6	<0.2	<0.2	85[1]	0	149[3]	0
Chromium (Total) [4]	mg/kg	6	14	86	910[1]	0	-	-
Chromium (VI)	mg/kg	6	<4.0	<4.0	6[1]	0	21[3]	0
Lead	mg/kg	6	15	360	-	-	310[3]	1
Inorganic Mercury	mg/kg	6	<0.3	1.7	56[1]	0	-	-
Nickel	mg/kg	6	9.8	47	180[1]	0	-	-
Selenium	mg/kg	6	<1.0	<1.0	430[1]	0	-	-
Copper	mg/kg	6	7.4	36	7100[1]	0	-	-
Zinc	mg/kg	6	35	180	40,000[1]	0	-	-
Boron	mg/kg	4	0.3	4.6	11,000[1]	0		
Phenols	mg/kg	4	<1.0	<1.0	440[1]	0	-	-
pH	-	11	7.4	10.8	-	-	-	-
Total Organic Carbon	%	6	0.2	2.5	-	-	-	-
Petroleum Hydrocarbons								
Aliphatics $C_5 – C_6$	mg/kg	5	<0.001	<0.001	42[1]	0	-	-
Aliphatics $C_6 – C_8$	mg/kg	5	<0.001	<0.001	100[1]	0	-	-
Aliphatics $C_8 – C_{10}$	mg/kg	5	<0.001	<0.001	27[1]	0	-	-
Aliphatics $C_{10} – C_{12}$	mg/kg	5	<1.0	<1.0	130[1]	0		
Aliphatics $C_{12} – C_{16}$	mg/kg	5	<2.0	<2.0	1100[1]	0	-	-
Aliphatics $C_{16} – C_{35}$	mg/kg	5	<8.0	<8.0	65,000[1]	0	-	-
							-	-
Aromatics $C_6 – C_7$	mg/kg	5	<0.001	<0.001	370[1]	0	-	-
Aromatics $C_7 – C_8$	mg/kg	5	<0.001	<0.001	860[1]	0	-	-
Aromatics $C_8 – C_{10}$	mg/kg	5	<0.001	<0.001	47[1]	0	-	-
Aromatics $C_{10} – C_{12}$	mg/kg	5	<1.0	<1.0	250[1]	0		
Aromatics $C_{12} – C_{16}$	mg/kg	5	<2.0	<2.0	1800[1]	0	-	-
Aromatics $C_{16} – C_{21}$	mg/kg	5	<10	<10	1900[1]	0	-	-
Aromatics $C_{21} – C_{35}$	mg/kg	5	<10	14	1900[1]	0	-	-
VOCs								
Benzene	mg/kg	5	<0.001	<0.001	0.38[1]	0	0.89[3]	0
Toluene	mg/kg	5	<0.001	<0.001	880[1]	0	-	-
Ethylbenzene	mg/kg	5	<0.001	<0.001	83[1]	0	-	-
Xylene	mg/kg	5	<0.001	<0.001	79[1]	0	-	-
MTBE	mg/kg	5	<0.001	<0.001	73[2]	0	-	-

Determinand	Units	No of Tests	Concentration (mg/kg)		Generic Assessment Criteria (mg/kg) Residential Without Plant Uptake		Category 4 Screening Level (mg/kg) Residential Without Plant Uptake	
			Min	Max	Value	No>GAC	Value	No>C4SL
PAHs								
Naphthalene	mg/kg	6	<0.05	<0.05	2.3[1]	0	-	-
Acenaphthylene	mg/kg	6	<0.05	<0.05	2900[1]	0	-	-
Acenaphthene	mg/kg	6	<0.05	<0.05	3000[1]	0	-	-
Fluorene	mg/kg	6	<0.05	<0.05	2800[1]	0	-	-
Phenanthrene	mg/kg	6	<0.05	0.46	1300[1]	0	-	-
Anthracene	mg/kg	6	<0.05	<0.05	31,000[1]	0	-	-
Fluoranthene	mg/kg	6	<0.05	1.0	1500[1]	0	-	-
Pyrene	mg/kg	6	<0.05	0.91	3700[1]	0	-	-
Benz(a)anthracene	mg/kg	6	<0.05	0.56	11[1]	0	-	-
Chrysene	mg/kg	6	<0.05	0.60	30[1]	0	-	-
Benzo(b)fluoranthene	mg/kg	6	<0.05	0.58	3.9[1]	0	-	-
Benzo(k)fluoranthene	mg/kg	6	<0.05	0.34	110[1]	0	-	-
Benzo(a)pyrene	mg/kg	6	<0.05	0.57	3.2[1]	0	5.3[3]	0
Indeno(123cd)pyrene	mg/kg	6	<0.05	0.22	45[1]	0	-	-
Dibenzo(ah)anthracene	mg/kg	6	<0.05	<0.05	0.31[1]	0	-	-
Benzo(ghi)perylene	mg/kg	6	<0.05	0.25	360[1]	0	-	-

NOTES

1. Suitable for Use Level (S4UL) published by LQM/CIEH, 2015 – Residential Without Plant Uptake land use. S4UL assumptions comprise 1% soil organic matter, soil pH of 7 and sandy loam soil type. Where S4UL presented by LQM is greater than 100%, the S4UL for this assessment has been capped at 1,000,000 mg/kg. S4ULs are copyright © Land Quality Management Limited reproduced with permission; Publication Number S4UL3133.
2. Soil GAC for Human Health Risk Assessment produced by CL:AIRE (2010) – Residential Without Plant Uptake. Assumption of 1% soil organic matter.
3. Category 4 Screening Level (C4SL), Department for Environment Food and Rural Affairs (March 2014) – calculated for 1% SOM using the CLEA Model v1.071
4. In the absence of desk study or historical map evidence indicating a potential source of chromium (VI) usage at or in the near vicinity of the site (and confirmed by laboratory testing), total chromium concentrations have been compared to the GAC for chromium (III).
5. For determinands that exceed the GAC and C4SL, site specific assessment criteria are derived in Appendix II.

TABLE 3

ASSESSMENT OF CONTAMINANT LINKAGES

NOTES:
1. Contaminant linkage validity assessed following qualitative or semi-quantitative risk assessment.
2. Contaminant linkage assessed following detailed quantitative risk assessment or assuming the recommended remediation or mitigation measures are in place.

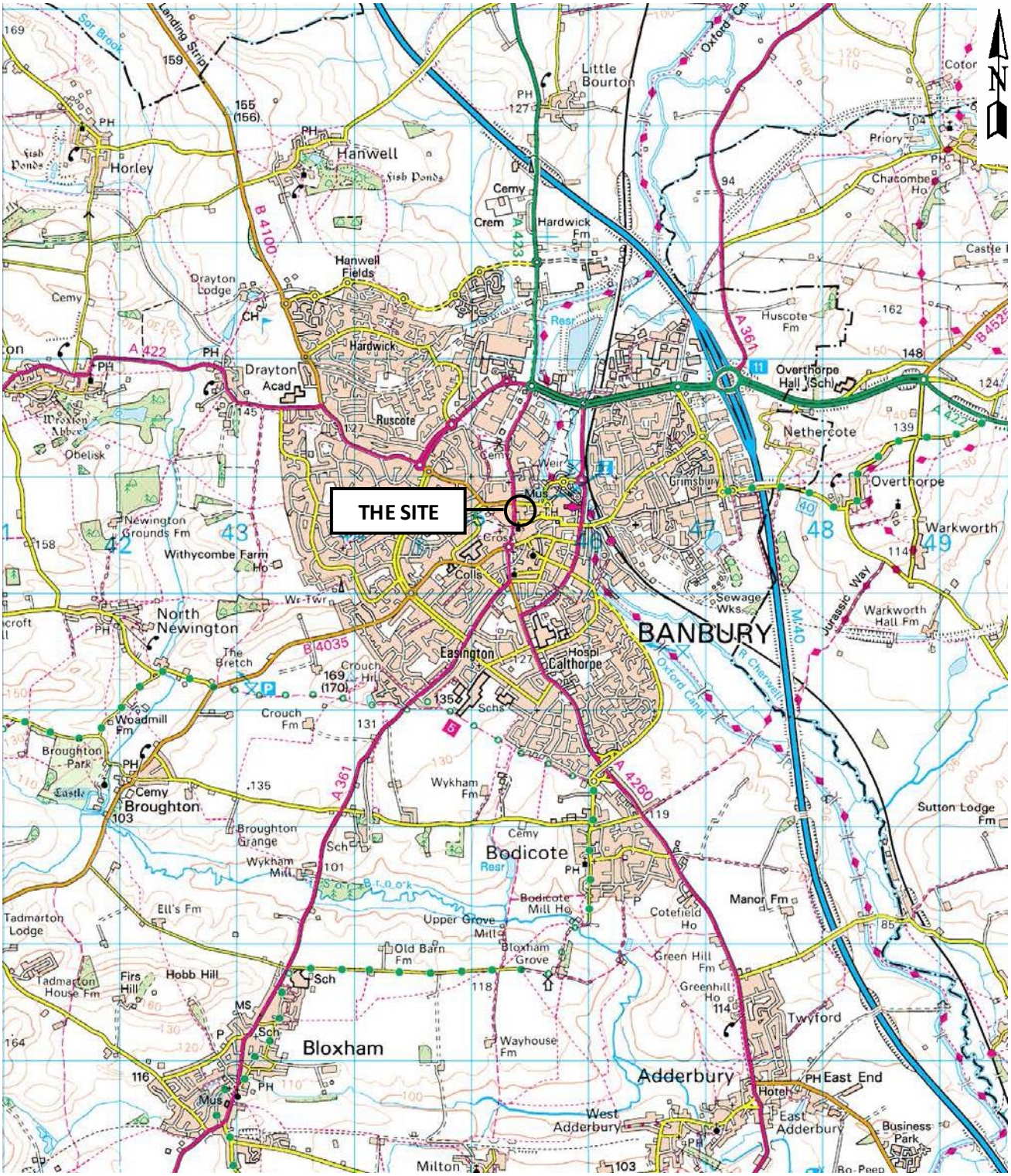
Probability (P)	Consequence (C)			
	Severe	Medium	Mild	Minor
High likelihood (HL)	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
Likely (L)	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
Low likelihood (LL)	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
Unlikely (UL)	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

All terminology in accordance with the definitions provided in CIRIA C552 (2001)

Contaminant Linkage			Assessment of Contaminant Linkage following Ground Investigation	Contaminant Linkage Valid? [1]	Risk Rating			Quantitative Risk Assessment	Recommended Remediation/Mitigation (See Section 7 for further details)	Recommended Work Verified?	Contaminant Linkage Valid? [2]
Source	**Pathway**	**Receptor**			**C**	**P**	**Risk**				
Toxic metals Petroleum hydrocarbons Polyaromatic hydrocarbons Asbestos fibres/ACM	Inhalation (dust) Ingestion, Dermal contact	End users	Elevated concentrations of lead and arsenic above GAC and C4SL Concentrations of TPHs all below GAC levels Concentrations of PAHs all below GAC levels No asbestos detected	Yes No No No	Med n/a n/a n/a	LL n/a n/a n/a	Mod/Low n/a n/a n/a	Yes, site specific assessment criteria (SSAC) obtained using CLEA Model v1.071. Concentrations are all below the SSAC.	On the basis of the current (limited) data, no remedial works are indicated to be necessary.	To be confirmed during construction phase	No
Toxic metals Petroleum hydrocarbons Polyaromatic hydrocarbons Asbestos fibres/ACM	Dermal contact (dust), Ingestion (dust), Inhalation (dust	Neighbours/general public	Elevated concentrations of lead and arsenic above GAC and C4SL Concentrations of TPHs all below GAC levels Concentrations of PAHs all below GAC levels No asbestos detected	Yes No No No	Med n/a n/a n/a	UL n/a n/a n/a	Low n/a n/a n/a	Not applicable	It is recommended that soil dampening equipment be used to minimise potential for airborne migration of fugitive dust from site.	To be confirmed during construction phase.	No
Toxic metals Petroleum hydrocarbons Polyaromatic hydrocarbons Asbestos fibres/ACM	Dermal contact, ingestion and inhalation	Construction workers	All tests below concentrations considered to be a short term (acute) risk. No further assessment required.	No	n/a	n/a	n/a	Not applicable	Not required but standard personal protective equipment is recommended as good practice and dust suppression measures should be adopted when undertaking groundworks.	Not applicable	No
Phytotoxic metals	Plant uptake	Landscape plantings	No elevated concentrations of phytotoxic metals have been recorded above guideline values given for healthy plant growth, based on BS 3882:2015.	No	n/a	n/a	n/a	Not applicable	The site is currently void of topsoil. Any imported topsoil should be of suitable quality for use in a residential development	To be confirmed during construction phase	No
Organic compounds	Direct contact	Potable water supply	No significant organic compounds detected. However, land considered to be brownfield based on historical land use	Yes	Med	UL	V Low	Not applicable	At this stage, allowance to be made for multi-layer barrier pipe or other protective pipe material to be used for potable water supply.	To be confirmed during construction phase	No
Sulphates	Chemical reaction	Buried concrete	No elevated water soluble sulphates have been recorded.	No	n/a	n/a	n/a	Not applicable	Not applicable	Not applicable	No

