GEO Environmental Engineering

REVISED CONTAMINATION REMEDIATION STRATEGY

PROPOSED RESIDENTIAL DEVELOPMENT OF LAND AT

IVY MILLS (PHASES 1 AND 2), MAIN STREET

HENSINGHAM, WHITEHAVEN

FOR:

GLEESON REGENERATION LTD

GEO Environmental Engineering

Web: www.geoenvironmentalengineering.com **Email:** info@geoenvironmentalengineering.com **Telephone:** 07883 440 186

DOCUMENT CONTROL SHEET

Report Ref:	2024-6320
Report Date:	05.06.2024
Report Type:	Draft Revised Contamination Remediation Strategy (RS)
Report Tracking:	05.06.2024 – Draft Report v1 Issued for Design Team and Regulator Review
Prepared By:	James Brock *BSc. MSc.* – Geo Environmental Engineer/Associate
Author Signature:	
Checked By:	Curtis Evans *B.Sc. (Hons), FGS* – Geo Environmental Engineer/Director
Client Title:	Gleeson Regeneration Ltd
Consultant:	~

CONTENTS

1.0 INTRODUCTION

1.1 Brief

GEO Environmental Engineering Ltd (GEO) were commissioned by the Client, Gleeson Regeneration Limited to complete a 'Revised Contamination Remediation Strategy' for the proposed residential development of land at Ivy Mills (Development Phases 1 and 2) in Hensingham, Whitehaven, Cumbria.

The report outlines an appropriate form of remediation required to ensure that the underlying soils do not pose a risk to human health or controlled waters and that the site is "fit for purpose".

The site has previously been investigated as two separate sites, known to the Client as Ivy Mills: Phase 1 and Phase 2. However, the Client now plans to combine the two phases as a single development area. This report combines all previous reports and provides an overall remediation strategy to cover the whole development area.

1.2 Site Location and Description

The combined site area, occupying c.2.1Ha is located in Hensingham to the east of Whitehaven as indicated on the site location plan in Appendix I. The site boundary is indicated in Figure 1 below which also includes the areas previously known as (development) Phases 1 and 2.

- National Grid Reference: 299086, 517049
- Post Code: CA28 8TP (approximate only)

Figure 1. Site Boundary and Phase 1 and Phase 2 Development Areas.

1.3 Proposed Development

It is understood that the Client plans to redevelop the site for residential end use with houses, private gardens, car parking, access roads with associated infrastructure. A proposed site layout plan is included in Appendix I.

1.4 Remediation Statement Limitations of Use

Although every effort is made to ensure a full and comprehensive investigation has been completed it should always be considered that ground conditions have the potential to vary between the exploratory hole locations to those identified and it is always recommended that a prudent developer adopt a "watching brief" during the redevelopment works, to ensure that any potential variations encountered are identified and dealt with in an appropriate manner.

In addition, this RS and its contents are limited to the boundaries of the site, as indicated on the plans in Appendix I. Reliance on the report is for the named Client only.

Reliance on the report and its associated information is strictly in accordance with Geo Environmental Engineering Ltd Terms and Conditions, copies of which are available on request.

2.0 PREVIOUS REPORT SUMMARY

2.1 Previous Report Details

The following section provides details of the previous reports which have been completed for the site. The reports are listed in chronological order for each development phase.

Phase 1 Area:

- Preliminary Environmental Risk Assessment by Elliot Environmental Surveyors Ltd, ref: EES16-131, dated: 7th March 2017.
- Phase 1: Desk Top Study by Geo Environmental Engineering Ltd, ref: 2019-3732, dated: June 2019.
- Phase 2: Ground Investigation Report by Geo Environmental Engineering Ltd, ref: 2019-3886, dated: 10th December 2019.
- Soil Infiltration Tests, by Geo Environmental Engineering Ltd, ref: 2021-4625, dated 9th February 2021.
- Remediation Strategy, by Geo Environmental Engineering Ltd, ref: 2021-4986, dated 8th December 2021.
- Revised Remediation Strategy & Supplementary Ground Investigation by Geo Environmental Engineering Ltd, ref: 2021-4986, dated: 27th April 2022.
- Risk Assessment Form for Water Supply Pipes v2 by Geo Environmental Engineering Ltd, ref: 2023-5765, dated March 2023.
- Radon Risk Assessment, by Geo Environmental Engineering Ltd, ref: 2023-5776, dated March 2023.

Phase 2 Area:

- Geoenvironmental Appraisal by Sirius Geotechnical Ltd, ref: C8049, dated: March 2021.
- Ground Gas Monitoring Addendum Letter by Sirius Geotechnical Ltd, ref: C8049/7851/APC, dated: 15th May 2021.
- Remediation Strategy by Geo Environmental Engineering Ltd, ref: 2022-5170, dated 27th April 2022.
- Ground Gas Protection System Verification Plan V1 by GeoEnginSeer Ltd Geological Services, ref: N/A, dated: 3rd May 2022.
- Ground Gas Verification Strategy Report by Geo Environmental Engineering Ltd, ref: 2022-5170, dated: 10th August 2022.
- Soil Screening Report (stockpile testing) by Geo Environmental Engineering Ltd, ref: 2022-5590, dated: 14th December 2022.
- Radon Risk Assessment, by Geo Environmental Engineering Ltd, ref: 2023-5776, dated March 2023.

2.2 Previous Report Summary

A summary of the previous findings is included below and on the following pages, however, it is recommended that the reports are read in full in conjunction with this Revised Remediation Strategy.

Phase 1 Area:

The site was previously occupied by a factory which manufactured work wear and personal protective equipment. Following demolition, the land comprised a mixture of gravel and concrete hardstanding in the west (former factory area) and an area of scrub vegetation and trees in the east. An Electric Sub-

Station is still present in the north west of the site. The DTS reports indicated a potential for localised made ground and associated contamination in the vicinity of the former factory.

