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Remediation Strategy

Residential Redevelopment

Barrington Road, Worthing

May 2023



Industrial Development

Document Title: Remediation Strategy

Document no.: STV5959-R01-Rev_C

Date: May 2023

Client: Bellway Homes Limited

Issuing office: Soiltechnics Ltd
Cedar Barn, White Lodge, Walgrave, Northampton. NN6 9PY
Tel: 01604 781 877 E-mail: mail@soiltechnics.net

Document history and status

Revision	Date	Description	Author	Checker	Reviewer
A	February 2023	First Issue	CR	KB	MOH
B	March 2023	Second Issue	CR	KB	MOH
C	May 2023	Inclusion of basic radon protection	CR	MOH	MOH

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Drawing Register

Title	Produced by	Date	Reference
Exploratory Hole Location Plan (current layout)	Soiltechnics	February 2021	STS5226-D02
Exploratory Hole Location Plan (proposed layout)	Soiltechnics	January 2021	STV5959-D03-A
Indicative Further Testing Plan	Soiltechnics	January 2023	STV5959-D02-A

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1 Introduction

1.1 Scheme Outline

- 1.1.1 We understand the scheme will comprise the demolition of existing commercial buildings (former HM Revenues and Customs) and construction of a residential development comprising a mixture of houses, apartments and a care home. Plans of the existing and proposed site layout are provided within Appendix A. Approximately, this comprises of 139 residential plots, 4 blocks of flats, and a care home.
- 1.1.2 It is understood that the development is controlled under the Worthing Borough Council planning regime, under the planning application number AWDM/0605/22.
- 1.1.3 The report is based on the project proposals and information outlined above; should the scheme change then it will be necessary to review the report.

1.2 Site Setting

- 1.2.1 The site is situated in a predominantly residential area of Goring-by Sea, west Worthing, with access granted off Barrington Road. Essentially, the site comprises a vacant office complex. An area of undeveloped scrubland is present to the southwest, which was previously part of the site boundary, but which is to now be developed under a separate planning application.
- 1.2.2 Historically the site was a brickworks until it was redeveloped for Inland Revenue Offices by c1953. A chimney and tanks were recorded in the centre of the site from 1967-68. The western most buildings were demolished by 2002 to make way for the existing car park.
- 1.2.3 The site is bound by a railway line to the north, and Barrington Road to the south, beyond which lies residential housing. A commercial building and car park border the site to the east and residential housing and undeveloped land border the site to the west.

1.3 Brief

- 1.3.1 This report has been prepared following instructions received from our client, Bellway Homes Limited. This report details a Remediation Strategy to support the proposed residential development at the former HM Revenues and Customs, Barrington Road, Worthing, West Sussex.
- 1.3.2 Compliance with condition 26 of the planning application requires the submission of a Remediation Strategy to deal with the risks associated with contamination of the site in respect of the development. The condition states that the strategy should include:
- A site investigation scheme for further investigations following demolition,
 - An options appraisal and remediation strategy based on the findings of risk assessments carried out.
 - A verification plan.
- 1.3.3 The Remediation Strategy will be carried out following the principles of BS10175: 2011+A2:2017 'Investigation of potentially contaminated sites – Code of Practice' and the Environment Agency's Land Contamination Risk Management guidance.

1.4 Aims and Objectives

1.4.1 The principal aim of this report is to satisfy the brief outlined above and thereby provide information to facilitate the safe development of the project. The objectives of this report are outlined below:

- i. Confirm if sufficient information is available to inform the remediation.
- ii. Set out a site investigation scheme where further investigation works are required.
- iii. State the relevant pollutant linkages which require remediation.
- iv. Identify a feasible remediation option to break the pollutant linkages.
- v. Set remediation objectives and criteria.
- vi. Outline how the remediation will be implemented.
- vii. Identify any monitoring and maintenance requirements.
- viii. Establish a verification plan.
- ix. Recommend any further works.

1.5 Limitations

1.5.1 Soiltechnics disclaims any responsibility to our Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence in accordance with the terms of our contract, taking account of the resources devoted to it by agreement with our Client. This report is confidential to our Client and Soiltechnics accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

1.6 Options Appraisal

1.6.1 In the context of the proposed development and the nature of the relevant pollutant linkages identified, an Options Appraisal is not considered necessary at this stage.

2 Site Conditions and Identified Contamination

2.1 Sources of information

2.1.1 Reference has been made to the following sources of information.

Author	Document Title	Date & Document Reference	Report Context
Ashdown Ground Investigation Limited	Combined Geotechnical and Ground Contamination Risk Assessment	December 2018 R18-13236	Preliminary geoenvironmental risk assessment, an assessment of ground conditions and a geotechnical appraisal
Soiltechnics	Ground Investigation Report	April 2021 STS5226-G01-Rev_A	The objective of this investigation was to undertake supplementary works to address outstanding geotechnical and contamination concerns at the site.
Soiltechnics	Piling Risk Assessment	February 2023 STV5959-R02	The overall brief of works is to complete a piling risk assessment in order to satisfy planning condition 29 of the planning application.
Soiltechnics	Supplementary Ground Investigation Report	May 2023 STV5959-R03 Rev A	The previous ground investigation works identified some data gaps which required further investigation once access into previously unexplored areas of the site was facilitated.

Table 2-A: Summary of previous reports

2.1.2 The recommendations made within this preliminary Remediation Strategy are based on ground investigations completed to date, detailed in the above reports. It is acknowledged that additional works are required as detailed within the Soiltechnics Ground Investigation Report (ref: STS5226-G01-Rev A, dated April 2021).

2.1.3 A reassessment to assess if any additional remediation measures is required upon completion of further works.

2.2 Ground Conditions Encountered

2.2.1 The ground conditions encountered are summarised in the table below.

Strata	Summary	Depth to Base (m)	Groundwater
Topsoil	Slightly gravelly very sandy CLAY (gravels of brick, pottery, and clinker within some parts of the site)	0.10-0.40	None observed
Made Ground	Orangish brown slightly gravelly clay (gravels of flint, brick, concrete, charcoal, clinker, chalk, glass and ash)	0.40-1.80	None observed
River Terrace Deposits	Firm to very stiff slightly gravelly clay and, medium dense to dense sands and gravels within the southern and western parts of the site	5.00-7.00	From 5.22
		1.90-2.60	
White Chalk Subgroup	Off-white clayey gravels with cobbles (eastern and western parts of the site)	4.40 - 4.80m	As above (saturated)

Table 2-B: Ground conditions encountered during Soiltechnics investigation

2.3 Groundwater

- 2.3.1 Groundwater was encountered within deep boreholes during the Soiltechnics ground investigation at depths of between 5.22m and 8.50m bgl.