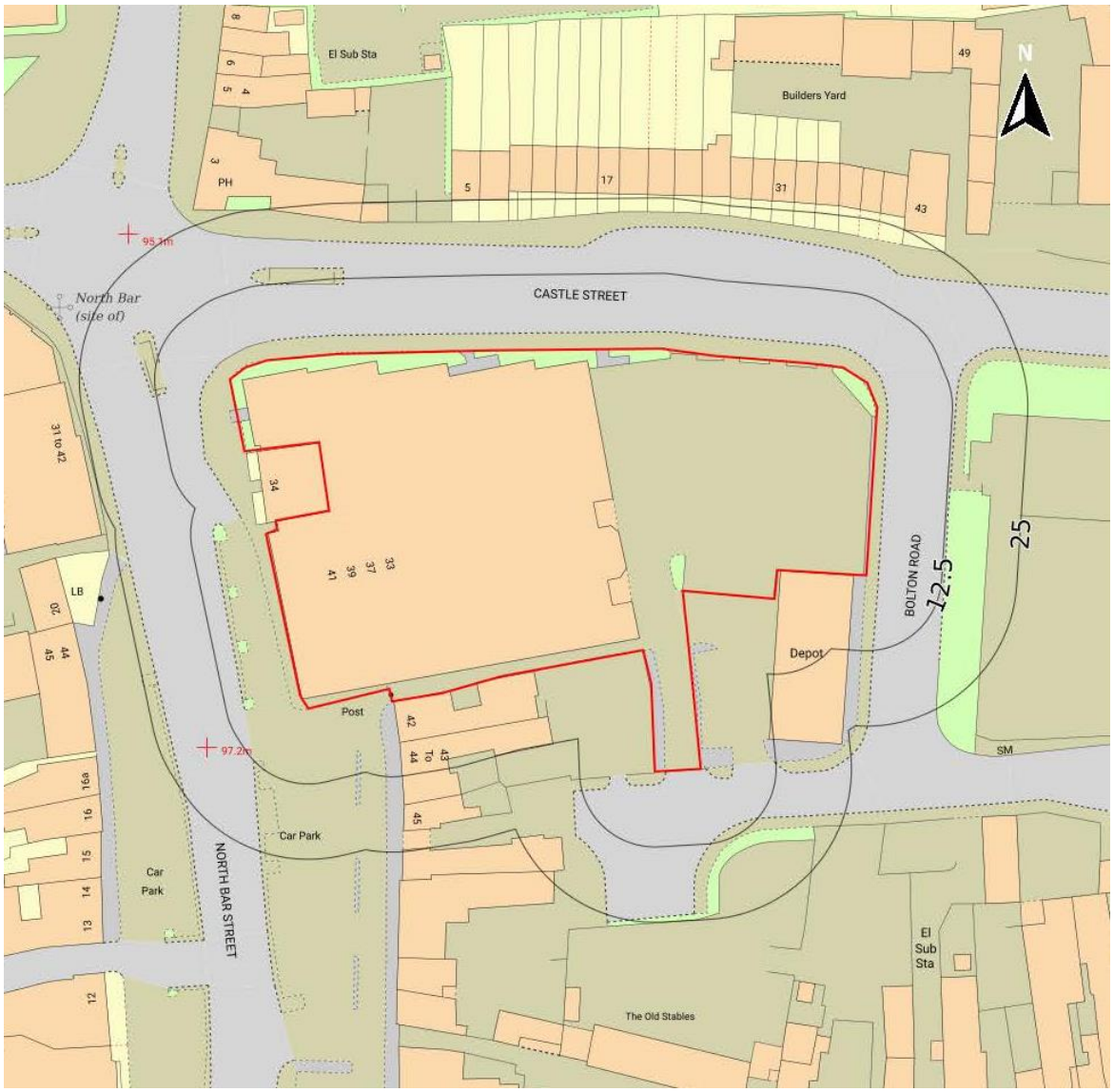
FIGURES

FIGURE 1

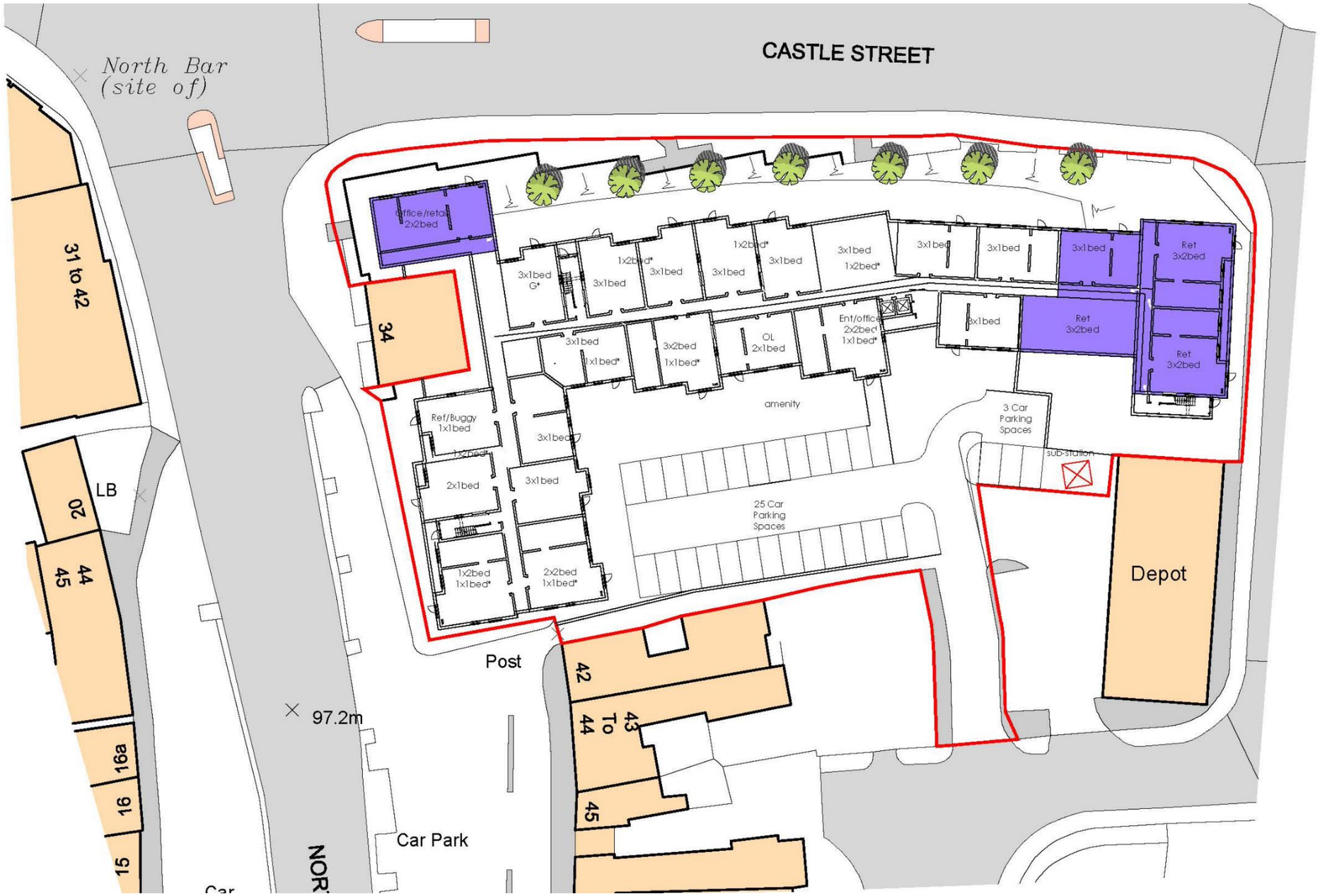


SITE LOCATION PLAN
Scale 1: 50,000

FIGURE 2



SITE PLAN
Scale 1:1250



PROPOSED DEVELOPMENT PLAN
Scale 1:500

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APPENDIX I

APPENDIX I – GROUND INVESTIGATION

Introduction

This Appendix, together with Sections 2 to 5 of the report, forms the Ground Investigation Report for the development described in the report, in compliance with the requirements of BS 5930:2015+A1:2020, BS EN1997-1:2004(2007) and BS EN1997-2:2007(2007).

The site operations were carried out on 29th July 2021 under the supervision of a geoenvironmental engineer from Crossfield Consulting Limited. The scope and rationale for the design of the investigation is presented in Table I-1.

The ground investigation was designed and supervised by qualified and experienced geoenvironmental specialists from Crossfield Consulting Limited. Where appropriate, and as outlined below, specialist drilling/sampling equipment was procured together with trained and experienced operators. Unless otherwise indicated, sampling and logging remained the responsibility of trained staff from Crossfield Consulting Limited and field records were prepared on site, during or immediately following drilling/sampling or in situ measurements/tests. The results of in situ tests are presented on the relevant record sheets in this Appendix.

An exploratory hole location plan is presented as Figure I-1.

Dynamic Sampling

Five dynamic sampling boreholes, denoted as DS1 to DS5, were sunk by Regional Drilling Ltd, on 29th July to between 3.0 m and 5.0 m depth. Dynamic/driven open-tube soil sampling/boring was undertaken using a Premier Compact rig. Using a 1.0 m long thick-walled open-tube sampler (with plastic liner), Category A and B samples were recovered (sample disturbance being influenced by the specific soils encountered). Where appropriate, small disturbed sub-samples were recovered from the materials recovered in the open-tube sampler.

Standard Penetration Tests (SPT) were carried out at regular intervals to provide data on the in situ density of coarse-grained strata and an indication of strength within fine-grained strata. The SPTs were carried out in accordance with BS EN ISO 22476-3:2005(2007).

The records from the investigation are presented in this Appendix. These records include the descriptions and depths of the strata encountered, together with sample depths, in situ test results (uncorrected values), groundwater observations, details of installations/backfill within exploratory holes and other pertinent comments.

Soil Samples

All samples for analytical testing were collected in appropriate containers, stored in cool boxes (where appropriate), and sent to the testing laboratory overnight. The sample containers, storage and handling procedures were all compatible with the relevant recommendations of the UKAS accredited testing laboratory for the specific testing proposed.

Samples designated for geotechnical testing were collected, stored, and transported in accordance with the published requirements for the specific tests scheduled, such that moisture content and soil structure integrity was maintained, as necessary for the test requirements.

Analytical Laboratory Testing

The rationale for the analytical testing is set out in Table I-2.