The superficial drift was recorded as Glacial Till overlying solid strata of the Hensingham Grit (Sandstone) and the Stainmore Formation (Mudstone, Siltstone and Sandstone). A geological fault was recorded as passing through the site.

The intrusive ground investigation encountered made ground to depths of between c.0.30m and in excess of c.2.40m bgl. The deeper made ground was encountered within the vicinity of the former factory in the western parts of the site. The made ground comprised areas of reworked clays with occasional anthropogenic materials, occasional relict topsoil and gravel of demolition rubble, sandstone, slag and pottery with occasional other anthropogenic materials (chipboard, plastic, hosing, wire, etc…). Evidence of former foundations or floor slabs was also noted within the vicinity of the former factory.

The eastern part was surfaced with unmanaged grass overlying sandy clay soil with occasional anthropogenic materials to depths of between c.0.10m and c.0.40m bgl. This area appeared to have remained undeveloped.

Evidence of possible hydrocarbon contamination was encountered within trial pit TPD within the western part of the site (former factory area). This was noted as a ‘slight olfactory evidence of hydrocarbons’. However, no free product or oily sheen was noted, and chemical screening did not indicate elevated concentrations of petroleum hydrocarbons within the soils.

The made ground was underlain by natural sandy gravelly clays. Suspected shallow sandstone bedrock was encountered in the northern part of the site only. Localised perched groundwater was encountered at depths of between c.0.40m and c.2.20m bgl.

Ground gas monitoring indicated low concentrations of carbon dioxide and methane, therefore, gas protection measures were not deemed necessary. However, a revised radon assessment was completed in February 2023. The assessment indicated that basic radon protection measures are now required for the proposed development.

The results of the chemical screening indicated elevated concentrations of metals (Lead) and PAH compounds within the made ground in the western part of the site (former factory area). The report indicated that, although some made ground was identified in the eastern part of the site, no elevated contaminants were recorded, therefore, the made ground in this part was not deemed as a potential risk to the proposed end users.

GEO returned to site in August 2022 (c.3 years later) to delineate the hydrocarbon contamination in the western part of the site. However, no evidence of the contamination was encountered. It was considered likely that the contamination had been localised, limited in extent and therefore dispersed and degraded over the preceding three years after being disturbed during the ground investigation works. Although no visual, olfactory or analytical evidence of hydrocarbon contamination was encountered during the supplementary ground investigation, GEO recommended that barrier pipe was adopted for the proposed water supplies on the site due to the potential for other unidentified pockets of hydrocarbon contamination which may be present.

The supplementary report concluded that remediation was required to mitigate the risk to human health from contamination associated with the made ground in the western part of the site (former factory area). Remediation of any hydrocarbon impacted soils / water was deemed necessary in order to protect the culvert and any offsite receptors from possible hydrocarbon contamination should it be encountered during redevelopment.

Phase 2 Area:

The site was previously used as a textile factory. The former building was located in the north western part with associated access roads, car parking and soft landscaping elsewhere on site. Storage tanks were recorded in the west and an above ground oil storage tank was recorded in the central area. The factory was demolished in 2010.

During the investigations, the site was disused and comprised crushed stone and a surfaced access road along the southern boundary. Three large stockpiles were present in the west of the site, comprising crushed recycled aggregate, asphalt, and topsoil.

The investigation encountered made ground to depths of between c.0.30m and in excess of c.2.20m bgl (typically less than c.1.00m). The made ground was locally absent in the east where the land had not been developed previously. The made ground was more extensive and deeper across the southern and western parts (former factory areas) where it typically comprised clayey gravel of concrete, slag, sandstone and brick and reworked gravelly clays. Evidence of former foundations was also noted.

The deepest area of made ground was encountered in the central-southern part of the site. The made ground exceeded c.2.20m depth and comprised gravel of sandstone, brick and concrete overlying silty/clayey gravelly sand and gravel of slag. Evidence of hydrocarbon contamination was encountered as noted below.

Evidence of possible hydrocarbon contamination was also encountered in trial pits TP03 and TP06 within the central-southern and western parts where it was noted an odour of hydrocarbons (TP03 – c.0.50m to c.0.55m bgl) and as oily sheen on the perched groundwater within the made ground (TP06 – c.1.50m bgl).

The natural deposits typically comprised gravelly clays. Perched groundwater was encountered at depths of between c.0.90m and c.3.00m bgl during the fieldwork. Suspected sandstone bedrock was encountered at shallow depth in the south west parts.

The contamination screening did not identify any elevated metals or organic contaminants with regards to human health. However, the report indicated that the made ground was strongly alkaline and recommended remediation in this respect.

The mounds of crushed recycled aggregate and asphalt were found to include asbestos fibres. The asphalt was also found to include coal tar binder. A surface mound of asbestos contaminated materials was also noted in the east of the site on the access road.

Elevated concentrations of petroleum hydrocarbons were recorded within the groundwater from TP06, however, the report recommended a cautious approach as there was no indication that the impacts from the hydrocarbon contamination extend beyond the deep made ground. The report concluded that the risk to controlled waters was negligible.

The ground gas monitoring encountered elevated concentrations of methane and carbon dioxide. The report recommended basic gas protection measures in line with Characteristic Situation 2 (CS2). A revised radon assessment was completed in February 2023. The assessment indicated that full radon protection measures are required for the proposed development.

Further testing of the mounds by GEO in 2022 confirmed the presence of trace quantities of asbestos within the crushed demolition rubble. However, the report indicated that consideration could be given to reusing the materials where it is encapsulated to mitigate risks to human health. The report indicated that the materials should not be used beneath gardens or soft landscaping (unless suitable remediation works

are undertaken to mitigate the risks to human health). The mound of topsoil was found to be visually and chemically suitable for reuse within a residential context.