2.4 Contamination Encountered

- 2.4.1 Both the Ashdown and Soiltechnics reports noted sporadic elevated levels of PAHs and metals within the Made Ground deposits following soil testing. In addition, asbestos fibres were identified in Made Ground local to the existing facilities maintenance compounds although given the variability of the Made Ground, its presence elsewhere could not be discounted.
- 2.4.2 The risk assessment concluded that while sporadic, due to the sensitivity of the development proposals, contaminant levels could pose an unacceptable level of risk to proposed end users, and therefore requires remediation.

2.5 Underground Tanks and Sub-stations

- 2.5.1 The site reconnaissance identified an interceptor tank in the south-western corner of the site. Samples from one borehole excavated adjacent to the interceptor did not contain any elevated concentrations of TPH or BTEX. However, the presence below the tank cannot be discounted.
- 2.5.2 Similarly, a sub-station was noted in the south-east of the site. Although no PCBs were detected in samples taken from a borehole adjacent to the sub-station, localised contamination in this area, particularly below the sub-station, cannot be fully discounted.

2.6 Adjacent Gas Holder

- 2.6.1 Land to the immediate west of the site is currently disused but historical maps indicate a gas holder was present until around 2010. Excavations, boreholes and gas and groundwater monitoring have not detected any evidence of contamination migrating from the site.

2.7 Ground Gas Conditions Encountered

- 2.7.1 Basic radon protection measures are required for all new properties.
- 2.7.2 No ground gas protection measures are required for carbon dioxide, methane or hydrocarbon vapours.

3 Site Considerations

3.1 Unexploded Ordnance

- 3.1.1 Worthing was subject to a moderate level of bombing during WWII and at least one highly explosive bomb strike was recorded on land to the west of the site. A UXO specialist attended site during intrusive investigations.
- 3.1.2 It is understood that a Detailed UXO Risk Assessment Report has subsequently been obtained for the site to determine the risk for the construction phase. The report indicates a low risk within the development site.
- 3.1.3 All stakeholders must be made aware of the UXO risk levels and the potential impact on the project, and UXO Safety Induction Training should be provided for all site workers.

3.2 Adjacent Residents

- 3.2.1 Residential and commercial properties are present adjacent to the east, south and west of the site. Whilst they are not currently considered to be put at an unacceptable risk by the development of the site, dust suppression measures should be maintained throughout all demolition and construction phases.
- 3.2.2 No significant odours are anticipated to be generated as a result of the works.

3.3 Dust Control Measures

- 3.3.1 Standard dust control measures should be always maintained across the site, including the dampening down of roadways, materials stockpiles, and any screening or crushing areas.
- 3.3.2 Stockpiles should be bladed down to reduce infiltration and minimise dust infiltration.
- 3.3.3 Routine dust monitoring is not considered necessary, except for any crushing activities; however, the Principal Contractor may wish to conduct such monitoring for reassurance and due diligence purposes.

3.4 Wastewater Disposal

- 3.4.1 Wastewater generated from site operations will require off-site disposal via tankers, or to sewer. Any disposal to sewer must be made under prior consent with the water authority by the operator.
- 3.4.2 The sewage operator must be consulted prior to mobilisation to obtain a discharge consent, along with establishing any compliance and monitoring targets.

3.5 Soil Resources

- 3.5.1 Due to extensive hardstanding present across the current site and the requirement to raise development levels, there is considered to be limited soils present which would be suitable as a growing medium in proposed soft landscaping. Therefore, suitable growing mediums will require importing to support the landscaping scheme.
- 3.5.2 A Materials Management Plan is anticipated to be undertaken to facilitate the transfer of suitable soils from off-site developments.

4 Outline Remediation Strategy

4.1 General

- 4.1.1 This Remediation Strategy only considers the process of remedial action in terms of addressing contamination recognised to date.
- 4.1.2 If, following the recommended further ground investigation or during development, contamination not previously identified is found to be present, then further assessment and a supplementary strategy will be required.
- 4.1.3 Sampling and laboratory analysis associated with the recommended remediation will be undertaken following nationally recognised guidelines and standards that are appropriate at the point of investigation.
- 4.1.4 Laboratory analysis must be commissioned with testing houses that are suitably experienced and are MCERTS accredited with a quality assurance system.

4.2 Relevant Pollutant Linkages

- 4.2.1 The relevant pollutant linkages identified within the previous Ground Investigation Report are as follows:

Source	Pathway	Receptor
Asbestos fibres within the Made Ground	Disturbance and inhalation of dusts	Construction workers during demolition /development End users
Elevated metals and PAHs within the Made Ground.	Dermal contact, inhalation and ingestion of soils and dusts.	Construction workers during demolition /development End users
Radon	Accumulation and inhalation	End users

Table 4-A: Established relevant pollutant linkages from previous reports.

4.3 Outline Remediation strategy

- 4.3.1 The remediation strategy has been determined in view of the previous ground investigation report findings and the proposed development scheme. It can be summarised as follows:
- Prepare a discovery strategy in the event of encountering unexpected or previously unencountered contamination.
 - Installation of barrier pipe for underground drinking water infrastructure where they are in contact with the Made Ground.
 - Importing of soils for use as fill and in the proposed soft landscaped areas.
 - Install a cover system in proposed soft landscaped areas to prevent end user exposure to identified contamination.
 - Install basic Radon Protection measures.
 - Provide a scope of works for further investigation

5 Discovery Strategy

5.1 General

- 5.1.1 With the development of any site, there is a residual risk of contamination being found that is unexpected or has not been previously encountered.
- 5.1.2 As a precaution, the Principal Contractor should adopt the contamination Discovery Strategy, contained within Appendix B, for dealing with unexpected contamination.
- 5.1.3 Accompanying the Discovery Strategy is a procedure to follow in the event of encountering any underground storage tanks.

6 Asbestos Controls for Construction Workers

6.1 General

- 6.1.1 Asbestos is present on site, and has been encountered sporadically at very low or trace concentrations. Based on the findings from all ground investigation phases, asbestos not pose a significant risk to construction workers. No special precautions are required, beyond adhering to good working practices for developing brownfield sites.
- 6.1.2 As with any brownfield site, there is the potential to encounter unexpected contamination during development, this could include gross asbestos contamination.

7 Drinking Water Infrastructure

7.1 General

- 7.1.1 Protective barrier pipe is recommended for all new below-ground water supply pipes (Protectaline or similar) where in contact with Made Ground.
- 7.1.2 Where existing water pipes are to remain in use, these should be upgraded to ensure the same level of protection is in place across the site.
- 7.1.3 The local water authority (Southern Water) should be consulted to inform them of the risk assessment, and to obtain their approval.

7.2 Verification Strategy

- 7.2.1 This is to be validated by the Contractor through the provision of delivery tickets showing protective barrier pipe has been delivered to site and by providing photographs showing the subsequent installation.
- 7.2.2 Southern Water should also be consulted to determine any further verification requirements.