Selected samples of the soils encountered were submitted for screening analysis of the following determinands:

- Arsenic (Total)
- Chromium (Total)
- Lead (Total)
- Nickel (Total)
- Selenium (Total)
- Cyanide (Total)
- Sulphate (Water soluble)
- Sulphate (Acid soluble)
- pH
- Asbestos (Fibre & ACM Screen)
- Cadmium (Total)
- Copper (Total)
- Mercury (Total)
- Zinc (Total)
- Boron (Water soluble)
- Sulphide (Total)
- Phenols (Total-monohydric)
- Sulphur (Total)
- Total Organic Carbon
- Asbestos (Quantification)

Note: Total determinands are based on an aqua-regia extract.

Selected samples of the soils encountered were submitted for analysis of the following determinands:

- Total Petroleum Hydrocarbons – aromatic/aliphatic split and carbon number banding, using GC-FID techniques
- Polyaromatic Hydrocarbons – using GC-MS techniques

Selected samples were submitted for Waste Acceptance Criteria Tests (WAC) to BS EN 12457-3:

Solid Tests

Total Organic Carbon (TOC)	PCB [#] - Total (7 Congeners)
Loss on Ignition @ 450°C	PAH [Δ] - (WAC 17)
TPH (C_{10} -C_{40})	Acid Neutralisation Capacity
BTEX *	pH

* BTEX: Benzene, Toluene, Ethylbenzene, Xylenes

[#] PCB: Polychlorinated biphenyl (congener Nos. 28, 52, 101, 118, 138, 153, 180)

[Δ] PAH: Polyaromatic Hydrocarbons (17No. compounds from WAC criteria)

Eluate Tests

Arsenic (dissolved)	Molybdenum (dissolved)	Chloride
Barium (dissolved)	Nickel (dissolved)	Fluoride
Cadmium (dissolved)	Lead (dissolved)	Sulphate as SO_4
Chromium (dissolved)	Antimony (dissolved)	Dissolved Solids
Copper (dissolved)	Selenium (dissolved)	Phenols - Total (monohydric)
Mercury (dissolved)	Zinc (dissolved)	Total Organic Carbon (TOC)

The analyses were carried out by i2 Analytical, a UKAS accredited laboratory, and the results are presented in this Appendix. Soil testing was undertaken in accordance with the Environment Agency's Monitoring Certification Scheme (MCERTS).

Geotechnical Laboratory Testing

The rationale for the geotechnical laboratory testing is set out in the Table *X*-3.

Selected samples of the soils encountered were submitted for analysis for the following tests:

- pH value
- Water soluble sulphate
- Acid soluble sulphate
- Total sulphur
- Moisture content
- Atterberg Limits

The analyses were carried out by i2 Analytical, a UKAS accredited laboratory, and the results are presented in this Appendix.

TABLE I-1

RATIONALE FOR THE DESIGN OF THE GROUND INVESTIGATION

The scope of the ground investigation was designed with reference to the published geology and ground conditions indicated in the desk study information. It is noted that the investigation works were constrained by access restrictions associated with the existing building.

In compliance with the guidance published in BS EN 1997-2:2007, the ground investigation was designed to verify the preliminary ground model, established from the desk study information and to characterise the ground conditions within influencing distance of the proposed structures. In this regard, the exploratory holes were targeted within relevant areas of the site to provide information on the strata profile down to competent materials. With reference to the desk study information and the support requirements of the proposed development, it is evident that adequate support is provided by the strata that continue below the depths of the exploratory holes.

In compliance with the guidance published in BS 10175:2011+A2:2017, BS 5930:2015+A1:2020 and Environment Agency LCRM (2020), the layout of the exploratory holes and sampling regime also considers the Conceptual Site Model and potential contaminant linkages, such that the spatial arrangement of the investigation provides the necessary information to support a risk assessment of the identified potential contaminant linkages.

Exploratory Hole and Technique	**Rationale for Hole Location**	**Depth (m)**	**Sampling/In Situ Testing and Monitoring**
DS1 – DS5	All exploratory hole locations were placed to provide information on the strata profile and to aid in foundation design. The holes also provide coverage of the site to identify if Made Ground is present.	Up to 5.0 m	Soil samples were recovered from soils at shallow depths for analytical laboratory testing. Soil samples were recovered from potential founding strata for geotechnical testing. Standard Penetration Tests (SPTs) were carried out at regular intervals to provide data on the in-situ density of coarse-grained strata and an indication of strength within fine grained strata.

Key

DS *X* Dynamic Sample Borehole

TABLE I-2

RATIONALE FOR THE ANALYTICAL TESTING SUITE

Exploratory Hole and Samples	Selection Criteria	Analytical Tests
DS1 – 1.2 m DS2 – 0.6 m DS3 – 0.4 m DS4 – 0.5 m DS5 – 0.5 m	Representative samples of shallow Made Ground tested to assess for inorganic and organic contaminants identified in the Conceptual Site Model and to assist in a preliminary assessment of waste classification	Screening tests for metals and metalloids, boron, cyanides, phenols (pH and total organic carbon also included to assist with risk assessments) Asbestos identification (and quantification, if applicable) Polyaromatic hydrocarbons (speciated 16 USEPA priority PAHs) Petroleum hydrocarbons (TPH-CWG with aliphatic/aromatic split)
DS1 – 1.2 m DS5 – 1.0 m	Representative samples of shallow soils tested to provide a preliminary assessment of landfill acceptance	Two-stage Eluate test: (BS EN 12457-3) Dissolved As, Ba, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se, Zn, Cl, F, SO4, Dissolved Solids, Phenols (monohydric), Solid suite: Mineral Oil (C_{10}-C_{40}), pH, loss on Ignition, total organic carbon, PCBs, BTEX, ANC, PAH WAC 17

TABLE I-3

RATIONALE FOR THE GEOTECHNICAL TESTING SUITE

Exploratory Hole and Sample	Selection Criteria	Geotechnical Tests
DS1 – 2.0 m DS1 – 3.0 m DS2 – 1.2 m DS3 – 2.0 m DS4 – 1.6 m DS5 – 1.0 m	Samples were recovered from potential founding strata to aid concrete classification	pH Water soluble sulphate Acid soluble sulphate Total sulphur
DS2 – 1.0 m DS3 – 1.2 m DS4 – 1.6 m	Samples were recovered from the natural strata for classification testing	Atterberg Limits Moisture content

DYNAMIC SAMPLE RECORDS

KEY

Sampling

	J	Disturbed Jar Sample
	G	Jar Sample in Glass Container
	g	Soil Sample in Glass Vial
	W	Water Sample
	IC	Nett sample recovery ratio (ratio of length of recovered sample to length of sample run)

In Situ Measurements

FVT	c_{fv}	Undrained Shear Strength (from hand vane shear vane test)
	c_{rv}	Undrained Remoulded Shear Strength (from hand vane shear vane test)
	c_{fv} *	Hand Vane Shear Strength Test (on Category A: OS-TK/W soil sample recovered in window sampler)
	S	Standard Penetration Test (SPT: split spoon sampler)
	SPT(C)	SPT carried out with a 60° cone
	'N'	'N' Value from SPT test
	N_{10}	Dynamic Probe Test: Number of blows to drive 100 mm
DPH	N_{H10}	Dynamic Probe Test: Heavy (30 kg mass & 500 mm fall)
DPSH-A	N_{SHA10}	Dynamic Probe Test: Super-Heavy A (63.5 kg mass & 500 mm fall)
DPSH-B	N_{SHB10}	Dynamic Probe Test: Super-Heavy B (63.5 kg mass & 750 mm fall)
	$\frac{x}{y\ mm}$	x Blows per y Driving Distance (for non-standard SPT or DP driving distance)
	T	Torque (max) required to turn rods (unit: Nm, unless otherwise shown)

Notes:

1. All measurement values on record sheets are uncorrected, unless otherwise indicated.
2. For corrected test values, refer to report.
3. Identification and classification of strata is based on the guidance published in the current edition of BS5930 together with BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003
4. Consistency (soft, firm, stiff etc) relates to a manual test/inspection on site (in compliance with BS EN ISO 14688-1:2002 Section 5.14).
5. Undrained shear strength (low, medium, high etc) relates to in situ or laboratory test data and the associated assessed strength of a stratum (in compliance with BS EN ISO 14688-2:2004 Section 5.3 and Table 5).
6. The density of coarse-grained soils is based on SPT N values (or equivalent Dynamic Probe test or CPT data) as outlined in BS5930 and BS EN ISO 14688-2:2004.
7. Rock strength (weak, strong etc) is based on field identification (and/or strength test data), as outlined in BS EN ISO 14689-1:2003 Table 5.

BOREHOLE & DRILLHOLE RECORDS - LEGENDS KEY SHEET

Legend - Strata Encountered in Exploratory Hole

Soil	Rock		
	Sedimentary	Igneous	Metamorphic
Made Ground	Mudstone	Fine-grained	Fine-grained
Clay	Shale	Medium-grained	Medium-grained
Silt	Siltstone	Coarse-grained	Coarse-grained
Sand	Sandstone		
Gravel	Limestone		
Peat/Topsoil	Chalk		
Organic Sand	Coal		
Organic Clay	Conglomerate		

Legend - Backfill to Borehole and Standpipe Installations

Backfill	Installations
Soil arisings	Concrete Cover Over Standpipe
Bentonite	Plain Standpipe - Bentonite Surround
Cement-based Grout	Perforated Standpipe - Geotextile and Granular Filter Surround
Gravel	Perforated Standpipe End Geotextile and Granular Filter Surround

Notes:

1. A combination of the strata symbols are indicative of mixed soil types.

2. The response zone of a standpipe refers to the section of perforated pipe within a granular surround, where substances may freely enter the standpipe from the surrounding strata.

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Dynamic Sample Record Sheet

Project:	Bolton Road, Banbury	**Hole Ref.**	DS1
Date:	29/07/2021	**Sheet**	1 of 1
		Job No.	CCL03458
Contractor	Regional Drilling Ltd	**Equipment**	Premier Compact 110
Method	0.0 m to 5.0 m windowless sampling	**Ground Level.**	m OD
Boring Diameter	100 mm	**Co-ordinates**	
		Logged by:	JH — Logged on site during drilling operations
		Checked by:	[redacted]

Sample Depth	Sample or Test	Casing Depth	Water Depth	Test Value	Description	Depth	Legend	Backfill	Level O.D.
					Block paving and sand base (MADE GROUND)	0.10			
					CONCRETE	0.20			
					Brown sandy gravel. Gravel is fine to coarse subangular to angulat flint, convrete, limestone and sandstone (MADE GROUND)	0.55			
					Stiff consistency brown and greyish brown sandy gravelly clay with low cobble content of limestone and brick. Gravel is fine to coarse subangular to angular limestone, flint, brick, coal fragments and rare wood				
1.00-1.45	SPT (C)		Dry	N=6	(MADE GROUND)				
1.20	JGg					1.30			
					Firm consistency brown gravelly clay. Gravel is fine to coarse subangular to subrounded flint, coal fragments and rare brick (MADE GROUND)				
1.50	J								
2.00-2.45	SPT (C)		Dry	N=5					
2.00	J								
						2.40			
					Soft to firm consistency orangish brown mottled light grey silty slightly gravelly CLAY with rare mudstone (CHARMOUTH MUDSTONE FORMATION)				
3.00-3.45	SPT (C)		Dry	N=8	... becoming firm consistency below 3.0 m				
3.00	J								
4.00-4.45	SPT (C)		4.10	N=12	... becoming firm to stiff consisency below 4.10 m				
					Medium dense orangish brown clayey gravelly SAND with localised iron staining. Gravel is fine to coarse subangular to subrounded mudstone and sandstone (CHARMOUTH MUDSTONE FORMATION)	4.80			
4.90	J								
5.00-5.45	SPT (C)		4.10	N=19	End of Hole	5.00			

Core Recovery

Depth	Recovery
0.00-1.00	100%
1.00-2.00	100%
2.00-3.00	100%
3.00-4.00	100%
4.00-5.00	100%