3.0 SOIL CONTAMINATION REMEDIATION STRATEGY

Following the results of the contamination assessments it can be seen that remediation is required to mitigate the risks to human health from elevated concentrations of metals within the made ground across the Phase 1 area and high pH levels across the Phase 2 area.

A 'Remediation Plan' has been provided in Appendix I. This outlines the remediation works required for the site and areas that require further investigation.

The Client plans to reuse the mounds of crushed concrete (Mound 1), the asphalt (Mound 2) and the topsoil (Mound 3) on the Phase 1 area. As trace amounts of asbestos have previously been recorded within mounds 1 and 2, protection measures will be required to mitigate risks to construction workers and members of the public during handling and material movements, and to the end user (residents) following placement.

Further works are also required within the Phase 2 area to delineate the area of deep made ground and relict sub-structures, and to further investigate possible hydrocarbon contamination that was encountered during the original ground investigation by Sirius.

These stages are outlined in the following sections below.

3.1 Re-Using Stockpiled Materials

3.1.1 Reusing Mound 1 (crushed concrete) to Increase Site Levels

It is understood that the Client plans to reuse the materials within Mound 1 for raising levels across the western parts of the site. Previous investigations confirmed that the mound comprises crushed gravel of concrete with occasional brick and tile (and rare metal, cloth, plastic and slag). Although no visual evidence of asbestos was encountered, laboratory tests confirmed the presence of trace amounts of chrysotile and amosite asbestos within the gravel which could potentially pose a risk to human health if the material is not dealt with appropriately.

Subsequent reporting indicated that the material should not be left exposed at the surface, however, encapsulating the materials beneath proposed roads and hardstanding could be considered as this would break the pathway, thereby mitigating the risks to the end user and would be the safest and most appropriate form of remediation. Consideration to reusing the materials beneath proposed soft landscaping and private gardens is also considered appropriate if suitable remediation and protection measures are put in place above.

Therefore, where the Client plans to re-use the materials beneath proposed soft landscaping and private gardens, a robust 'Clean Cover System' should be employed to mitigate the risks to the end user. This remediation technique incorporates a layer of "clean soils" which are placed directly over the made ground materials as discussed below.

The clean cover would need to be at least 600mm thick and incorporate a high visibility marker (membrane) directly over the made ground. The membrane layer should be similar to the 'Terram Hi-Vis Geotextile Fabric' or 'Geosynthetics Alert Contamination Indicator' and should be non-degradable, high permeability, puncture / abrasion resistant and robust enough to last the lifetime of the proposed development. This is overlain by a 150mm 'no-dig' layer comprising well compacted quarry stone (dolomite or similar) with 300mm of sub-soils and 150mm of topsoil at the surface as indicated in Figure 2 overleaf.

As well as providing a physical barrier between the contaminated material and the end user (i.e., residents), the clean cover layer also provides a suitable growing medium for plants and trees. However, deepening of the clean cover is recommended where large plants and trees are proposed.

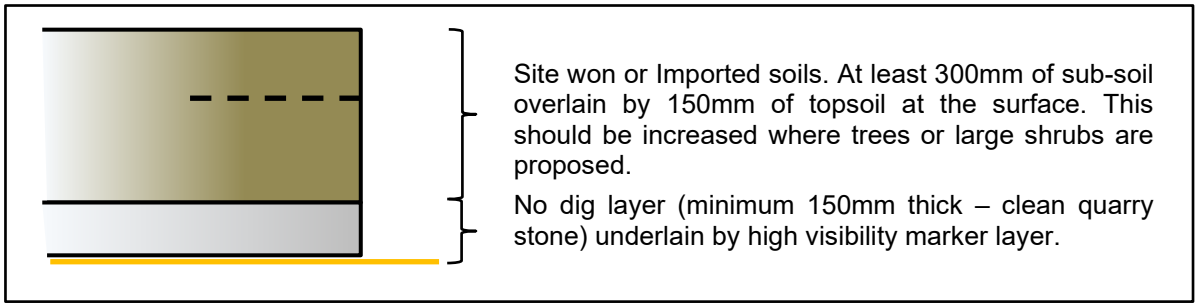


Figure 2. Clean Cover Layer Section for Private Gardens (Phase 1 where Mound 1 is to be used to raise site levels)

Any buried utilities that pass through this part of the site should be lined with clean and inert materials that are free from asbestos to mitigate the risks to future workers.

Dust suppression techniques should be employed during any earthworks and the materials should not be crushed as this could release asbestos fibres into the air. The principal Contractor should be made aware that the materials in Mound 1 have tested positive for asbestos fibres so that they can accommodate this in their risk assessments and method statements and employ the relevant protection and protocols on site to mitigate the risks to their staff, sub-contractors and the surrounding environment. Care should also be taken to avoid cross-contamination.

If asbestos fragments are identified on site, then these should be handpicked by personnel wearing suitable PPE with any asbestos being bagged and labelled for disposal at a suitable waste facility.

Any materials from Mound 1 which cannot be accommodated on site will need to be disposed of to an appropriate waste facility that is accredited to accept soils that are impacted by asbestos wastes.

3.1.2 Reusing Mound 2 (asphalt) Beneath Proposed Roads and Pavements

Previous Investigations have confirmed that Mound 2 comprises coarse angular gravel and cobbles of road planings and binder (asphalt) with occasional brick, concrete and aggregate. Laboratory testing by Sirius confirmed the presence of high concentrations of PAH compounds suggesting the presence of coal tar within the binding element. Trace amounts of asbestos fibres were also detected.