8 Soils and Material Compliance

8.1 Material Sourcing

- 8.1.1 A clean cover system is required within the development and limited suitable soils are present on site. Therefore, soils will require importing to support the proposed landscaping scheme.
- 8.1.2 It is understood that as part of the development site levels are to be raised by approximately 1m. Therefore, fill materials are expected to be imported to site facilitate construction.
- 8.1.3 Site-won natural and Made Ground materials are also likely to be utilised as general fill. However, they are considered unsuitable for use as a growing medium within soft landscaping areas and require capping.

8.2 Contractor Pre-delivery Compliance Checks

- 8.2.1 The Contractor should confirm the origin of all imported materials and request available chemical testing results from suppliers prior to delivery, to provide confidence of suitability.

8.3 Contractor Requirements Upon Delivery

- 8.3.1 The source and volume of all imported fill and soil materials used in the development must be clearly documented, with records provided for inclusion in the Verification Report.
- 8.3.2 The contractor should take and provide a series of site photographs to evidence the laying of clean soils on site.
- 8.3.3 For all imported materials, the Principal Contractor should maintain records sufficient to evidence the following:
- The supplier
 - Material source (address)
 - Material origin (e.g. virgin material, recycled, manufactured)
 - Material type (e.g. topsoil, subsoil, recycled aggregate, 6F2, etc.)
 - The overall volume of each material type imported.
 - Delivery dates.
 - The overall volume of each material type imported, as part of each batch.
 - Inspection records of the materials to confirm the physical, visual, and olfactory suitability of the material, at the following frequencies:
 - **Clean cover soils:** An inspection of every other delivery of landscaping soil (1 in 2).
 - **Fill materials:** An inspection of each “batch” of fill materials.
- 8.3.4 A ‘batch’, in the context used above can comprise of multiple deliveries from the same source, delivered over consecutive days for a period of no more than one working week.

8.4 Material Suitability Criteria

- 8.4.1 All imported soils and fill material should be inspected and tested to confirm they are chemically and physically suitable for use, in terms of the risks to human health.
- 8.4.2 The physical composition of materials must be free of harmful and injurious artefacts (such as sharps), over-sized materials (such as cobbles and boulders) and show no visual or olfactory evidence of contamination.
- 8.4.3 Materials should also be chemically suitable, with concentrations of contaminants falling within widely recognised and published soil guideline values (such as the C4SLs and S4ULs), with the following model being applied.
- Residential with plant uptake, at 2.5% SOM.
- 8.4.4 No bulk ACM materials should be present. Asbestos fibres, if present, should be quantified and be found at concentrations of less than 0.001%.

8.5 Unsuitable Materials

- 8.5.1 If an inspection of a materials proves or suspects it to be unsuitable, the load should be quarantined on site, pending collection or off-site disposal. The Consultant should be notified, and a record made for inclusion into the Verification Report.
- 8.5.2 Alternatively, the Consultant should undertake an investigation and risk assessment to delineate the areas of impacted soils and/or to identify a possible alternative use for the materials.

8.6 Inspection Verification Strategy

- 8.6.1 Site visits by a geoenvironmental consultant are required during the placement of fill materials to inspect and photograph the works being undertaken.
- 8.6.2 The visual inspection strategy for the clean cover system is outlined in the following report section.

8.7 Chemical Verification Strategy

- 8.7.1 All verification sampling must be undertaken by the Consultant. In addition, an inspection of the soils at the time of sampling must confirm the physical, visual, and olfactory suitability of the material. The following table summarises the sampling and chemical verification requirements.
- 8.7.2 Where the material is sourced from a brownfield, remediated, or unknown source, the testing frequency should increase to 1 sample per 50m³ and include TPH CWG analysis.
- 8.7.3 A 'batch', can comprise of multiple deliveries from the same source, delivered over consecutive days for a period of no more than one working week.

Material Type	Sampling Frequency	Sampling Timing	Testing Schedule
Topsoil and Subsoils	1 per 100m ³ , Minimum of 3 per batch Minimum of 3 per type	After placement. Reassurance sampling prior to placement is recommended.	Metals Suite, Cyanide (free and complex)
Fill Soil Materials	1 per 250m ³ , Minimum of 3 per batch Minimum of 3 per type	Before, during or after placement	Asbestos screen, PAHs (USEPA 16) Banded TPH
Recycled Aggregate	1 per 500m ³ , Minimum of 2 per batch		
Virgin Quarried Materials	2 per source	Before, during or after placement	Metals Suite, Asbestos screen

Table 8-A: Verification Sampling Plan

- 8.7.4 A metals suite must include arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, and zinc.

8.8 Exceptions

- 8.8.1 Where the Made Ground is removed entirely from the areas of soft landscaping, this removes the source of contamination and therefore negates the need for a clean cover system in that area. However, all imported soil materials for use within soft landscaping areas will still require the same level of physical, visual, and chemical verification to demonstrate suitability.
- 8.8.2 Where bulk removal of the Made Ground occurs, a site visit must be completed by a geo-environmental consultant to inspect the reduced-dig excavation and exposed natural soils.

9 Soft Landscaping Clean Cover

9.1 Scope

- 9.1.1 Where present, the provision of hardstanding areas will negate the requirement for a clean cover system, and no action is considered necessary.
- 9.1.2 In proposed landscaped areas, a cover system of 'clean' suitable soils should be placed to sever the pathway between contaminants in the Made Ground and end-users, thus breaking the pollutant linkage and reducing the risk to acceptable levels.
- 9.1.3 All soils used within the clean cover system should be inspected and tested to confirm they are chemically and physically suitable for use, in terms of the risk to human health.
- 9.1.4 Limited soils, as a suitable growing medium, are present on site. Therefore, soils will require importing to support the proposed landscaping scheme.

9.2 Clean Cover Design

- 9.2.1 For this development, soft landscaping areas comprise private garden areas, and managed areas of public open space (POS) within the park, care home and apartment blocks, and parcels of road-side public open space. Hand-excavations and planting is anticipated in garden areas; whereas following development the maintenance of public open space areas will largely be limited to superficial works on grassed areas and hedgerows. Excavations in such areas would be minimal and of very short duration.
- 9.2.2 The following overall depth requirements can therefore be applied:
 - Private garden areas: 600mm minimum cover
 - Planted areas of public open space: 600mm minimum cover
 - Grassed lawn areas of public open space: 300mm minimum cover
- 9.2.3 The cover system should comprise of topsoil between 150mm and 300mm thick, with the remainder of the cover comprising of loosened subsoil.
- 9.2.4 It should be noted that in large areas of the site, substantial fill materials will be placed below the cover system to raise site levels. Where such materials are a suitable growing medium and have been proven to be chemically and physically suitable, they can be considered as part of the 'subsoil' component and count towards the minimum depth requirement.

9.3 Additional Design & Suitability Considerations

- 9.3.1 BS 3882:2015 states that at least 450mm of suitable soil is required to provide a sufficient rooting depth for grass. This increases to a minimum depth of 600mm for shrubs, and 900mm for the planting of trees.
- 9.3.2 The suitability of soils as a growing medium (irrespective of the risk to human health) could be evidenced through sampling and analysis in accordance with BS:3882 (2015).