Groundwater

Hole Depth	Strike Depth	Water Depth	Observations
5.00 m	Approx. 3.0 m	4.10 m	

Additional Tests

Test type	Test Depth	Test Value

Remarks

Notes

1. All logging and sampling in accordance with BS 5930:2015+A1:2020
2. The depths to strata change are approximate only
3. Symbols and abbreviations are explained on the accompanying key
4. All linear dimensions are in metres unless otherwise stated
5. Undrained shear strength test value given in kN/m^2

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Dynamic Sample Record Sheet

Project:	Bolton Road, Banbury	**Hole Ref.**	**DS2**
Date:	29/07/2021	**Sheet**	1 of 1
		Job No.	CCL03458
Contractor	Regional Drilling Ltd	**Equipment**	Premier Compact 110
Method	0.0 m to 5.0 m windowless sampling	**Ground Level.**	m OD
Boring Diameter	100 mm	**Co-ordinates**	
		Logged by:	JH — Logged on site during drilling operations
		Checked by:	[redacted]

Sample Depth	Sample or Test	Casing Depth	Water Depth	Test Value	Description	Depth	Legend	Backfill	Level O.D.
					Block paving and sand base (MADE GROUND)	0.10			
					Light brown very sandy gravel. Gravel is fine to coarse subangular to angular flint, concrete, granite and limestone (MADE GROUND)	0.20			
					Brown sandy gravel. Gravel is fine to coarse subangular to angular quartzitic gravel, concrete, limestone and quartzite (MADE GROUND)	0.55			
0.60	JGg				Firm consistency brown slightly sandy slightly gravelly clay. Gravel is fine to coarse subangular to subrounded flint, chalk, quartzite, rare coal fragments and rare brick fragments (MADE GROUND)	1.00			
1.00-1.45	SPT (C)		Dry	N=7	Firm consistency orangish brown silty slightly gravelly CLAY with rare mudstone and flint (RIVER TERRACE DEPOSITS)				
1.00	J								
1.20	J								
					... localised horizon of sandy silty clay at 1.70 m to 1.80m				
					... becoming firm to stiff consistency and mottled light grey below 1.90 m				
2.00-2.45	SPT (C)		Dry	N=11					
3.00-3.45	SPT (C)		Dry	N=8					
					Firm consistency orangish brown mottled light grey slightly sandy silty CLAY (CHARMOUTH MUDSTONE FORMATION)	3.10			
4.00-4.45	SPT (C)		Dry	N=14					
					Firm to stiff consistency greyish brown mottled orange brown silty CLAY with rare mudstone (CHARMOUTH MUDSTONE FORMATION)	4.30			
						4.90			
5.00-5.45	SPT (C)		5.20	N=26	Stiff consistency grey silty CLAY (CHARMOUTH MUDSTONE FORMATION)	5.00			

Core Recovery

Depth	Recovery
0.00-1.00	100%
1.00-2.00	100%
2.00-3.00	100%
3.00-4.00	85%
4.00-5.00	100%

Groundwater

Hole Depth	Strike Depth	Water Depth	Observations
5.00 m	Approx. 5.0 m	5.20 m	

Additional Tests

Test type	Test Depth	Test Value

Remarks

Notes

1. All logging and sampling in accordance with BS 5930:2015+A1:2020
2. The depths to strata change are approximate only
3. Symbols and abbreviations are explained on the accompanying key
4. All linear dimensions are in metres unless otherwise stated
5. Undrained shear strength test value given in kN/m^2

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Dynamic Sample Record Sheet

Project:	Bolton Road, Banbury	**Hole Ref.**	**DS3**
Date:	29/07/2021	**Sheet**	1 of 1
		Job No.	CCL03458
Contractor	Regional Drilling Ltd	**Equipment**	Premier Compact 110
Method	0.0 m to 5.0 m windowless sampling	**Ground Level.**	m OD
Boring Diameter	100 mm	**Co-ordinates**	
		Logged by:	JH — Logged on site during drilling operations
		Checked by:	[redacted]

Sample Depth	Sample or Test	Casing Depth	Water Depth	Test Value	Description	Depth	Legend	Backfill	Level O.D.
					Asphalt surfacing (MADE GROUND)	0.10			
					Brown sandy gravel with medium cobble content. Gravel and cobbles are subangular to angular limestone and concrete (MADE GROUND)	0.30			
0.40	JGg				Firm to stiff consistency greyish brown organic slightly gravelly silty clay with rare roots. Gravel is fine to coarse subangular to subrounded flint, quartzite, sandstone, coal fragments and rare brick fragments (MADE GROUND)	0.60			
					Firm consistency brown slightly sandy slightly gravelly silty clay. Gravel is fine to coarse subangular to subrounded flint, coal and brick fragements (MADE GROUND)	1.00			
1.00-1.45 1.20	SPT (C) J		Dry	N=5	Soft to firm consistency brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded flint and sandstone (RIVER TERRACE DEPOSITS)	1.60			
2.00-2.45 2.00	SPT (C) J		Dry	N=9	Loose to medium dense brown gravelly SAND. Gravel is fine to coarse subangular to subrounded flint, sandstone and mudstone (RIVER TERRACE DEPOSITS)	2.20			
					Firm consistency orangish brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint and sandstone (RIVER TERRACE DEPOSITS)	2.70			
3.00-3.45	SPT (C)		Dry	N=5	Firm consistency orangish brown slightly sandy silty CLAY (CHARMOUTH MUDSTONE FORMATION)				
4.00-4.45	SPT (C)		Dry	N=7		4.40			
					Firm consistency greyish brown silty CLAY (CHARMOUTH MUDSTONE FORMATION)				
5.00-5.45	SPT (C)		Dry	N=11	Firm consistency grey silty CLAY (CHARMOUTH MUDSTONE FORMATION) End of Hole	4.90 5.00			

Core Recovery

Depth	Recovery
0.00-1.00	100%
1.00-2.00	100%
2.00-3.00	80%
3.00-4.00	100%
4.00-5.00	70%

Groundwater

Hole Depth	Strike Depth	Water Depth	Observations
5.00 m			None encountered Damp materials within sample liners between 2.50 - 2.60 m

Additional Tests

Test type	Test Depth	Test Value

Remarks

Notes

1. All logging and sampling in accordance with BS 5930:2015+A1:2020
2. The depths to strata change are approximate only
3. Symbols and abbreviations are explained on the accompanying key
4. All linear dimensions are in metres unless otherwise stated
5. Undrained shear strength test value given in kN/m^2

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Dynamic Sample Record Sheet

Project:	Bolton Road, Banbury	**Hole Ref.**	**DS4**
Date:	29/07/2021	**Sheet**	1 of 1
		Job No.	CCL03458
Contractor	Regional Drilling Ltd	**Equipment**	Premier Compact 110
Method	0.0 m to 3.0 m windowless sampling	**Ground Level.**	m OD
Boring Diameter	100 mm	**Co-ordinates**	
		Logged by:	JH — Logged on site during drilling operations
		Checked by:	[redacted]

Sample Depth	Sample or Test	Casing Depth	Water Depth	Test Value	Description	Depth	Legend	Backfill	Level O.D.
					Block paving and sand base (MADE GROUND)	0.10			
					CONCRETE	0.25			
0.50	JGg				Loose pale yellowish brown sandy gravel and cobbles. Gravel and cobbles are limestone and fine to coarse flint (MADE GROUND)				
1.00-1.45	SPT (C)		Dry	N=5					
						1.50			
1.60	JJ				Stiff consistency brown mottled orangish brown and grey slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded weak mudstone (CHARMOUTH MUDSTONE FORMATION)				
2.00-2.45	SPT (C)		1.50	N=12					
						3.00			
					End of Hole				

Core Recovery

Depth	Recovery
0.00-1.00	100%
1.00-2.00	60%
2.00-3.00	20%

Groundwater

Hole Depth	Strike Depth	Water Depth	Observations
3.00 m		Approx. 1.5 m	

Additional Tests

Test type	Test Depth	Test Value

Remarks

Hole collapse in gravels prevented further drilling

Notes

1. All logging and sampling in accordance with BS 5930:2015+A1:2020
2. The depths to strata change are approximate only
3. Symbols and abbreviations are explained on the accompanying key
4. All linear dimensions are in metres unless otherwise stated
5. Undrained shear strength test value given in kN/m^2

Crossfield CONSULTING
GEOTECHNICAL ENVIRONMENTAL

Dynamic Sample Record Sheet

Project:	Bolton Road, Banbury	**Hole Ref.**	**DS5**
Date:	29/07/2021	**Sheet**	1 of 1
		Job No.	CCL03458
Contractor	Regional Drilling Ltd	**Equipment**	Premier Compact 110
Method	0.0 m to 5.0 m windowless sampling	**Ground Level.**	m OD
Boring Diameter	100 mm	**Co-ordinates**	
		Logged by:	JH — Logged on site during drilling operations
		Checked by:	[redacted]

Sample Depth	Sample or Test	Casing Depth	Water Depth	Test Value	Description	Depth	Legend	Backfill	Level O.D.
					Asphalt surfacing (MADE GROUND)	0.10			
					Reddish brown sandy gravel. Gravel is fine to coarse subangular to angular flint and granite (MADE GROUND)	0.20			
0.50	JGg				Light brown sandy gravel with medium cobble content of limestone and brick. Gravel is fine to coarse subangular to angular limestone, flint, brick and granite (MADE GROUND)	0.80			
1.00-1.45	SPT (C)		Dry	N=5	Firm to stiff consistency brown slightly sandy gravelly clay. Gravel is fine to coarse subangular to subrounded flint, quartzite, coal fragments and rare brick (MADE GROUND)				
1.00	JGg								
1.20	J								
1.50	J								
2.00-2.45	SPT (C)		Dry	N=14		2.00			
					Medium dense orangish brown slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded flint and sandstone (RIVER TERRACE DEPOSITS)	2.50			
					Firm to stiff consistency orange brown silty slightly gravelly CLAY with rare f (RIVER TERRACE DEPOSITS)				
3.00-3.45	SPT (C)		Dry	N=15					
3.00	J					3.10			
					Medium dense orangish brown gravelly SAND. Gravel is fine to coarse subangular to subrounded flint (RIVER TERRACE DEPOSITS)	3.30			
					Firm becoming stiff consistency greyish brown silty CLAY (CHARMOUTH MUDSTONE FORMATION)				
4.00-4.45	SPT (C)		Dry	N=21		4.00			
					Stiff consistency greyish brown CLAY (CHARMOUTH MUDSTONE FORMATION)				
					... becoming grey with shell debris below 4.70 m				
5.00-5.45	SPT (C)		Dry	N=31	End of Hole	5.00			

Core Recovery

Depth	Recovery
0.00-1.00	100%
1.00-2.00	100%
2.00-3.00	100%
3.00-4.00	100%
4.00-5.00	90%

Groundwater

Hole Depth	Strike Depth	Water Depth	Observations
			None encountered Damp materials in sample liner at 2.50 m

Additional Tests

Test type	Test Depth	Test Value

Remarks

Notes

1. All logging and sampling in accordance with BS 5930:2015+A1:2020
2. The depths to strata change are approximate only
3. Symbols and abbreviations are explained on the accompanying key
4. All linear dimensions are in metres unless otherwise stated
5. Undrained shear strength test value given in kN/m^2

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	110.124
Test Date:	12/04/2021
Report Date:	12/04/2021
File Name:	110.124.spt
Test Operator:	JL

Instrumented Rod Data

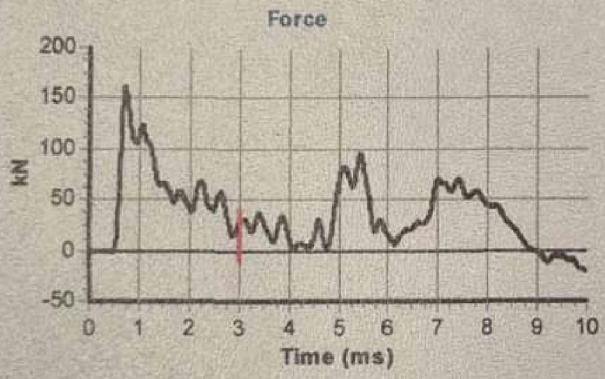
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	7080
Accelerometer No.2:	11609