Consideration could be given to recycling the asphalt for re-use within paving structures (roads and pavements) as stated with the Environment Agency's (EA) 'Regulatory Position Statement 075'. The EA refer to 'Asphalt Waste Containing Coal Tar' as 'AWCCT'. The use of AWCCT in construction applications is a waste recovery operation for which the EA consider a permit disproportionate. They do, however, provide some general rules which are outlined within the statement.

AWCCT can be used as a base, sub-base or binder, however, surface applications are not allowed. A copy of the statement is included in Appendix II.

The principal Contractor should be made aware that the materials in Mound 2 have tested positive for trace quantities of asbestos fibres so that they can accommodate this in their risk assessments and method statements to mitigate the risks to their staff, sub-contractors and the environment (similar to Mound 1).

Any materials from Mound 2 which cannot be accommodated on site will need to be disposed of to an appropriate facility. Waste Acceptance Criteria Testing has previously been undertaken on these materials and a copy of the test results can be provided upon request. The waste carrier should also be notified that the materials have tested positive for trace amounts of asbestos and coal tar.

3.1.3 Reusing Mound 3 (topsoil) for Proposed Gardens and Areas of Soft Landscaping

Previous investigations have confirmed that Mound 3 comprises sandy gravelly loam (with occasional rare brick, concrete and plastic). Chemical testing confirmed that the material is chemically suitable for re-use.

Therefore, consideration can be given to reusing the materials within Mound 3 for proposed gardens and areas of soft landscaping. However, careful inspection of the materials is recommended to ensure that if any evidence of possible contamination or unsuitable materials are encountered within the mound, the materials are set aside for further investigation and not re-used on site. Care should also be taken by the principal Contractor to ensure cross-contamination does not occur.

3.2 Further Intrusive Ground Investigations

The investigation by Sirius identified deep made ground with localised pockets of hydrocarbon contamination and slag within the western part of the Phase 2 area. This appears to be an area previously occupied by buildings/structures and tanks. Some additional intrusive ground investigation works were completed by Sirius to delineate the deep made ground, however, the works were limited due to the presence of mounds (material stockpiles). The report by Sirius concluded that the risk to controlled waters was negligible. However, as the area of investigation was limited, further investigations are considered necessary.

Therefore, following removal of the mounds, additional trial pitting is recommended to further investigate and possibly delineate the deep made ground, determine the extent of the slag and any associated geotechnical risks (potential expansion issues) and to assess any risks associated with possible hydrocarbon contamination (should they be identified). This could potentially be completed by the remediation principal Contractor during the site enabling works.

3.3 Removal of Former Foundations and Floor Slabs

During the previous investigations, evidence of former floor slabs and possible foundations was encountered. It is recommended that these are fully excavated and grubbed out prior to development.

It is possible that trapped (perched) waters may be encountered within the relict buried structures as noted during the previous investigations. The water may be impacted by hydrocarbon contamination associated with the site's former land uses. Any organic (fuel or oil) contamination associated within the former floor slabs or foundations or within the resulting excavation should be delineated, removed as much as reasonably possible and disposed of appropriately.

The buried concrete should be inspected for possible asbestos materials (floor tiles, insulation, etc). Any suspected asbestos should be tested and if confirmed to be present, should be removed by a specialist contractor. If no such materials are present, consideration could be given to crushing and reusing the concrete beneath the proposed roads and areas of hardstand, subject to confirmation by the Consulting Engineer.

It is recommended that these works are over seen by a Geo Environmental Engineer to ensure that any contamination is dealt with appropriately.

3.4 General Made Ground - Clean Cover System (CCS)

3.4.1 Phase 1 Area (Former Factory Area)

The ground investigation by GEO identified elevated Lead and PAH compounds within the made ground across the western part of the Phase 1 area (former factory area) and remediation was recommended to mitigate these risks.

The report indicated a possible risk to Human Health (future residents) in areas of private gardens where there is a potential for direct contact, inhalation or consumption of contaminants. The risk to Human Health is mitigated where the contaminated soils are covered by proposed buildings or hardstand as the pathway between the source and the receptor will be broken.

If made ground is to remain below areas of any soft landscaping, then remediation in the form of a Clean Cover System is considered appropriate. This will allow the contaminated materials to remain on site but not to represent a risk to the proposed end users (i.e., the residents).

For rear and side gardens, it is conceivable that residents may grow produce for human consumption. Therefore, the CCS should be a minimum of c.600mm thick and comprise a high visibility membrane (directly over the made ground), c.450mm of sub-soil and c.150mm of topsoil at the surface.

For front gardens, the risk to the residents is generally less than front gardens. Therefore, the CCS should be c.300mm thick and comprise a high visibility membrane (directly over the made ground), c.150mm of sub-soil and c.150mm of topsoil at the surface.

A robust CCS will be required in any areas that are to be raised using materials from Mound 1 due to the presence of trace asbestos fibres. The robust CCS should be a minimum of c.600mm thick (both in front and rear gardens and areas of soft landscaping) and should incorporate a ‘no-dig’ layer. Full details are provided in Section 3.1.1 above.

As well as providing a barrier between the contaminated material and the end user (i.e., residents), the clean cover layer also provides a suitable growing medium for plants and trees. Therefore, deepening of the clean cover is recommended where large plants and trees are proposed.

The high visibility marker layer, should be similar to the ‘Geosynthetics Alert Contamination Indicator’, ‘Terram Hi-Vis Geotextile Fabric’ or similar, and should be non-degradable, high permeability, puncture / abrasion resistant and robust enough to last the lifetime of the proposed development.

Where site-won materials are to be used, further sampling and chemical screening is advised to ensure that the materials are suitable prior to placement. For imported soils, it is recommended that the soils are sampled and screened at source to ensure that contaminated materials are not being imported onto site. Testing should be completed in accordance with the YALPAG Verification Requirements for Cover Systems guidance document. Testing of the materials will be required after placement.