- 9.3.3 Whilst desirable, these recommendations do not form part of the remedial strategy and have been included for reference. Site specific advice should be sought from the landscape designer regarding the suitability of soils as growing mediums and any requirements for deepening the cover system to accommodate the planting scheme.

9.4 Contractor Requirements

- 9.4.1 In addition to the requirements outlined in the Soils and Material Compliance report section, the contractor must provide photographic evidence demonstrating the laying of the clean cover system.

9.5 Verification Strategy

- 9.5.1 The verification of the chemical and physical suitability of soils is outlined within Soils and Material Compliance report section.
- 9.5.2 Upon completion of the cover system, a site visit will be required by the Consultant to undertake a series of hand pits to visually inspect, document, photograph, and sample the soils to verify adherence to this Remediation Strategy.
- 9.5.3 Based upon the development proposals, the following number of inspection pits are required. Each pit must penetrate the full depth of the cover system.
- Private gardens (~139 plots): 1 pit every 5 plots. Total of 28 pits.
 - Park and general POS: 3 pits in total.
 - Care home POS: 2 pits in total
 - Flat blocks (6 No. blocks): 3 pits in total
 - Total pits within scheme: 36
- 9.5.4 The hand pits should demonstrate an adequate thickness of cover, confirm physical suitability, and obtain samples so the chemical suitability can be confirmed through laboratory analysis.
- 9.5.5 Verification must be completed by a competent geoenvironmental consultant, with a record of each visit made for inclusion in the Verification Report.

10 Radon Protection

10.1 General

10.1.1 The site is in an area where the above ground radon Affected Area status is classed as a Higher Probability Radon Area with 3-5% of homes estimated to be at or above the action level. Therefore, basic radon protection measures are required for new above-ground buildings, conversions, and refurbishments.

10.2 Radon Protection Designs

10.2.1 At this stage of the development, the detailed designs are not available however basic protection measures must include the following as a minimum.

- Minimum 1,200 gauge membrane.
- Minimum 150mm sub-floor void ventilated with air-bricks at 2m spacings.

10.2.2 The developer or their specialist contractor should complete the NHBC Risk Guide, included in Appendix C, which also provides the general design requirements.

10.2.3 Further detailed guidance on the design and installation of radon protection measures can be found in BR211 and BRE GBG74.

10.3 Verification Strategy

10.3.1 The contractor should record and photograph their works and liaise with the NHBC or their insurer to determine the level of verification and record keeping required.

10.3.2 Independent 3rd party inspection and verification is not required as part of the site's Verification Report or discharge of planning conditions.

10.4 Monitoring and Maintenance

10.4.1 The building regulations do not require a radon test for new domestic dwellings. However, the PHE recommends that new buildings should be subject to an appropriate test during the first year of occupation.

10.4.2 For non-domestic buildings such as the care home, employers must ensure the health and safety of employees and others who have access to their work environment (so far as is reasonably practicable). It is therefore recommended that radon testing is carried out upon completion or occupation of all non-domestic buildings. Radon monitoring should comprise of at least two passive instruments running over a 3-month period.

10.4.3 The radon monitoring regime, results and assessments should be included within the owner's and employer's health and safety documentation.

10.4.4 It is not a requirement of national building regulations to test new non-domestic buildings, and there is no obligation to provide post completion monitoring to the regulator for planning purposes.

10.4.5 The undertaking of post-completion monitoring falls outside the scope of this Remediation Strategy and subsequent verification works, and is provided for the developer's reference only.

10.5 Maintenance

No works must be permitted which could compromise the integrity of the installation. Therefore, the owner, occupier, and any future purchaser of the site must be made aware of the location of the radon barrier within the construction, along with the position of any sumps, vents and exhaust outlets. Any underfloor vents should be maintained and kept clear.

11 Verification Report

11.1 General Requirements

- 11.1.1 The verification requirements discussed above should be compiled into a Verification Report, which is to be produced on completion of the remedial works.
- 11.1.2 As part of the Verification Report, any imported materials should be clearly documented, including source certificates, delivery notes, and site plans. The results and frequency of verification testing undertaken should also be documented, along with confirmation of the materials suitability for use.
- 11.1.3 Records of the on-site inspections must be included within the Verification Report, and include a hole location plan, logs of the excavation and photographic record as a minimum.

11.2 Client / Contractor Requirements

- 11.2.1 Supporting information will be required from the client and their contractors. This includes the following:
- Appropriate site plans confirming location of remediated areas.
 - Photographic evidence of the clean cover system installation.
 - Photographic evidence of the drinking water 'barrier pipe' installation.
 - Signed delivery tickets, or an alternative reference system to track imported loads, including a statement on the type and volume of materials imported.
 - All waste transfer documentation, including a statement on the type and volume of materials taken off-site.
 - Details on any unexpected ground conditions encountered and contingency arrangements that had to be implemented.

11.3 Report Requirements

- 11.3.1 The Validation Report will include the following, where appropriate:
- A summary of remedial requirements.
 - A summary of any supplementary risk assessments.
 - A concise summary of material types, sources and volumes imported.
 - Lines of evidence to demonstrate compliant and effective material management, including confirmation of source, volumes and suitability of all site-won and imported materials, delivery notes, waste transfer and consignment notes and chemical testing records.
 - Details demonstrating the chemical and physical suitability of the capping materials.
 - Details of any unexpected or unencountered materials encountered, along with further investigative and remedial action undertaken.
 - Statements confirming if the remedial objectives have been met, and if the site is suitable for its proposed use.

12 Recommendations

12.1 Further Ground Investigation and Watching Brief

12.1.1 The following table summarises the additional works which should be undertaken post demolition, and prior to the enabling works and construction of the site.

Aspect	Delivered By	Description
Consultation on Protective Barrier Pipe	Principal Contractor / Developer	Liaison with Southern Water to confirm the use of barrier pipe and determine any additional verification requirements.
UXO Detailed Risk Assessment	Specialist	The Preliminary Risk Assessment identified that bombing occurred in the vicinity of the site and the site is at Medium Risk. A Detailed UXO Risk Assessment should be undertaken in accordance with CIRIA C785.
UXO Pile Testing	Specialist	Mag Cone testing of all pile locations prior to commencement. Unless a Detailed Risk Assessment is produced down-grading the preliminary UXO risk.
Material Management Plan	Soiltechnics	To facilitate the sustainable use of soils in the development, an MMP is recommended to control the import of soil fill materials from other development sites and for the reuse of Made Ground on site. Verification Works
Watching Brief	Soiltechnics	Soiltechnics must be informed to carry out inspections and verification during the removal of any above or below ground storage tanks on site.