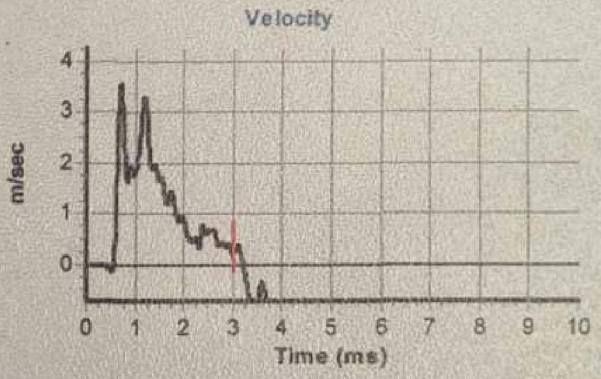
SPT Hammer Information

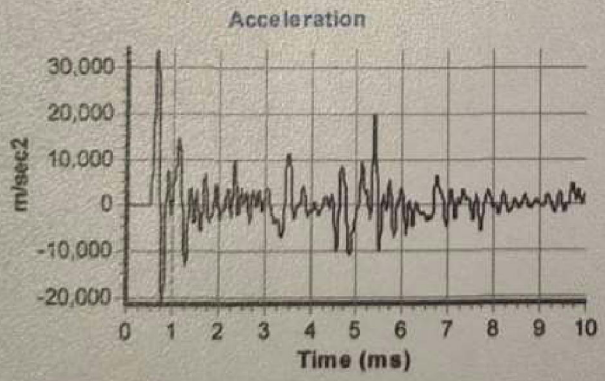
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

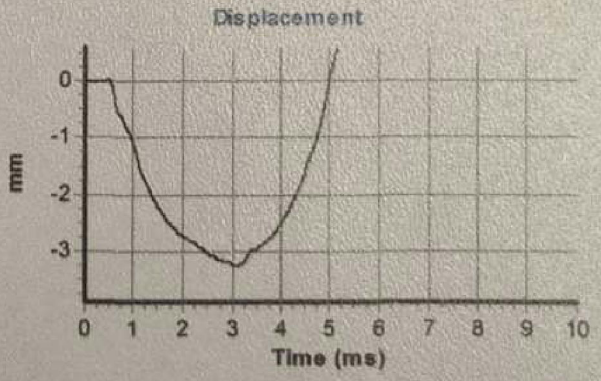
Comments / Location

REGIONAL DRILLING - 75089









Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	305

Energy Ratio E_r (%): 64

[redacted]

Signed: J.LOCK

Title: FITTER

The recommended calibration interval is 12 months

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Analytical Report Number : 21-90276

Project / Site name:	Bolton Road Banbury	**Samples received on:**	30/07/2021
Your job number:	CCL03458	**Samples instructed on/ Analysis started on:**	30/07/2021
Your order number:	PO12033	**Analysis completed by:**	11/08/2021
Report Issue Number:	1	**Report issued on:**	11/08/2021
Samples Analysed:	11 soil samples		

Signed: [redacted]

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957896	1957897	1957898	1957899	1957900
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	0.40	0.50	0.50
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	17	17	17	11	7.6
Total mass of sample received	kg	0.001	NONE	1.1	1.0	1.1	1.0	1.1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected

General Inorganics

pH - Manual	pH Units	N/A	MCERTS	7.8	-	-	-	-
pH - Automated	pH Units	N/A	MCERTS	-	8.1	7.6	10.8	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	540	680	2400	910
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.038	0.32	0.16	0.054
Sulphide	mg/kg	1	MCERTS	-	< 1.0	10	2.7	3.6
Total Sulphur	mg/kg	50	MCERTS	-	260	760	1000	460
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.5	1.1	1.8	0.2	0.4
Loss on Ignition @ 450oC	%	0.2	MCERTS	6.1	-	-	-	-
Acid Neutralisation Capacity	+/- mol/kg	-999	NONE	3.9	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.44	< 0.05	< 0.05	< 0.05	0.46
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.84	< 0.05	< 0.05	< 0.05	1.0
Pyrene	mg/kg	0.05	MCERTS	0.79	< 0.05	< 0.05	< 0.05	0.91
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.51	< 0.05	< 0.05	< 0.05	0.56
Chrysene	mg/kg	0.05	MCERTS	0.55	< 0.05	< 0.05	< 0.05	0.60
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.47	< 0.05	< 0.05	< 0.05	0.58
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.28	< 0.05	< 0.05	< 0.05	0.34
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.45	< 0.05	< 0.05	< 0.05	0.57
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.21	< 0.05	< 0.05	< 0.05	0.22
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.24	< 0.05	< 0.05	< 0.05	0.25
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	< 0.80	< 0.80	< 0.80	5.53
Total WAC-17 PAHs	mg/kg	0.85	NONE	4.78	-	-	-	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957896	1957897	1957898	1957899	1957900
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	0.40	0.50	0.50
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	49	41	47	13	17
Boron (water soluble)	mg/kg	0.2	MCERTS	-	2.8	4.6	1.0	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	84	71	75	14	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	36	27	33	7.4	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	360	79	100	15	50
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	45	38	42	9.8	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	120	140	35	60
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	-	-	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	14	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	19	< 10	15
TPH (C10 - C25)	mg/kg	10	MCERTS	< 10	-	-	-	-
TPH (C25 - C40)	mg/kg	10	MCERTS	< 10	-	-	-	-
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957896	1957897	1957898	1957899	1957900
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	0.40	0.50	0.50
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957896	1957897	1957898	1957899	1957900
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	0.40	0.50	0.50
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
PCBs by GC-MS								
PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	-	-	-	-
Total PCBs by GC-MS								
Total PCBs	mg/kg	0.007	MCERTS	< 0.007	-	-	-	-

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

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957901	1957902	1957903	1957904	1957905
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	1.20	2.00	1.60	1.00
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	13	13	9.5	12	14
Total mass of sample received	kg	0.001	NONE	0.50	0.40	0.70	0.60	0.90
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	Not-detected
General Inorganics								
pH - Manual	pH Units	N/A	MCERTS	-	-	-	-	7.7
pH - Automated	pH Units	N/A	MCERTS	8.0	8.0	7.9	7.4	7.8
Total Cyanide	mg/kg	1	MCERTS	-	-	-	-	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	330	380	820	790	650
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.051	0.040	0.013	0.12	0.014
Sulphide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	150	150	280	320	350
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	1.6
Loss on Ignition @ 450oC	%	0.2	MCERTS	-	-	-	-	4.2
Acid Neutralisation Capacity	+/- mol/kg	-999	NONE	-	-	-	-	1.0
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Coronene	mg/kg	0.05	NONE	-	-	-	-	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-
Total WAC-17 PAHs	mg/kg	0.85	NONE	-	-	-	-	< 0.85

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957901	1957902	1957903	1957904	1957905
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	1.20	2.00	1.60	1.00
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	56
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	-	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	86
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	28
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	120
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	1.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	47
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	130
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
o-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH (C10 - C25)	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH (C25 - C40)	mg/kg	10	MCERTS	-	-	-	-	< 10
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957901	1957902	1957903	1957904	1957905
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	1.20	2.00	1.60	1.00
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957901	1957902	1957903	1957904	1957905
Sample Reference				DS1	DS2	DS3	DS4	DS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	1.20	2.00	1.60	1.00
Date Sampled				29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
PCBs by GC-MS								
PCB Congener 28	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Total PCBs by GC-MS								
Total PCBs	mg/kg	0.007	MCERTS	-	-	-	-	< 0.007

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

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957906
Sample Reference				DS1
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				29/09/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	13
Total mass of sample received	kg	0.001	NONE	1.3

Asbestos in Soil	Type	N/A	ISO 17025	-

General Inorganics

pH - Manual	pH Units	N/A	MCERTS	-
pH - Automated	pH Units	N/A	MCERTS	8.1
Total Cyanide	mg/kg	1	MCERTS	-
Total Sulphate as SO4	mg/kg	50	MCERTS	210
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.026
Sulphide	mg/kg	1	MCERTS	-
Total Sulphur	mg/kg	50	MCERTS	87
Total Organic Carbon (TOC)	%	0.1	MCERTS	-
Loss on Ignition @ 450oC	%	0.2	MCERTS	-
Acid Neutralisation Capacity	+/- mol/kg	-999	NONE	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-
Acenaphthylene	mg/kg	0.05	MCERTS	-
Acenaphthene	mg/kg	0.05	MCERTS	-
Fluorene	mg/kg	0.05	MCERTS	-
Phenanthrene	mg/kg	0.05	MCERTS	-
Anthracene	mg/kg	0.05	MCERTS	-
Fluoranthene	mg/kg	0.05	MCERTS	-
Pyrene	mg/kg	0.05	MCERTS	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-
Chrysene	mg/kg	0.05	MCERTS	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-
Coronene	mg/kg	0.05	NONE	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-
Total WAC-17 PAHs	mg/kg	0.85	NONE	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957906
Sample Reference				DS1
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				29/09/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-
Monoaromatics & Oxygenates				
Benzene	µg/kg	1	MCERTS	-
Toluene	µg/kg	1	MCERTS	-
Ethylbenzene	µg/kg	1	MCERTS	-
p & m-xylene	µg/kg	1	MCERTS	-
o-xylene	µg/kg	1	MCERTS	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-
Petroleum Hydrocarbons				
Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-
TPH (C10 - C25)	mg/kg	10	MCERTS	-
TPH (C25 - C40)	mg/kg	10	MCERTS	-
VOCs				
Chloromethane	µg/kg	1	ISO 17025	-
Chloroethane	µg/kg	1	NONE	-
Bromomethane	µg/kg	1	ISO 17025	-
Vinyl Chloride	µg/kg	1	NONE	-
Trichlorofluoromethane	µg/kg	1	NONE	-
1,1-Dichloroethene	µg/kg	1	NONE	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957906
Sample Reference				DS1
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				29/09/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-
Trichloromethane	µg/kg	1	MCERTS	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-
Benzene	µg/kg	1	MCERTS	-
Tetrachloromethane	µg/kg	1	MCERTS	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-
Trichloroethene	µg/kg	1	MCERTS	-
Dibromomethane	µg/kg	1	MCERTS	-
Bromodichloromethane	µg/kg	1	MCERTS	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-
Toluene	µg/kg	1	MCERTS	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-
Dibromochloromethane	µg/kg	1	ISO 17025	-
Tetrachloroethene	µg/kg	1	NONE	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-
Chlorobenzene	µg/kg	1	MCERTS	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-
Ethylbenzene	µg/kg	1	MCERTS	-
p & m-Xylene	µg/kg	1	MCERTS	-
Styrene	µg/kg	1	MCERTS	-
Tribromomethane	µg/kg	1	NONE	-
o-Xylene	µg/kg	1	MCERTS	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-
Isopropylbenzene	µg/kg	1	MCERTS	-
Bromobenzene	µg/kg	1	MCERTS	-
n-Propylbenzene	µg/kg	1	ISO 17025	-
2-Chlorotoluene	µg/kg	1	MCERTS	-
4-Chlorotoluene	µg/kg	1	MCERTS	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-
tert-Butylbenzene	µg/kg	1	MCERTS	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-
sec-Butylbenzene	µg/kg	1	MCERTS	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-
Butylbenzene	µg/kg	1	MCERTS	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-

Analytical Report Number: 21-90276
Project / Site name: Bolton Road Banbury
Your Order No: PO12033

Lab Sample Number				1957906
Sample Reference				DS1
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				29/09/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
PCBs by GC-MS				
PCB Congener 28	mg/kg	0.001	MCERTS	-
PCB Congener 52	mg/kg	0.001	MCERTS	-
PCB Congener 101	mg/kg	0.001	MCERTS	-
PCB Congener 118	mg/kg	0.001	MCERTS	-
PCB Congener 138	mg/kg	0.001	MCERTS	-
PCB Congener 153	mg/kg	0.001	MCERTS	-
PCB Congener 180	mg/kg	0.001	MCERTS	-

Total PCBs by GC-MS

Total PCBs	mg/kg	0.007	MCERTS	-

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

Analytical Report Number : 21-90276
Project / Site name: Bolton Road Banbury

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1957896	DS1	None Supplied	1.2	Brown clay and loam with gravel.
1957897	DS2	None Supplied	0.6	Brown clay and loam with gravel.
1957898	DS3	None Supplied	0.4	Brown clay and loam with gravel and vegetation.
1957899	DS4	None Supplied	0.5	Brown gravelly loam.
1957900	DS5	None Supplied	0.5	Brown loam and clay with gravel.
1957901	DS1	None Supplied	2	Brown clay and loam with gravel.
1957902	DS2	None Supplied	1.2	Brown clay and loam with gravel.
1957903	DS3	None Supplied	2	Brown loam and sand with gravel.
1957904	DS4	None Supplied	1.6	Brown clay and loam with gravel.
1957905	DS5	None Supplied	1	Brown clay and loam with gravel.
1957906	DS1	None Supplied	3	Brown clay and sand.