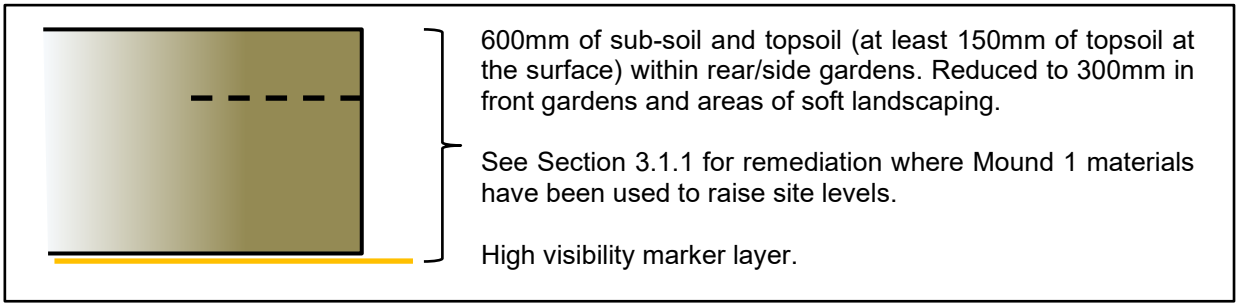


Figure 3. Clean Cover Layer Section for Private Gardens and Soft Landscaping (Phase 1).

It is likely that some made ground will need to be removed prior to placement of the clean cover layer to accommodate the proposed final levels. Consideration could be given to re-using granular materials beneath roads, pavements and buildings where the pathway to the end user would be broken and the material would not pose a risk to the end user (see comments regarding the reuse of granular made ground in Section 3.1.1). This would also be subject to confirmation from the Structural or Civil Engineer.

Inspection of the underlying natural soils would be required for validation purposes. Any imported soils should be visually inspected to confirm suitability and samples should be recovered for chemical screening. The scope and frequency of testing would be dependent on the volume of material required and source of the imported soil.

Where the made ground is thin (c.<0.40m thick) or levels are being reduced, consideration could be given to removing the made ground from the proposed private gardens and areas or soft landscaping. Removing the contaminated made ground would mitigate the risks to the end user by removing the source of the contamination and would negate the requirement for the Clean Cover, although clean topsoil would be required.

Inspection of the underlying natural soils would be required for validation purposes. The materials would need to be replaced with clean inert sub-soil and/or topsoil (at least 150mm of topsoil should be provided at the surface). Any imported soils should be visually inspected to confirm suitability and samples should be recovered for chemical screening. The scope and frequency of testing would be dependent on the volume of material required and source of the imported soil.

3.4.2 Phase 1 Area (Previously Undeveloped Area)

The ground investigation by GEO indicated that the area of Phase 1 which has previously remained undeveloped comprised a thin layer of made ground (reworked clays). Testing of these soils indicated no elevated contaminants were present and, therefore no significant risks to human health. As such, the report did not identify any specific requirements for remediation. However, it was considered prudent to incorporate a minimum c.100mm of topsoil at the surface.

Validation of the clean cover layer would be required upon completion. A summary of the validation requirements is included in Section 4.2.

3.4.3 Phase 2 Area

The ground investigation by Sirius indicated that the made ground materials within the Phase 2 area had a high pH (alkali) content. Therefore, Sirius recommended a Clean Cover System (CCS) to mitigate any risks to the end user (residents) and to provide a suitable growing medium.

The risk to Human Health is mitigated where the contaminated soils are covered by proposed buildings or hardstand as the pathway between the source and the receptor will be broken.

If made ground is to remain below areas of any soft landscaping and gardens, then remediation in the form of a Clean Cover System (CCS) is considered appropriate. This will allow the contaminated materials to remain on site but not to represent a risk to the proposed end users (i.e., the residents).

For front, rear and side gardens and areas of soft landscaping the CCS should be c.300mm thick and comprise a membrane (Geosynthetics Alert Contamination Indicator or similar) directly over the made ground, c.150mm of sub-soil and c.150mm of topsoil at the surface as indicated in Figure 4 on the following page.

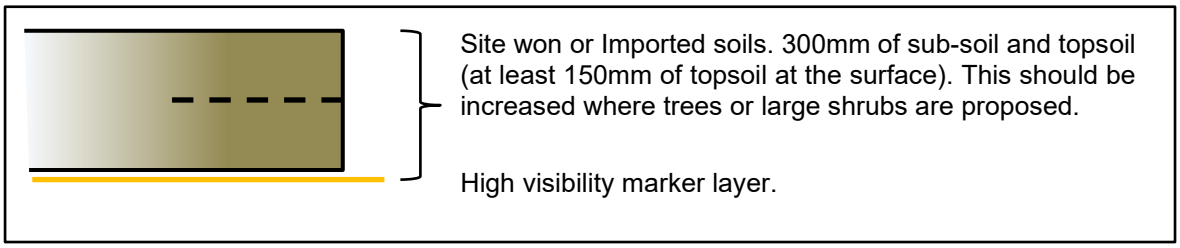


Figure 4. Clean Cover Layer Section for Private Gardens and Soft Landscaping (Phase 2).

Validation of the clean cover layer would be required upon completion. A summary of the validation requirements is included in Section 4.2.

Where the made ground is thin (c.<0.40m thick) or levels are being reduced, consideration could be given to removing the made ground from the proposed private gardens and areas or soft landscaping. Removing the contaminated made ground would mitigate the risks to the end user by removing the source of the contamination and would negate the requirement for the Clean Cover.

Inspection of the underlying natural soils would be required for validation purposes. The materials would need to be replaced with clean inert sub-soil and/or topsoil (at least c.150mm of topsoil should be provided at the surface). Any imported soils should be visually inspected to confirm suitability and samples should be recovered for chemical screening. The scope and frequency of testing would be dependent on the volume of material required and source of the imported soil.