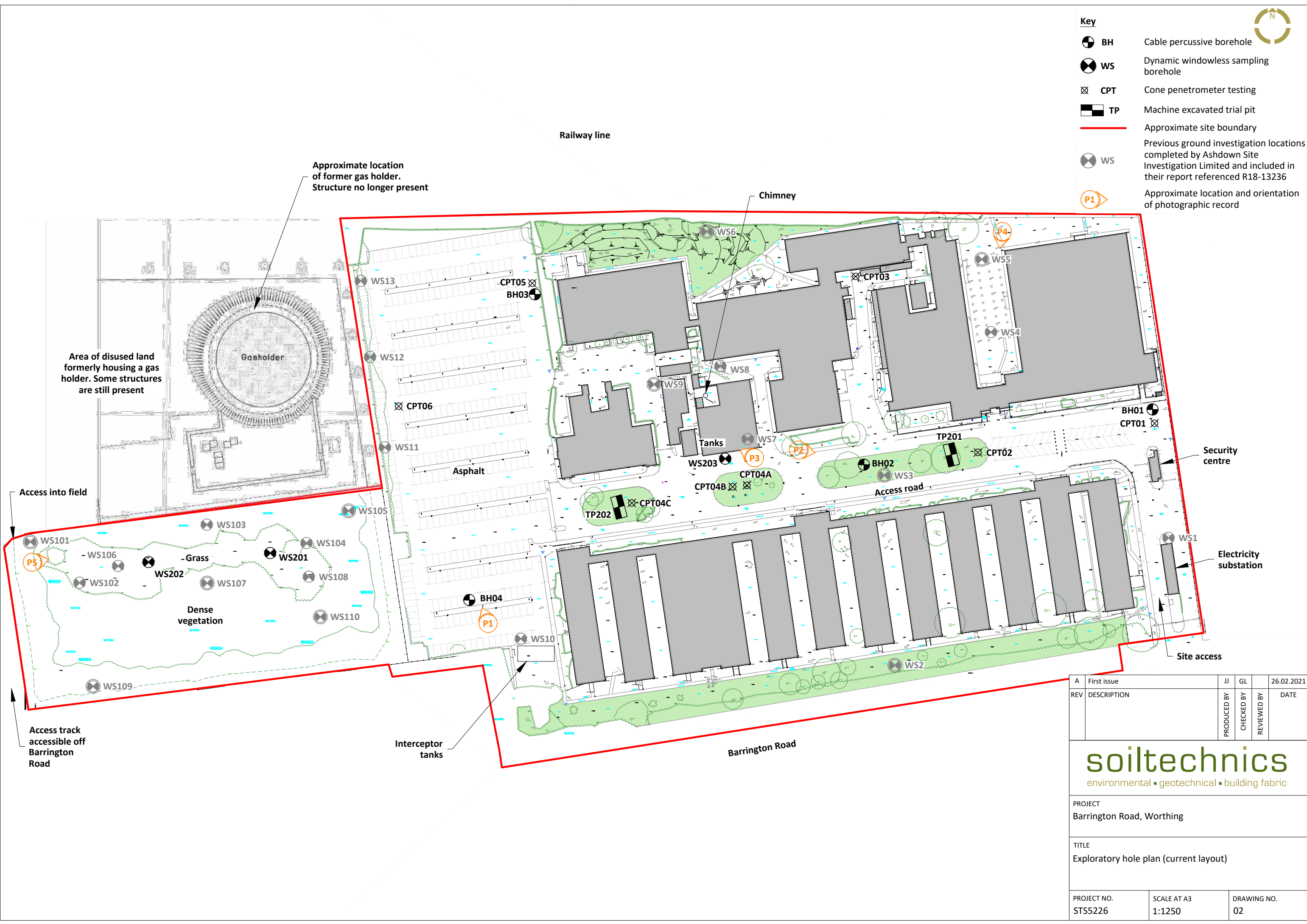
Table 12-A: Recommended Further Works (Post demolition, prior to enabling works)

12.1.2 The following table summarises the additional works which should be undertaken during the main enabling and construction works phase, and prior to occupation of the site.

Aspect	Delivered By	Description
UXO Risk	Specialist	Provision of UXO Safety Induction Training for all site workers. EOD supervision during all bulk excavations and drilling works. Unless a Detailed UXO Risk Assessment states otherwise.
Installation of barrier pipe	Principal Contractor	Provide delivery certificates and photographic evidence demonstrating installation of drinking water barrier pipes, along with any other verification works as stated by Southern Water.
Verification of imported soils and fill materials and material management	Soiltechnics	Chemical and physical verification of all imported soft landscaping soils and fill materials. Verification of material management in accordance with the MMP.
Verification of the clean cover system	Soiltechnics	Chemical and physical verification of the installed clean cover system.
Verification Report	Soiltechnics	Undertaking a report to draw all necessary lines of evidence together, to demonstrate the effective remediation of the site.
Radon protection	Principal Contractor	Basic radon protection measures should be installed, with evidence and verification undertaken according to the insurer's requirements.

Table 12-B: Recommended Further Works (Construction Phase)