Analytical Report Number : 21-90276
Project / Site name: Bolton Road Banbury

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 21-90276
Project / Site name: Bolton Road Banbury

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

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

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

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Analytical Report Number : 21-90277

Replaces Analytical Report Number: 21-90277, issue no. 1
Report format change.

Project / Site name:	Bolton Road Banbury	**Samples received on:**	30/07/2021
Your job number:	CCL03458	**Samples instructed on/ Analysis started on:**	30/07/2021
Your order number:	PO12033	**Analysis completed by:**	09/08/2021
Report Issue Number:	2	**Report issued on:**	09/08/2021
Samples Analysed:	2 wac multi samples		

Signed: [redacted]

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results

Report No:	**21-90277**						
					Client:	**CROSSFCLTD**	
Location	**Bolton Road Banbury**						
Lab Reference (Sample Number)	1957907				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	29/09/2021				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	DS1						
Depth (m)	1.20						
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) #	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test		
(BS EN 12457 - 3 preparation utilising end over end leaching procedure)	mg/l	mg/l		mg/kg	using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.010	< 0.010		0.070	0.5	2	25
Barium *	0.013	0.029		0.27	20	100	300
Cadmium *	< 0.0005	< 0.0005		< 0.0020	0.04	1	5
Chromium *	< 0.0010	0.0018		0.017	0.5	10	70
Copper *	0.051	0.028		0.30	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	0.034	0.015		0.16	0.5	10	30
Nickel *	0.0070	0.0091		0.090	0.4	10	40
Lead *	< 0.0050	0.0062		0.059	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	0.0099	0.0143		0.14	4	50	200
Chloride *	29	8.8		110	800	15000	25000
Fluoride	0.15	0.19		1.9	10	150	500
Sulphate *	19	18		180	1000	20000	50000
TDS*	220	140		1400	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	42	16		180	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.1						
Dry Matter (%)	83						
Moisture (%)	17						
Stage 1							
Volume Eluate L2 (litres)	0.31						
Filtered Eluate VE1 (litres)	0.15						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Waste Acceptance Criteria Analytical Results

Report No:	**21-90277**						
					Client:	**CROSSFCLTD**	
Location	**Bolton Road Banbury**						
Lab Reference (Sample Number)	1957908				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	29/09/2021				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	DS5						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	-				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	-				6000	--	--
Sum of PCBs (mg/kg) **	-				1	--	--
Mineral Oil (mg/kg) #	-				500	--	--
Total PAH (WAC-17) (mg/kg)	-				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test		
(BS EN 12457 - 3 preparation utilising end over end leaching procedure)	mg/l	mg/l		mg/kg	using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.010	< 0.010		< 0.050	0.5	2	25
Barium *	0.012	0.010		0.10	20	100	300
Cadmium *	< 0.0005	< 0.0005		0.0030	0.04	1	5
Chromium *	< 0.0010	0.0023		0.022	0.5	10	70
Copper *	0.051	0.058		0.57	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	0.012	0.011		0.11	0.5	10	30
Nickel *	0.0026	0.0026		0.026	0.4	10	40
Lead *	< 0.0050	< 0.0050		< 0.020	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	0.018	0.0106		0.11	4	50	200
Chloride *	< 4.0	< 4.0		17	800	15000	25000
Fluoride	0.70	0.67		6.7	10	150	500
Sulphate *	7.0	9.7		95	1000	20000	50000
TDS*	99	80		810	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	9.1	5.6		59	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.90						
Dry Matter (%)	86						
Moisture (%)	14						
Stage 1							
Volume Eluate L2 (litres)	0.32						
Filtered Eluate VE1 (litres)	0.16						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

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Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 21-90277
Project / Site name: Bolton Road Banbury

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1957907	DS1	None Supplied	1.2	Brown clay and loam with gravel.
1957908	DS5	None Supplied	1	Brown clay and loam with gravel.

Analytical Report Number : 21-90277
Project / Site name: Bolton Road Banbury

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Preparation WAC leachate		In-house method	L043-PL	W	NONE
Chloride in WAC leachate (BS EN 12457-3 Prep)	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride in WAC leachate (BS EN 12457-3 Prep)	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L033-PL	W	ISO 17025
Phenol Index in WAC leachate (BS EN 12457-3 Prep)	Determination of monohydric phenols in leachate by continuous flow analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Sulphate in WAC leachate (BS EN 12457-3 Prep)	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025
TDS in WAC leachate (BS EN 12457-3 Prep)	Determination of total dissolved solids in leachate by electrometric measurement.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L031-PL	W	NONE
DOC in WAC leachate (BS EN 12457-3 Prep)	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L037-PL	W	NONE
Metals in WAC leachate (BS EN 12457-3 Prep)	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025

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

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

TEST CERTIFICATE

Liquid and Plastic Limits

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

4041

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

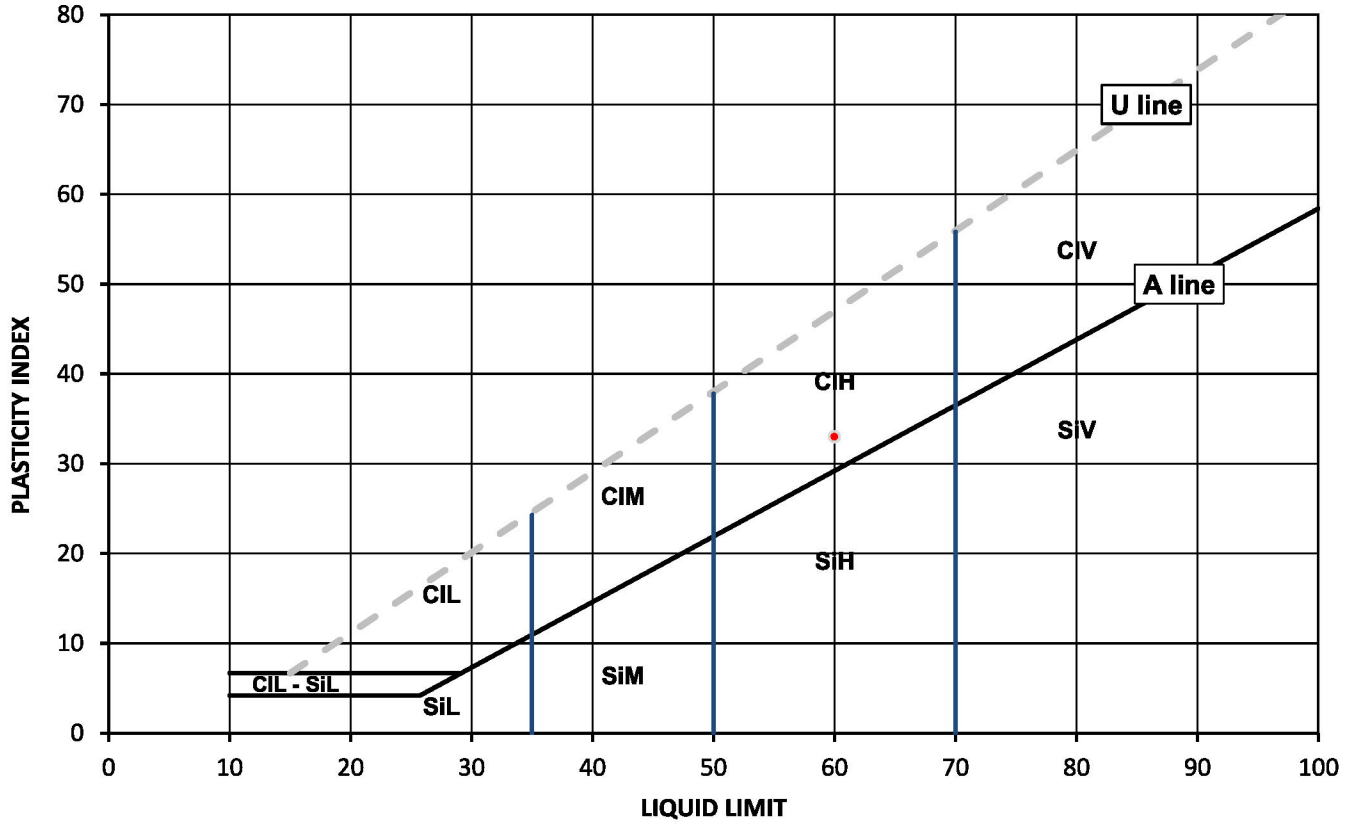
Client:	Crossfield Consulting Ltd	Client Reference:	CCL03458
Client Address:	The Granary, White Hall Farm, Leamington Road, Long Itchington, Warwickshire, CV47 9PU	Job Number:	21-90884
		Date Sampled:	29/07/2021
		Date Received:	30/07/2021
Contact:	Jasmine Hall	Date Tested:	07/08/2021
Site Address:	Bolton Road Banbury	Sampled By:	Not Given

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

Test Results:

Laboratory Reference:	1961965	Depth Top [m]:	1.00
Hole No.:	DS2	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Yellowish brown slightly gravelly CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
29	60	27	33	83



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

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

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

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 13/08/2021

GF 236.10

TEST CERTIFICATE

Liquid and Plastic Limits

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

4041

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

Client:	Crossfield Consulting Ltd	Client Reference:	CCL03458
Client Address:	The Granary, White Hall Farm, Leamington Road, Long Itchington, Warwickshire, CV47 9PU	Job Number:	21-90884
		Date Sampled:	29/07/2021
		Date Received:	30/07/2021
Contact:	Jasmine Hall	Date Tested:	07/08/2021
Site Address:	Bolton Road Banbury	Sampled By:	Not Given