3.5 Ground Gas Requirements

3.5.1 Ground Gas Requirements - Phase 1 Area

The ground investigation identified low concentrations of carbon dioxide and methane, therefore gas protection measures were not deemed necessary in this respect.

However, a revised Radon Assessment in 2023 identified that the site requires Basic Radon Protection Measures within new properties. A Ground Gas Verification Plan will be required to outline the requirements for the Basic Radon Protection Measures, how they should be installed and subsequently verified as suitable.

3.5.2 Ground Gas Requirements - Phase 2 Area

The Ground investigation by Sirius identified elevated concentrations of carbon dioxide and methane across this area and recommended gas protection measures in line with CS2. A Ground Gas Verification Plan was completed for the Phase 2 area in August 2022.

A revised Radon Assessment in 2023 identified that the site now requires Full Radon Protection Measures within new properties. The Ground Gas Verification Plan will need to be updated to include the requirements for the Full Radon Protection Measures, how they should be installed and subsequently verified as suitable.

3.6 Water Supply Pipe Requirements

Barrier pipe is recommended for both the Phase 1 and Phase 2 development areas.

The ground investigation for the Phase 1 area by GEO indicated that the made ground materials may potentially pose a risk to future buried utilities (particularly water supplies) and that non-standard

supply pipes may be required. GEO returned to site in August 2022 (c.3 years later) to delineate the hydrocarbon contamination that was previously encountered in the western part of the site. However, no evidence of hydrocarbon contamination was encountered, and it was considered that the contamination was limited in extent and had likely dispersed over the years after being disturbed.

Although no evidence of hydrocarbon contamination was encountered during the supplementary ground investigation, GEO recommended that barrier pipe was adopted for the proposed water supplies on the site due to the potential for other unidentified pockets of hydrocarbon contamination which may be present.

The ground investigation for the Phase 2 development area by Sirius identified localised visual and olfactory evidence of hydrocarbon contamination in the western part of the site and groundwater screening confirmed that perched water could be a potential risk to potable water supply pipes. Based on this information, GEO recommended that barrier pipe was adopted for the proposed water supplies on the site.

4.0 RESPONSIBILITIES AND VALIDATION

4.1 Responsibilities

It is the responsibility of the Client and Principal Remediation Contractor to agree the Remediation Strategy with the Local Authority prior to commencing and to collate the following information which will form an important chain of custody and proof of works for the validation report:

- Geographical location for the source of the clean cover materials.
- Laboratory testing of the following:
  - WAC Testing for the waste materials requiring off-site disposal prior to disposal at an appropriate facility.
  - Contamination screening to verify the appropriateness of the clean cover materials to be brought to site.
- Photographic evidence of earthworks incorporating the removal of contaminated soils and/or placement of the geotextile, no dig layer and clean cover materials.
- Topographical Survey data before, during and after inclusion of the Clean Cover Layer. This may be used as accompanying evidence of the appropriate thickness of the no-dig layer and the clean cover soils.
- Off-site disposal tickets (including the chain of custody records) to confirm the appropriate disposal of any contaminated soils.
- Contamination test reports for any imported topsoil materials brought on to site to be placed in areas of soft landscaping or private gardens to confirm that contaminated materials are not inadvertently being brought to site.
- Procurement of an appropriate his-visibility marker layer (Terram Hi-Vis Geotextile' or similar).

The Principal Remediation Contractor should also ensure all appropriate licenses and Material Management Plans (MMP's), where required are in place prior to commencing on site.

4.2 Validation for Soil Contamination Remediation

The remediation works will need to be independently witnessed and checked to ensure that they been completed to a suitable standard and in accordance with the strategy outlined above. The validation works would be completed in accordance with YALPAG (Yorkshire and Lincolnshire Pollution Advisory Group) Verification Requirements for Cover Systems.

An experienced Geo-Environmental Engineer will need to be present during the remediation works at 'key stages' to check that the contaminated soils have been removed, or that the imported soils are of suitable thickness to mitigate the risk to human health. The requirements for validation will vary depending on the type of remediation completed as outlined below:

- **Clean Cover Layer:** inspections would be required for validation purposes. This would include an inspection of the high visibility marker layer (including inspection of accompanying documentation), no-dig layer and the imported soils to confirm suitability and appropriate thickness.

  The validation works should be in line with the YALPAG, Verification for Cover Systems. A copy can be acquired using the following link:

  https://www.leeds.gov.uk/docs/YALPAG%20Guidance%20-%20Verification.pdf.

  Validation would include sampling of the donor material and chemical screening prior to importation. This would avoid any costly removal of contaminated materials that are inadvertently brought to site.

Once in place, hand dug inspection pits are made in the gardens to confirm the appropriate thickness. Samples are also recovered, and these are scheduled for chemical screening to determine if the materials are suitable for purpose and do not pose a risk to human health. The scope and frequency of testing would be dependent on the source of the imported material and in line with YALPAG requirements.

In accordance with YALPAG, the following is a summary of the minimum test requirements:

- Brownfield source: minimum of 6 samples or 1 test per 100m^3 of material*.
- Greenfield source: a minimum of 3 samples or 1 test per 250m^3 of material*.
  (* - whichever is greater)

Figure 5 indicates the minimum test requirements for sub-soil and topsoil on NHBC sites.

Site size	Nominal sampling frequency (Subject to minimum totals)	Suggested minimum total number of tests per site of each material used within the capping layer[1]
1 to 5 plots	1 test per plot	3
6 to 10 plots	1 test per 2 plots	5
11 to 20 plots	1 test per 2 plots	5
21 to 30 plots	1 test per 3 plots	7
31 to 40 plots	1 test per 4 plots	10
Over 40 plots	1 test per 4 plots	10

[1] If the cover system consists of subsoil and topsoil, both components require testing.