Appendix A Drawings



A	First issue	JJ	GL	26.02.2021
REV	DESCRIPTION	PRODUCED BY	CHECKED BY	REVIEWED BY

soiltechnics
environmental ■ geotechnical ■ building fabric

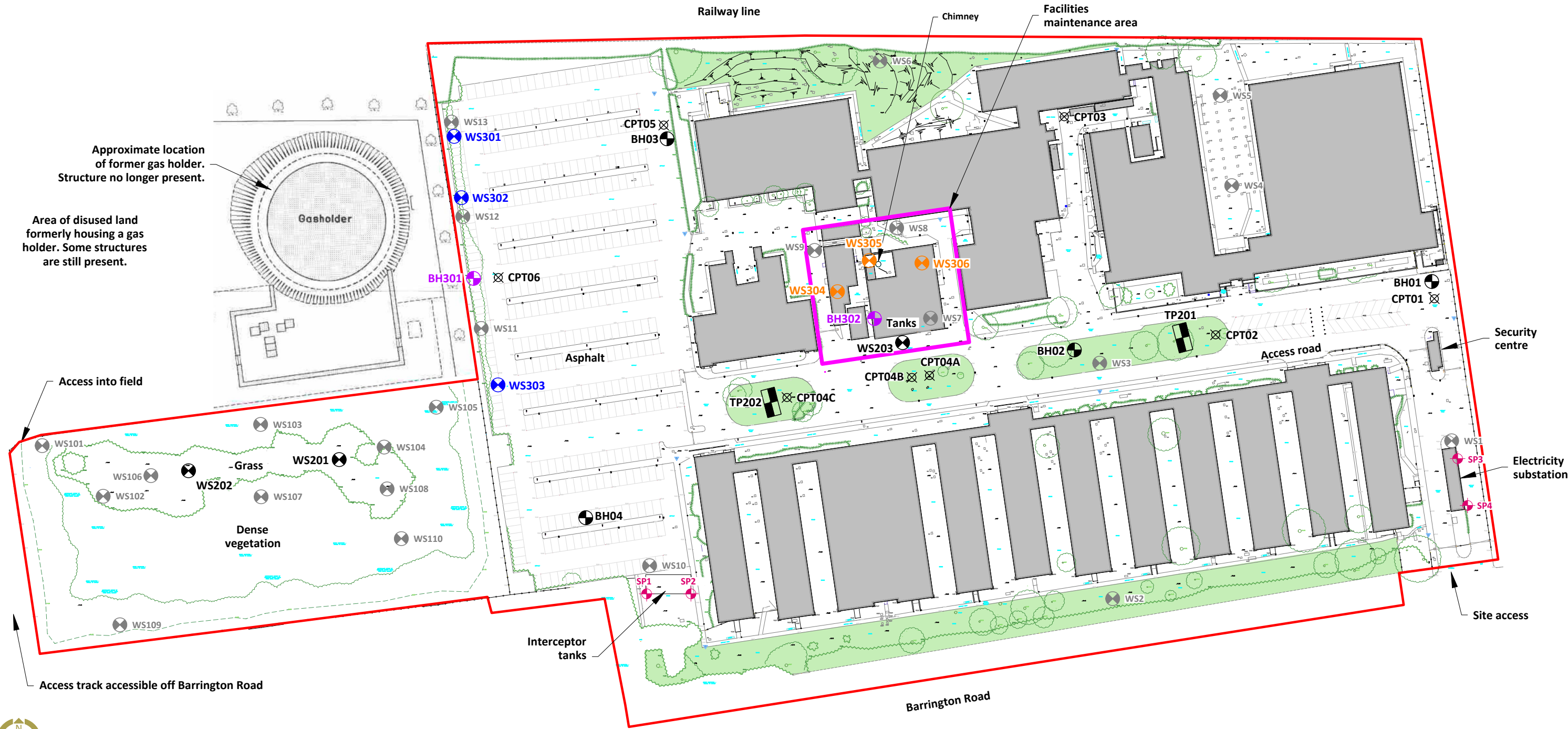
PROJECT
Barrington Road, Worthing

TITLE
Exploratory hole plan (current layout)

PROJECT NO.
STS5226

SCALE AT A3
1:1250

DRAWING NO.
02



Key

-  BH Cable percussive borehole
-  WS Dynamic windowless sampling borehole
-  CPT Cone penetrometer testing
-  TP Machine excavated trial pit
-  WS Previous ground investigation locations completed by Ashdown Site Investigation Limited and included in their report referenced R18-13236
-  Approximate site boundary

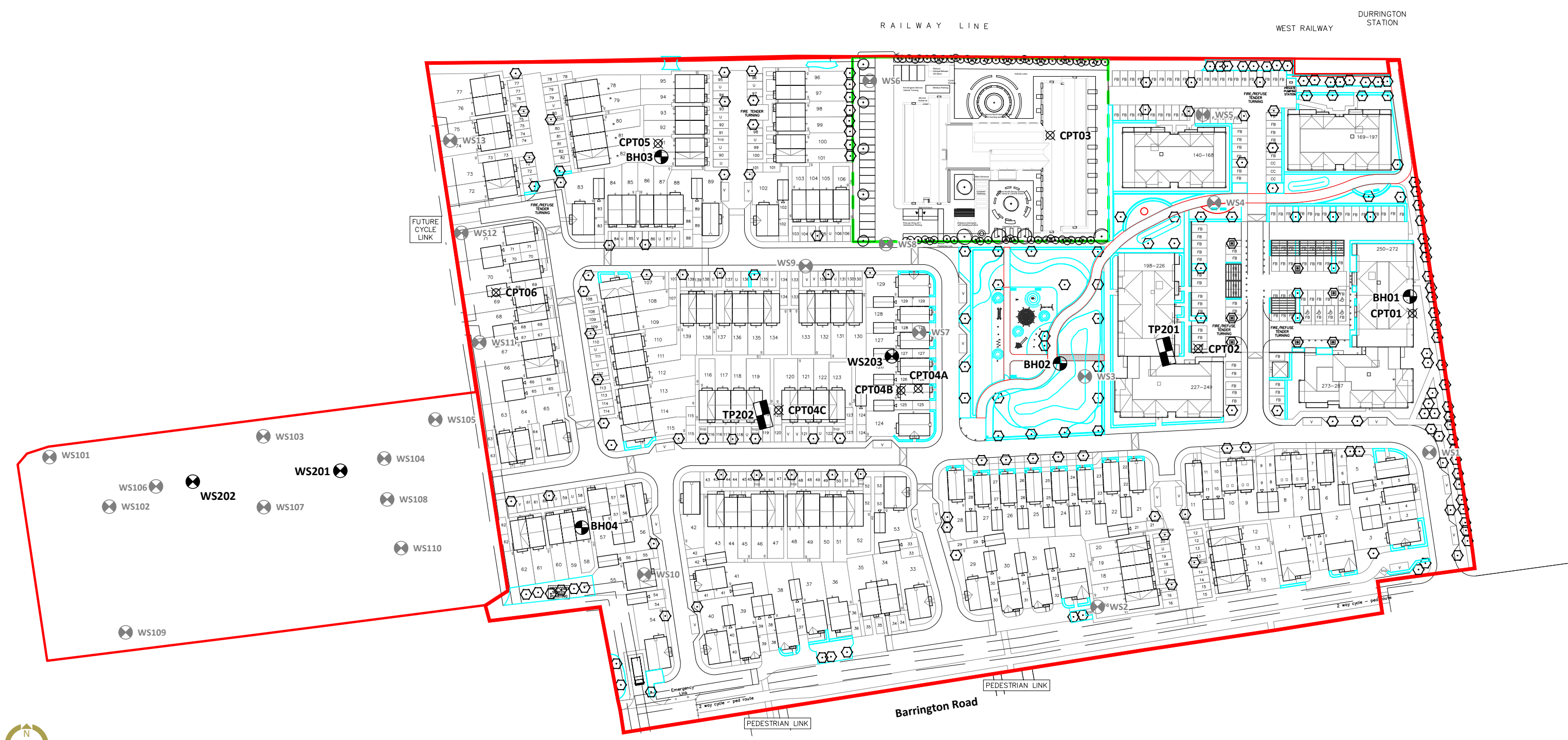
-  BH Proposed deep borehole to assess groundwater
-  WS Proposed shallow borehole for vapour monitoring
-  WS Proposed shallow borehole to determine presence of shallow soil contamination
-  SP1 Proposed sampling position

A	First issue	AM	13.02.2023
REV	DESCRIPTION	PREP	DATE
soiltechnics environmental • geotechnical • building fabric			
PROJECT Barrington Road, Worthing			
TITLE Further testing plan (current layout)			
DRAWING NO. STV5959-D02-A		SCALE AT A3 1:1250	



Key

-  **BH** Cable percussive borehole
-  **WS** Dynamic windowless sampling borehole
-  **CPT** Cone penetrometer testing
-  **TP** Machine excavated trial pit
-  **WS** Previous ground investigation locations completed by Ashdown Site Investigation Limited and included in their report referenced R18-13236
-  Approximate site boundary



A	First issue	AM	13.02.2023
REV	DESCRIPTION	PREP	DATE
soiltechnics environmental • geotechnical • building fabric			
PROJECT Barrington Road, Worthing			
TITLE Exploratory hole plan (proposed layout)			
DRAWING NO. STV5959-D03-A		SCALE AT A3 1:1250	

Appendix B Contamination Discovery Strategy and Underground Storage Tank Procedure

Contamination Discovery Strategy: Procedure

1 General

- 1.1 With the development of any site, there is a residual risk of contamination being found that is unexpected or has not previously been identified.
- 1.2 As a precaution, the Principal Contractor should adopt this Contamination Discovery Strategy for dealing with unexpected contamination.
- 1.3 The Principal Contractor should also ensure it is distributed and communicated appropriately to all relevant ground workers.