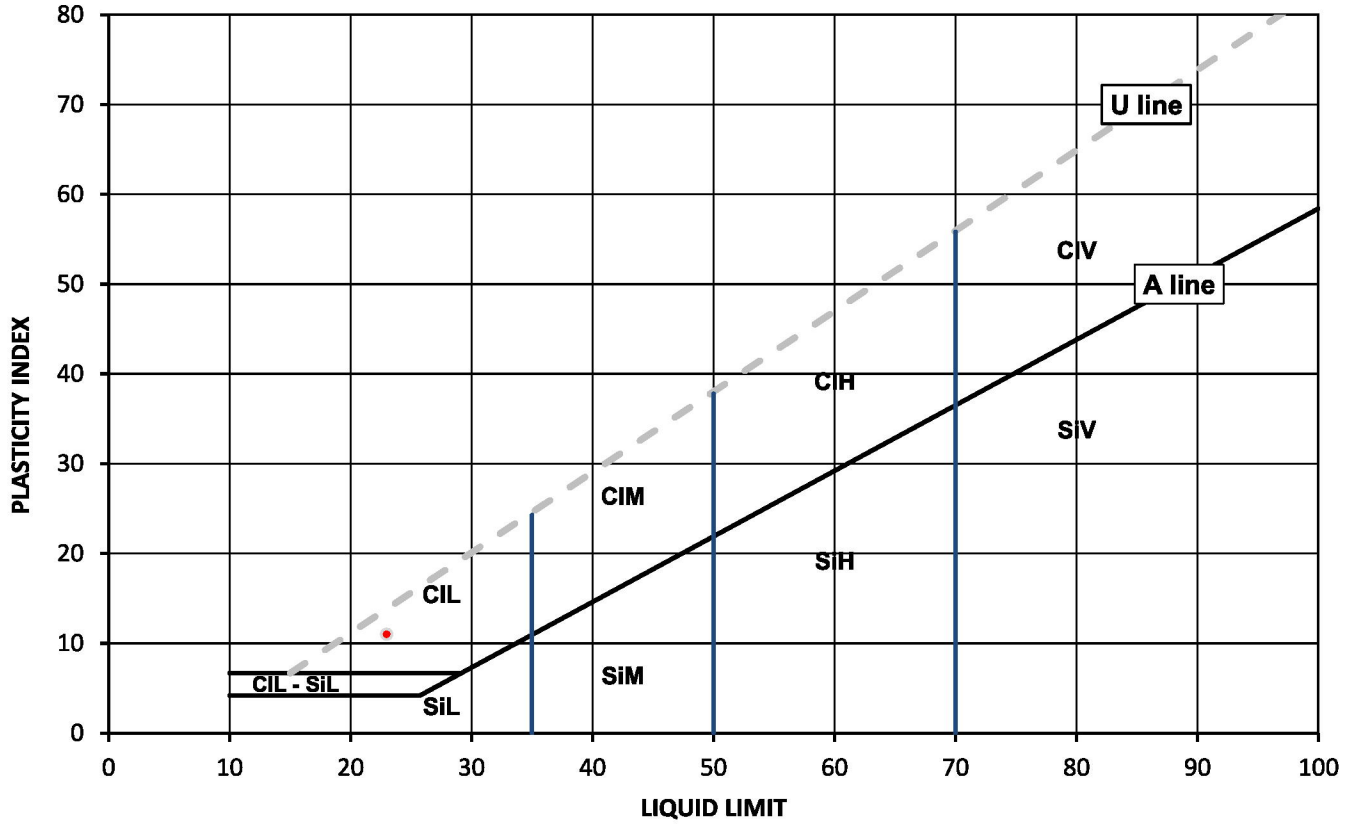
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1961966	Depth Top [m]:	1.20
Hole No.:	DS3	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brown slightly gravelly clayey SAND		

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
17	23	12	11	82



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

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

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

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 13/08/2021

GF 236.10

TEST CERTIFICATE

Liquid and Plastic Limits

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

4041

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

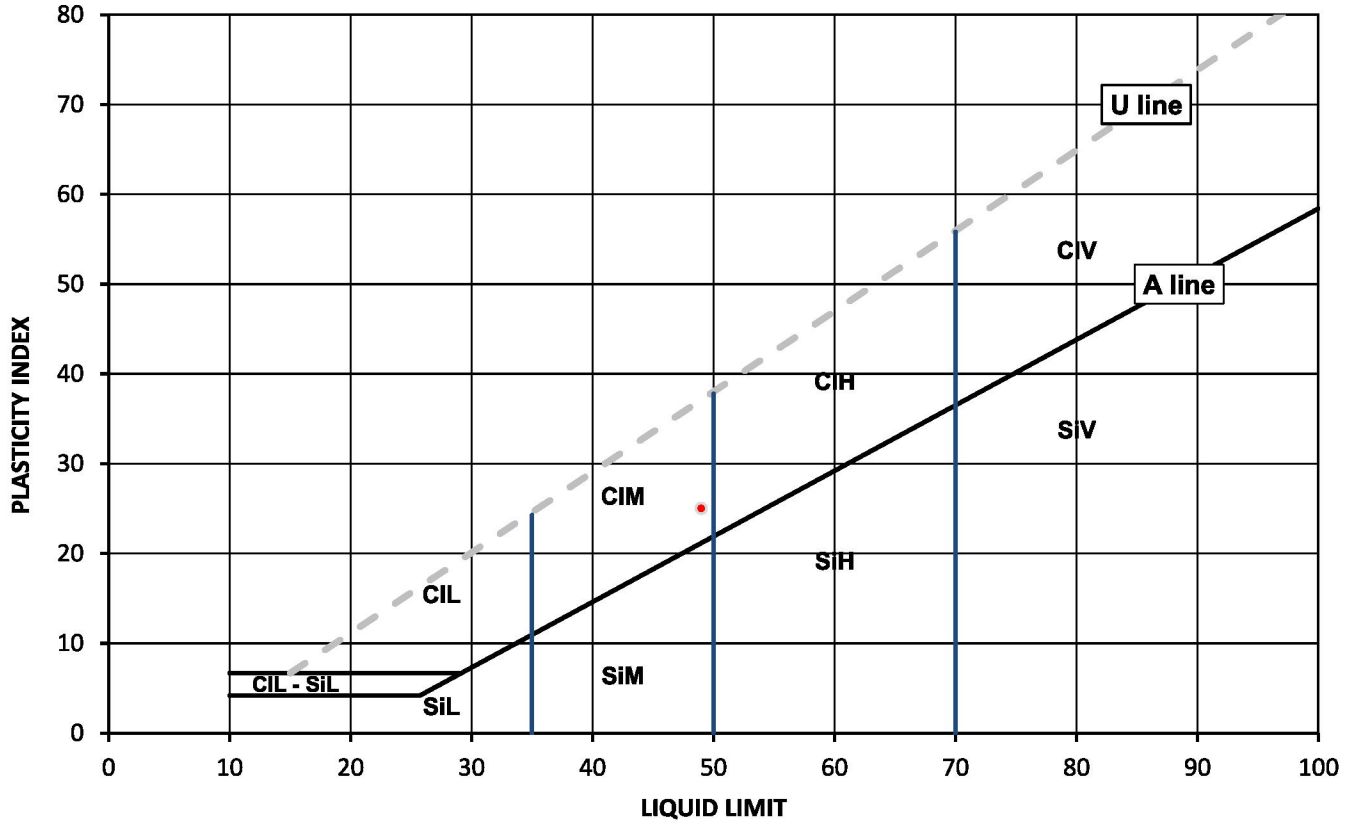
Client:	Crossfield Consulting Ltd	Client Reference:	CCL03458
Client Address:	The Granary, White Hall Farm, Leamington Road, Long Itchington, Warwickshire, CV47 9PU	Job Number:	21-90884
		Date Sampled:	29/07/2021
		Date Received:	30/07/2021
Contact:	Jasmine Hall	Date Tested:	07/08/2021
Site Address:	Bolton Road Banbury	Sampled By:	Not Given

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

Test Results:

Laboratory Reference:	1961967	Depth Top [m]:	1.60
Hole No.:	DS4	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
23	49	24	25	88



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

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

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

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 13/08/2021

GF 236.10

SUMMARY REPORT

Summary of Classification Test Results

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

4041

Tested in Accordance with:

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

Client: Crossfield Consulting Ltd

Client Address: The Granary, White Hall Farm, Leamington Road, Long Itchington, Warwickshire, CV47 9PU

Contact: Jasmine Hall

Site Address: Bolton Road Banbury

Client Reference: CCL03458
Job Number: 21-90884
Date Sampled: 29/07/2021
Date Received: 30/07/2021
Date Tested: 07/08/2021
Sampled By: Not Given

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

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top m	Depth Base m	Type			%	%	% Passing 425um %	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3	%		
1961965	DS2	Not Given	1.00	Not Given	D	Yellowish brown slightly gravelly CLAY	Atterberg 4 Point	29		83	60	27	33						
1961966	DS3	Not Given	1.20	Not Given	D	Brown slightly gravelly clayey SAND	Atterberg 4 Point	17		82	23	12	11						
1961967	DS4	Not Given	1.60	Not Given	D	Brown slightly gravelly slightly sandy CLAY	Atterberg 4 Point	23		88	49	24	25						

Note: # Non accredited; NP - Non plastic

Comments:

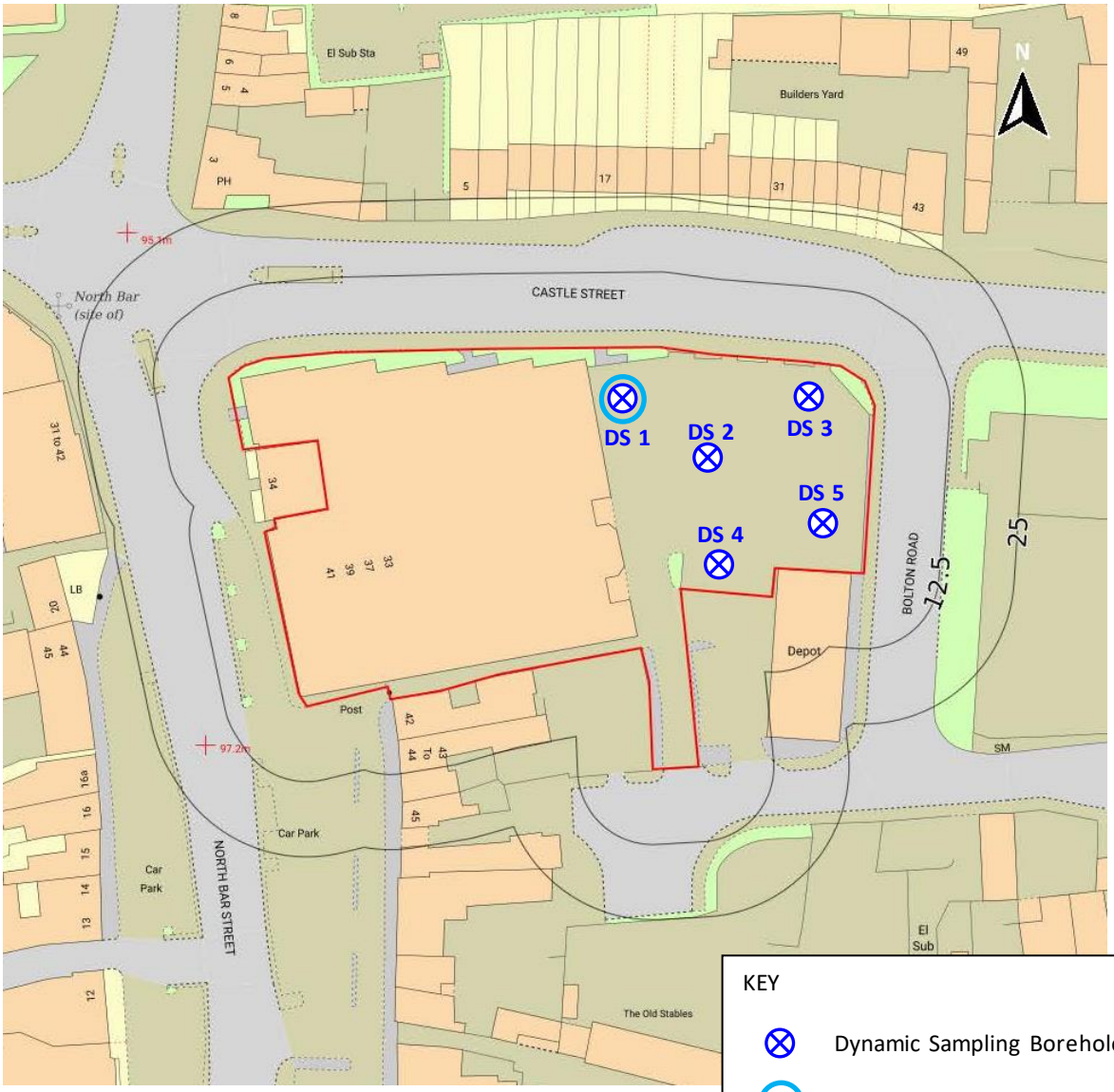
Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 13/08/2021

GF 238.12

FIGURE I-1



EXPLORATORY HOLE LOCATION PLAN

Scale 1:1250

APPENDIX II

APPENDIX II – QUANTITATIVE RISK ASSESSMENT: HUMAN HEALTH - APARTMENTS

Contaminated Land Exposure Assessment Model v1.071

A site-specific risk assessment, with respect to human health considerations, has been undertaken due to the concentrations of the metals arsenic and lead recorded at levels above the generic assessment criteria (GAC).