Figure 5. NHBC Requirements for Testing Sub-soils and Topsoil.

- Where the contaminated soils are removed entirely, visual inspection of the underlying natural soils by an independent Geo-Environmental Engineer would be required to confirm that the soil is free of anthropogenic material and visual / olfactory evidence of hydrocarbon contamination. At least 150mm of topsoil would be required as a planting medium and validation testing would be required to confirm that the topsoil is suitable.

Any excess made ground materials that cannot be accommodated on site should be disposed of appropriately, at a waste disposal facility. Waste disposal tickets should be maintained as part of the chain of custody records. Waste Acceptance testing may be required to confirm a suitable landfill classification.

A validation report will be issued upon completion of the remediation works if the Geo-Environmental Engineer is satisfied that the remediation works have been completed to a suitable standard.

Any issues should be discussed with the Engineer to agree a suitable solution. If the imported soils are deemed unsuitable, the materials may need to be disposed of offsite. It is, therefore recommended that samples of the proposed imported soils are recovered and tested at source to confirm acceptability prior to importation.

4.2.1 Imported Soils – Laboratory Chemical Screening

Any imported topsoil should be as specified in BS 3882:2007 as 'suitable for their intended purpose'.

Any imported soils should be sampled and tested prior to being imported to avoid importing contaminated material.

All materials brought on to site that are to be used within the areas of soft landscaping should be tested and the results reviewed against the generic assessment criteria (GAC) set out within the table included in Appendix II (correct at the time of writing but could be subject to change).

The sampling and testing frequency should be in accordance with YALPAG guidelines (Verification Requirements for Cover Systems guidance document) and would be dependent on the source of the soil.

4.2.2 Stockpiling, Offsite Disposal and WAC Testing

During the construction works it is likely that materials will be excavated on site (i.e. future foundations and buried utilities, etc.) that will not be able to be accommodated on site due to space and level constraints, ultimately requiring removal off site.

During the construction works different materials should be kept separate, as it may be the case that uncontaminated natural materials can be classified as non-reactive hazardous waste and disposed of as such although this should be confirmed by the receiving Landfill site. A separate assessment will be required for any topsoil (naturally occurring organic materials) that may be encountered as they cannot be classified as inert due to their natural organic content.

Where made ground materials or disturbed natural strata is to be removed, the results of the soil testing undertaken in the GIR can be used as a preliminary assessment and the anticipated waste disposal facility should be provided with a copy of the results for review. It may be the case that the waste facility requires additional contamination screening to aid the characterisation of the made ground for off-site disposal (i.e. Waste Acceptance Criteria – WAC) and it is recommended that this be confirmed by the design team prior to commencing on site.

During the construction phase, it may be the case that WAC screening is required to aid classification for disposal, and it is recommended that all materials are classified prior to excavation and disposal off site.

Conversely, if materials are required to be brought to site to raise site levels or as part of a clean cover system then certification and/or soil testing results should be reviewed by a suitably experienced and qualified geo-environmental engineer to ensure that potentially contaminated materials are not being brought to site.

5.0 GENERAL COMMENTS

It is the responsibility of the Client and Principal Remediation Contractor to agree the Remediation Strategy with the Local Authority prior to commencing. The Principal Remediation Contractor should also ensure all appropriate licenses and Material Management Plans (MMP's), where required are in place prior to commencing on site.

Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility and areas where limited access was available.

It is therefore recommended that a "watching brief" and "observational technique" be applied to this site to ensure that if ground conditions appear to vary from those identified within this investigation report then advice should be sought from a suitably qualified and experienced Geotechnical or Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the strata observed within the exploratory holes and the results of the laboratory tests. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them. GEO takes no responsibility for the accuracy of third-party information provided by sub-contract drillers or laboratories.

The conclusions and recommendations presented within this report are considered reasonable based on the available information. However, these cannot be guaranteed to gain regulatory approval. Therefore, the report should be passed to the appropriate regulatory authorities and/ or other key stakeholders, including warranty providers in order to seek their approval of the findings prior to undertaking any works on site and prior to occupation of the proposed properties.