2 Step 1: Halting Works

- 2.1 Should any previously unidentified contamination be encountered, works should be made safe then temporarily halted in the affected area and Soiltechnics (The Consultant) informed within 24hrs.
- 2.2 If, due to site constraints, the contaminated materials need to be excavated prior to being assessed, the Contactor should segregate the material as best as is reasonably practicable, based upon visual and olfactory observations. The contaminated materials should then be stockpiled on an impermeable surface and covered with impermeable sheeting.

3 Step 2: Initial Assessment

- 3.1 The Consultant must liaise with the contractor and undertake an initial assessment within 48 hours of notification to determine if the event represents “*potentially significant unexpected contamination*”.
- 3.2 Where the initial assessment does not consider the contamination to be potentially significant and unexpected, works can recommence.

4 Step 3: Contamination Assessment and Remedial Strategy

- 4.1 Where *potentially significant unexpected contamination* is confirmed, the Consultant must produce a standalone report which includes a description and risk assessment of the contamination.
- 4.2 A phase of intrusive investigation works may be required to inform the risk assessment.
- 4.3 Where remediation is required, the report must also include a remedial and verification strategy.
- 4.4 The report must also make it clear whether remediation, and the subsequent submission and approval of an event-specific Verification Report to the Local Authority is required prior to recommencement.
- 4.5 Within 24 hours of completion, the report must be provided to the Local Authority for their approval, and a copy held for appending to the project Verification Report.

5 Step 4: Recommencement and Implementation

- 5.1 Works can only recommence upon specific instruction from the Consultant and once the event-specific Remediation Strategy has been submitted to, and approved in writing by, the Local Authority.
- 5.2 All remedial works must be implemented and verified in full. The event-specific Verification Report (if required) must be submitted to the Local Authority for approval.

Contamination Discovery Strategy: Contractor Site Guide

Discovery Event

- Previously unidentified contamination is encountered.
- This includes encountering underground storage tanks (UST).

Halt Works in Area

- Make the area safe.
- Halt works in the affected area.
- Stockpile any contaminated arisings on an impermeable surface and cover with impermeable sheeting.
- Works to recommence only upon instruction from the Consultant (Soiltechnics Ltd).

Inform the Consultant

- Contact Soiltechnics (the Consultant) within 24 hours.
- Tel: 01604 781 877
- E-mail: enquiries@soiltechnics.net

Assessment

- An initial assessment must be carried out by Soiltechnics to determine the appropriate course of action.
- A detailed assessment and a sampling exercise may be required.
- If remediation is necessary, the Local Authority will need to approve a Remediation Strategy prior to commencement.

Remediation

- All remedial works must be implemented and verified in full, in accordance with the Remediation Strategy.
- Once remedial works are complete, the event-specific Verification Report must be submitted to the Local Authority.

Encountering & Decommissioning of Underground Storage Tanks

1 General

- 1.1 The following expands on the general procedures outlined within the Contamination Discovery Strategy to provide a detailed process that must be followed in the event of encountering an underground storage tank (UST).
- 1.2 Any UST encountered and associated pipework shall be decommissioned and removed from site following the current guidance within the APEA document “Design, Construction, Modification, Maintenance And Decommissioning Of Petrol Filling Stations”, April 2015.
- 1.3 The purpose of this report is to provide a Remediation Strategy for the site contractors and Consultant to work to in the event of encountering underground storage tanks.

2 Step 1: Halting Works

- 2.1 Should any USTs be encountered, works should be made safe then temporarily halted. A tank decommissioning specialist and Soiltechnics (The Consultant) should be informed within 24hrs. Efforts should be made, under the guidance of the specialist, to inspect and confirm the contents of the tank and identify any special precautions which may be required.

3 Step 2: Bottoming

- 3.1 Before the removal of a UST, all residual fuel/oil should be removed from the tank, so far as is reasonably practicable. This is referred to as 'bottoming' and should be carried out by a specialist contractor.
- 3.2 Where present, pipework carrying fuel should be drained back to the tank before bottoming takes place.

4 Step 3: Inerting

- 4.1 Due to the potential for explosive atmospheres to be present, any tanks containing flammable substances, such as petrol or solvents, should be ‘inerted’ prior to excavation. Where tanks contain substances with a low flashpoint, inerting is not required.
- 4.2 Inerting operations can include filling with gases or cleaning and de-gassing followed by carrying out oxygen testing, or the filling of the tank with water or foam.
- 4.3 The operation should be carried out by a specialist and a certificate provided ensuring the tank is safe to remove.

5 Step 4: Pipework Removal

- 5.1 All pipework connected to the tank should, as far as is reasonably practicable, be removed.
- 5.2 The removal of pipework should not be carried out until it has been drained and isolated from fuel sources.
- 5.3 Residual fuels may be present in pipework and a precautionary measure of flushing with water should precede the removal and dismantling work.
- 5.4 Care should be taken to ensure that no fuel or contaminated water is allowed to enter any drainage system, watercourse or the ground. Water used to flush out the pipework should be collected for safe disposal. It may be possible, with appropriate approval, to discharge this water through the on-site oil/water separator.

6 Step 5: Tank Lifting and Excavation Works

- 6.1 Prior to lifting a tank from an excavation, a risk assessment should be prepared by the specialist contractor responsible for the works.
- 6.2 During the excavation and removal of a UST it should be assumed that contaminated soils are likely to be encountered in the area immediately surrounding the underground tank and pipework. Excavations should continue until all grossly contaminated soils have been removed. The sides and the base of the excavation must then be sampled by a Geoenvironmental consultant to verify the satisfactory removal of contaminated soils.

7 Step 6: Dismantling and Disposal

- 7.1 Uplifted redundant tanks may be broken up on-site prior to disposal, providing such works can be undertaken without endangering workers of the environment.
- 7.2 To minimise the risk of fire or explosion only cold cutting techniques should be used.