The model has been set up on the basis that the proposed development comprises apartments, for residents of retirement age. The development will have managed landscaping such that there will be no private gardens and residents will not be permitted to cultivate the ground. The pollutant linkages considered are compatible with the published criteria for a residential development without plant uptake. It is noted that the risk assessment model presumes that the soil associated with the substance will be exposed at the surface following completion of the development. However, as the soft landscaped areas will comprise entirely grassed and mulched ornamental planting areas, which will be tended by landscaping contractors as part of a maintenance agreement, it is considered that there will be no exposure route relating to home grown produce or long-term direct dermal soil contact. The CLEA model has been set up for an age class of 18, which is appropriate for end users of retirement age as the critical risk receptor. The soil organic matter and pH parameters have been determined from average site data.

The model parameters, exposure route analysis and the summary of results for the relevant compounds are presented in this Appendix. The output data are summarised as follows:

Substance	Maximum Concentration (mg/kg)	Concentration Range (mg/kg)	Site Specific Assessment Criteria (SSAC) (mg/kg)	Maximum Concentration Exceeds SSAC? [1]	No. of Samples that Exceed SSAC
Arsenic	56	13 – 56	410	No	0
Lead	360	15 – 360	1480	No	0

Notes

1. Where the maximum concentration does not exceed the SSAC, risks to end users are considered to be negligible and, therefore, no further assessment is required. For compounds with a maximum concentration above the SSAC, further consideration of risks or remediation may be required. See Section 7.

CLEA Software Version 1.071

Report generated 12/08/2021

Report title Bolton Road, Banbury

Created by JH at Crossfield Consulting Limited

BASIC SETTINGS

Land Use Residential without produce

Building Apartment - Large
Receptor Female (res) Start age class 18 End age class 18 Exposure Duration 10 years
Soil Sandy clay loam

Exposure Pathways

Direct soil and dust ingestion	✓	Dermal contact with indoor dust	✓	Inhalation of indoor dust	✓
Consumption of homegrown produce	✖	Dermal contact with soil	✖	Inhalation of soil dust	✓
Soil attached to homegrown produce	✖			Inhalation of indoor vapour	✓
				Inhalation of outdoor vapour	✓

Environment Agency

Land Use Residential without produce **Receptor** Female (res)

Age Class	Exposure Frequencies (days yr^{-1})						Occupation Periods (hr day^{-1})		Soil to skin adherence factors (mg cm^{-2})		Direct soil ingestion rate (g day^{-1})	Body weight (kg)	Body height (m)	Inhalation rate (m^3 day^{-1})	Max exposed skin factor		Total skin area (m^2)
	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with indoor dust	Dermal contact with soil	Inhalation of dust and vapour, indoor	Inhalation of dust and vapour, outdoor	Indoors	Outdoors	Indoor	Outdoor					Indoor (m^2 m^{-2})	Outdoor (m^2 m^{-2})	
1	180	0	180	180	365	365	23.0	1.0	0.06	1.00	0.10	5.60	0.7	8.5	0.32	0.26	3.43E-01
2	365	0	365	365	365	365	23.0	1.0	0.06	1.00	0.10	9.80	0.8	13.3	0.33	0.26	4.84E-01
3	365	0	365	365	365	365	23.0	1.0	0.06	1.00	0.10	12.70	0.9	12.7	0.32	0.25	5.82E-01
4	365	0	365	365	365	365	23.0	1.0	0.06	1.00	0.10	15.10	0.9	12.2	0.35	0.28	6.36E-01
5	365	0	365	365	365	365	19.0	1.0	0.06	1.00	0.10	16.90	1.0	12.2	0.35	0.28	7.04E-01
6	365	0	365	365	365	365	19.0	1.0	0.06	1.00	0.10	19.70	1.1	12.2	0.33	0.26	7.94E-01
7	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	22.10	1.2	12.4	0.22	0.15	8.73E-01
8	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	25.30	1.2	12.4	0.22	0.15	9.36E-01
9	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	27.50	1.3	12.4	0.22	0.15	1.01E+00
10	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	31.40	1.3	12.4	0.22	0.15	1.08E+00
11	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	35.70	1.4	12.4	0.22	0.14	1.19E+00
12	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	41.30	1.4	13.4	0.22	0.14	1.29E+00
13	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	47.20	1.5	13.4	0.22	0.14	1.42E+00
14	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	51.20	1.6	13.4	0.22	0.14	1.52E+00
15	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	56.70	1.6	13.4	0.21	0.14	1.60E+00
16	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	59.00	1.6	13.4	0.21	0.14	1.63E+00
17	0	0	0	0	0	0	0.0	0.0	0.00	0.00	0.00	70.00	1.6	14.8	0.33	0.27	1.78E+00
18	**365**	**365**	**365**	**170**	**365**	**365**	**16.0**	**1.0**	**0.06**	**0.30**	**0.05**	70.90	1.6	**17.4**	0.33	0.27	1.80E+00

Consumption Rates

Consumption rates (g FW kg^{-1} bodyweight day^{-1}) by Produce Group

Age Class	MEAN RATES						90TH PERCENTILE RATES					
	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit	Green veg	Root veg	Tuber veg	Herb. Fruit	Shrub fruit	Tree fruit
1							7.12E+00	1.07E+01	1.60E+01	1.83E+00	2.23E+00	3.82E+00
2							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
3							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
4							6.85E+00	3.30E+00	5.46E+00	3.96E+00	5.40E-01	1.20E+01
5							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
6							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
7							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
8							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
9							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
10							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
11							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
12							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
13							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
14							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
15							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
16							3.74E+00	1.77E+00	3.38E+00	1.85E+00	1.60E-01	4.26E+00
17							2.94E+00	1.40E+00	1.79E+00	1.61E+00	2.20E-01	2.97E+00
18							2.94E+00	1.40E+00	1.79E+00	1.61E+00	2.20E-01	2.97E+00

Top 2 applied? No

Where top 2 method is applied, two produce categories use 90th percentile rates, while the remainder use the mean. Produce categories vary on a chemical-by-chemical basis. Where top 2 method is not used, all produce categories for all chemicals assume 90th percentile rates.

Building Apartment - Large

Soil Sandy clay loam

Building footprint (m^2)	8.00E+01
Living space air exchange rate (hr^{-1})	5.00E-01
Living space height (above ground, m)	2.50E+00
Living space height (below ground, m)	0.00E+00
Pressure difference (soil to enclosed space, Pa)	3.10E+00
Foundation thickness (m)	1.50E-01
Floor crack area (cm^2)	2.56E+03
Dust loading factor ($\mu g\ m^{-3}$)	5.00E+01

Porosity, Total ($cm^3\ cm^{-3}$)	5.30E-01
Porosity, Air-Filled ($cm^3\ cm^{-3}$)	1.60E-01
Porosity, Water-Filled ($cm^3\ cm^{-3}$)	3.70E-01
Residual soil water content ($cm^3\ cm^{-3}$)	1.50E-01
Saturated hydraulic conductivity ($cm\ s^{-1}$)	2.37E-03
van Genuchten shape parameter *m* (dimensionless)	3.10E-01
Bulk density ($g\ cm^{-3}$)	1.20E+00
Threshold value of wind speed at 10m ($m\ s^{-1}$)	7.20E+00
Empirical function (F_x) for dust model (dimensionless)	1.22E+00
Ambient soil temperature (K)	2.83E+02
Soil pH	8.00E+00
Soil Organic Matter content (%)	1.00E+00
Fraction of organic carbon ($g\ g^{-1}$)	5.80E-03
Effective total fluid saturation (unitless)	5.79E-01
Intrinsic soil permeability (cm^2)	3.16E-08
Relative soil air permeability (unitless)	5.78E-01
Effective air permeability (cm^2)	1.83E-08

Soil - Vapour Model

Depth to top of source (no building) (cm)	0
Depth to top of source (beneath building) (cm)	65
Default soil gas ingress rate?	Yes
Soil gas ingress rate ($cm^3\ s^{-1}$)	2.50E+01
Building ventilation rate ($cm^3\ s^{-1}$)	2.78E+04
Averaging time surface emissions (yr)	10
Finite vapour source model?	No
Thickness of contaminated layer (cm)	200

Air Dispersion Model

Mean annual windspeed at 10m ($m\ s^{-1}$)		5.00
Air dispersion factor at height of 0.8m *		2400.00
Air dispersion factor at height of 1.6m *		0.00
Fraction of site cover ($m^2\ m^{-2}$)		0.75

* Air dispersion factor in $g\ m^{-2}\ s^{-1}$ per $kg\ m^{-3}$

Soil - Plant Model

	Dry weight conversion factor	Homegrown fraction		Soil loading factor	Preparation correction factor
		Average	High		
	$g\ DW\ g^{-1}\ FW$	dimensionless		$g\ g^{-1}\ DW$	dimensionless
Green vegetables	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	0.103	0.06	0.40	1.00E-03	1.00E+00
Tuber vegetables	0.210	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	0.058	0.06	0.40	1.00E-03	6.00E-01
Shrub fruit	0.166	0.09	0.60	1.00E-03	6.00E-01
Tree fruit	0.157	0.04	0.27	1.00E-03	6.00E-01

Gardener type None

CLEA Software Version 1.071

Report generated 12-Aug-21

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Created by JH at Crossfield Consulting Limited

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Arsenic (S4UL)	4.11E+02	4.81E+02	NR	1.00	0.85	NR	NR	No	No	No	0	0	0	0	0	0
2	Lead (C4SL adult)	1.48E+03	NR	NR	1.00	NR	NR	NR	No	No	No	Yes	No	Yes	No	No	No
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Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Arsenic (S4UL)	99.9	0.1	0.0	100.0	4.11E+02	NR	2.05E+02	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA	NA	NA
2	Lead (C4SL adult)	100.0	0.0	0.0	100.0	1.48E+03	NR	7.40E+02	6.30E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA	NA	NA
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Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Arsenic (S4UL)	2.90E-04	0.00E+00	1.03E-05	1.71E-06	0.00E+00	0.00E+00	0.00E+00	96.56	0.00	3.44	0.00	0.00	0.00	0.00	0.00
2	Lead (C4SL adult)	6.26E-04	0.00E+00	0.00E+00	3.94E-06	0.00E+00	0.00E+00	0.00E+00	99.37	0.00	0.00	0.63	0.00	0.00	0.00	0.00
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Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Inhalation Health Criteria Value ($\mu g\ kg^{-1}\ BW\ day^{-1}$)		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{OC} ($cm^3\ g^{-1}$)	log K_{OW} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Arsenic (S4UL)	ID	0.3	ID	0.002	NR	NR	NR	NR	NR	NR	NR	0.03	0.5	1	1	1
2	Lead (C4SL adult)	ID	0.63	NR	0	NR	NR	NR	NR	NR	NR	NR	0	0.5	1	0.6	0.64
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Environment Agency

		Soil-to-water partition coefficient ($cm^3 g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Arsenic (S4UL)	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 dw	0.00033 fw	0.0002 fw	0.0011 fw
2	Lead (C4SL adult)	1.00E+03	NR	2.96E+05	0.00419 fw	0.00402 fw	0.00731 fw	0.00074 fw	0.00020 fw	0.00022 fw
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