8 Watching Brief and 3rd Party Verification

- 8.1 A Geoenvironmental Consultant should be present during all UST tank removals to undertake verification sampling of the excavation prior backfilling and to aid in the identification and segregation of grossly contaminated soils for off-site removal.
- 8.2 The overall frequency of verification sampling will be dependent upon the scale of the excavations and extent of contamination.
- 8.3 As a minimum, sampling must comprise one sample from each pit side and two samples from the base (6 No.). Additional side-wall and base samples will be required for every 10 linear metres of excavation.
- 8.4 For fuel oils, the testing scope will comprise of a speciated TPH CWG, PAH and BTEX suite per sample. Tanks storing solvent shall be subject to a TPHCWG, SVOC & VOC testing suite.
- 8.5 Any remaining soils or imported backfill materials must meet published UK-specific generic assessment criteria produced under the 'commercial/industrial' scenario. Such as C4SLs, S4ULs, SGVs, and ATRISKsoil SSVs.
- 8.6 All tank removal and remedial works undertaken must be documented and submitted to the Local Authority within a Verification Report

9 Contractor Records

- 9.1 The contractor should maintain all records associated with the decommissioning and removal of fuel/oil tanks, and provide them to the geo-environmental consultant for inclusion into the Verification Report. As a minimum, the records should include:
 - i) A plan showing the location of the tank(s) encountered and removed.
 - ii) The approximate volume, contents and state of each tank upon inspection.
 - iii) Who undertook the specialist decommissioning works.
 - iv) Records confirming the bottoming out and inerting of tanks has taken place, along with the provision of any disposal records for the oil and contaminated water.
 - v) Off-site disposal records for the tank carcass and grossly contaminated soils .

Appendix C Radon NHBC Risk Guide

NHBC Risk Guide

Radon/Gas protection (Revised May 2020)

(Refer BR 211, BR 414, GBG 74 and CIRIA 735)

Site ref: Site manager: Inspector:
 Date: Signature: Signature:

Radon protection		
Is radon gas present?		Yes / No
If unsure, check with NHBC surveyor / engineer for clarification		
Please specify floor design and level of protection required:	Ground bearing	Suspended
Basic:		
Full:		
Note: Where high radon protection is required, depressurisation/ventilation (either a radon sump or a ventilated subfloor void) should be provided below the level of the radon barrier. Note: If the site is in an area known for a high or fluctuating water table, there is a risk that radon sumps may become waterlogged. As such, tanking should be used to prevent water ingress and provide radon protection. Note: For acceptable radon solutions, please refer to BR211 Radon; Guidance on protective measures for new dwellings 2015 edition.		
Please specify the membrane barrier to be installed:		
Note: If a recycled product is being used, ensure that it provides the same or better level of protection and longevity as that offered by 300 micrometre (1200 gauge) virgin polyethylene.		

Other gas protection			
Is methane/carbon dioxide or other hazardous gas (i.e. Hydrocarbons) present?			Yes / No
If unsure, check with NHBC surveyor / engineer for clarification			
Has the level of gas regime been defined?	Yes / No	Amber 1	Amber 2
		Moderate Risk ← → High Risk	
		CS2	CS3
Note: Ensure the gas risk assessment report has been accepted by NHBC Surveyor/Engineer. Note: Amber2/CS3 gas regimes are considered high risk. It is essential that the gas risk assessment & construction detail is agreed in advance of works. Note: Verification of measures will be requested for CS3/Amber2 sites. The verification plan should be discussed in advance of construction. Note: The opportunity to provide post construction evidence will be difficult, costly & disruptive.			

Gas protection measures			
Have gas protection measures been agreed?			Yes / No
Please specify floor design, membrane specification, sub slab ventilation and ventilator requirements:			
		Ground bearing	Suspended
Membrane specification	Straight Polymeric		
	Reinforced product		
	Multi-layer with aluminium insert		
	Hydrocarbon		
	Specialist membrane		
Note: Minimum 1200gauge. Technical specification datasheets should provide test permeation data. Note: Only virgin products (non-recycled) to be used. Note: Membrane should be suitable for level of gas risk, nature of construction & durable. Note: Specialist membrane may be required where hydrocarbon vapours are present.			
Sub slab ventilation	Clear void		
	Geostrips		
	Void former		
	Granular venting blanket		
	Venting pipes		
Ventilators	Air bricks		
	Vent boxes		
	Other		
Note: Sub Slab ventilation (or pressure relief system) is required where gas protection measures are needed. Note: A specialist system will be required where ground bearing slabs adopted Note: The layout & connectors require specialist design. Note: Granular blankets with venting pipes require specialist design. Note: If the site is in an area known for a high or fluctuating water table, there is a risk that sub slab ventilation may become waterlogged & specialist advice is required.			

Continues on reverse

Has a specialist installer been employed to install the barrier system?	Yes / No
Note: For site classed as Amber 2 or CS3, operatives should be suitably qualified. An NVO Level 2 qualification is one example of specialist qualification. Note: In all instances the installer should be familiar & appropriately experienced in gas membrane installations. Note: Third party verification is required for Amber2/CS3 gas regime sites. The verifier should not be the installer.	

General requirements and considerations for radon and other gas protection

The barrier should be continuous across the whole plan of the building, including:

- taking it through or under internal wall and external walls,
- continuing across party or separating walls,
- provide an air tight seal around any penetrations through the barrier,
- Tapes and jointing should be specified in the design.

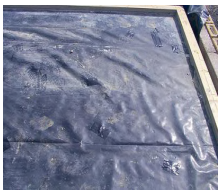
Where the barrier crosses the cavity, a cavity tray should be formed to prevent the ingress of water

Ensure the following where subfloor ventilation is provided:

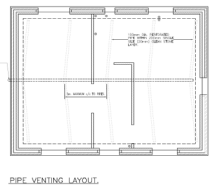
- air bricks are not restricted e.g. by raised external ground levels, meter boxes etc.
- they are positioned at 2m maximum centres, not more than 450mm from corners and installed on two opposite sides
- the joints between the upper and lower halves of periscope subfloor ventilators are taped

Provide temporary/permanent protection to prevent damage during installation or by follow-on trades

Membranes

		
Ensure product is sufficiently durable to withstand the construction process.	Specialist installers may be required to joint thicker products.	Specialist membranes may be required. Taped seams may not be appropriate.

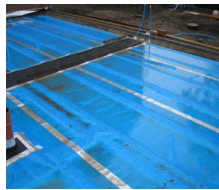
Ventilation

		
Specialist venting solution required for ground bearing slabs.	Sub slab voids should be clear of debris.	Venting pipes should be interleaved to prevent short circuiting & have more than one inlet & outlet point.

Ventilators

		
Ensure telescopic ventilators are adequate. Photo shows ventilator too short & disconnected.	Vents should not be susceptible to clogging. Refer to Technical Guidance 6.1/27.	Planting proposals must consider air brick positions & not hinder air flow.

Installation

		
Vertical walls & steps require specialist products & knowledge/skills to install.	The product needs sufficient strength, detailing & adherence across steps.	Preformed components offer solutions for difficult detailing.
		
Thicker membranes advisable under position of sleeper walls.	Timber frame sole plate must not damage membrane integrity.	Weld temperatures are critical. Example shows burning of membrane.