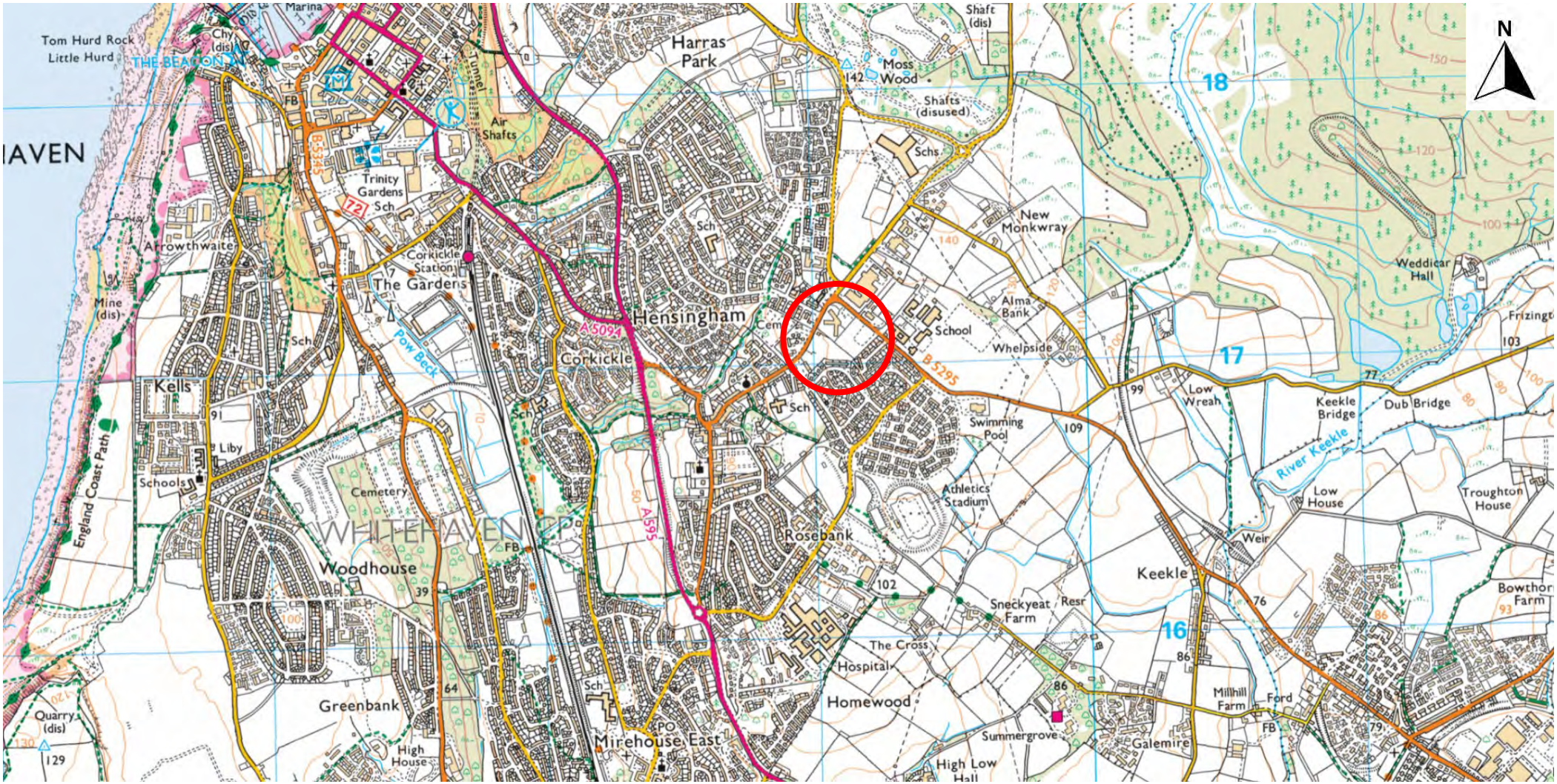
End of Report

Appendix I

- Site Location Plan
- Proposed Site Layout Plans
- Remediation Plan

GEO Environmental Engineering

GEO2024-6320: Ivy Mills (Phases 1 & 2), Main Street, Hensingham, Whitehaven – Site Location



Website: www.geoenvironmentalengineering.com
Email: info@geoenvironmentalengineering.com
Telephone: 07883 440 186

0m 5m 10m 20m 30m 40m 50m 100m

SCALE BAR @ 1:500

KEY

- 1.8m HIGH TIMBER SCREEN FENCE TO SEPARATE DETAIL
- 1.8m HIGH TIMBER SCREEN DIVISIONAL FENCE TO SEPARATE DETAIL (AS ABOVE DETAIL)
- 1.8m HIGH SCREEN WALL TO SEPARATE DETAIL
- PROPOSED TREE PLANTING
- EXISTING TREES TO BE REMOVED
- BIN COLLECTION POINTS
- SHARED DRIVE
- AS / OPP — 'AS' AND 'OPP' HANDINGS OF HTs

SCHEDULE OF ACCOMMODATION

TYPE	DESCRIPTION	SQ.FT	No.
201	2 bed semi-det.	651	4
211	2 bed semi-det.	651	3
301	3 bed semi-det.	759	14
303	3 bed semi-det.	772	8
340	3 bed semi-det.	839	3
353	3 bed detached	904	9
337	3 bed detached	864	2
359	3 bed detached	984	6
450	4 bed detached	1156	7
435	4 bed detached	1221	7
TOTAL		**56,283 SQ.FT**	**63No.**

REV	DESCRIPTION	DATE
B	UPDATED TO LATEST LAYOUTS.	10.04.24
A	PLOT 38 OMITTED AND 36 & 37 ON PHASE 2 AMENDED.	15.04.22

gleeson

GLEESON HOMES & REGENERATION

DRAWING
PLANNING LAYOUT (COMBINED)

PROJECT
IVY MILL, WHITEHAVEN

SCALE	1:500@A1	REV. B	DRAWING No.
DATE	DEC 2021		MJG/PL-112-6
DRAWN	TWENTY10		

IVY MILL, WHITEHAVEN (COMBINED LAYOUT)

TWENTY 10
DESIGN AND PLANNING
Twenty10 Management Limited, 62 Hawkshead Avenue, Euxton, Chorley, Lancashire. PR7 6NZ
Tel: (01257) 277 100 Email: info@twenty10.biz Fax: (01257) 266 911

GEO Environmental Engineering

GEO2024-6320: Ivy Mills, Hensingham, Whitehaven, Phases 1 and 2 – Remediation Plan

Basic Radon protection Measures:

The Phase 1 Area will require Basic Radon protection Measures.

CS2 Gas Protection Measure & Full Radon protection Measures:

The Phase 2 Area will require Gas Protection Measure in line with Characteristic Situation 2 and Full Radon protection Measures.

Clean Cover System (100mm to 300mm):

The GIR by Sirius recommended a Clean Cover System within areas of soft landscaping and gardens due to high pH concentrations. This included:

- 100mm with geotextile in front gardens and soft landscaping.
- 300mm with geotextile in rear and side gardens.

Clean Cover System (300mm to 600mm):

The GIR by GEO recommended a Clean Cover System within private gardens and soft landscaped areas due to elevated contamination. This included:

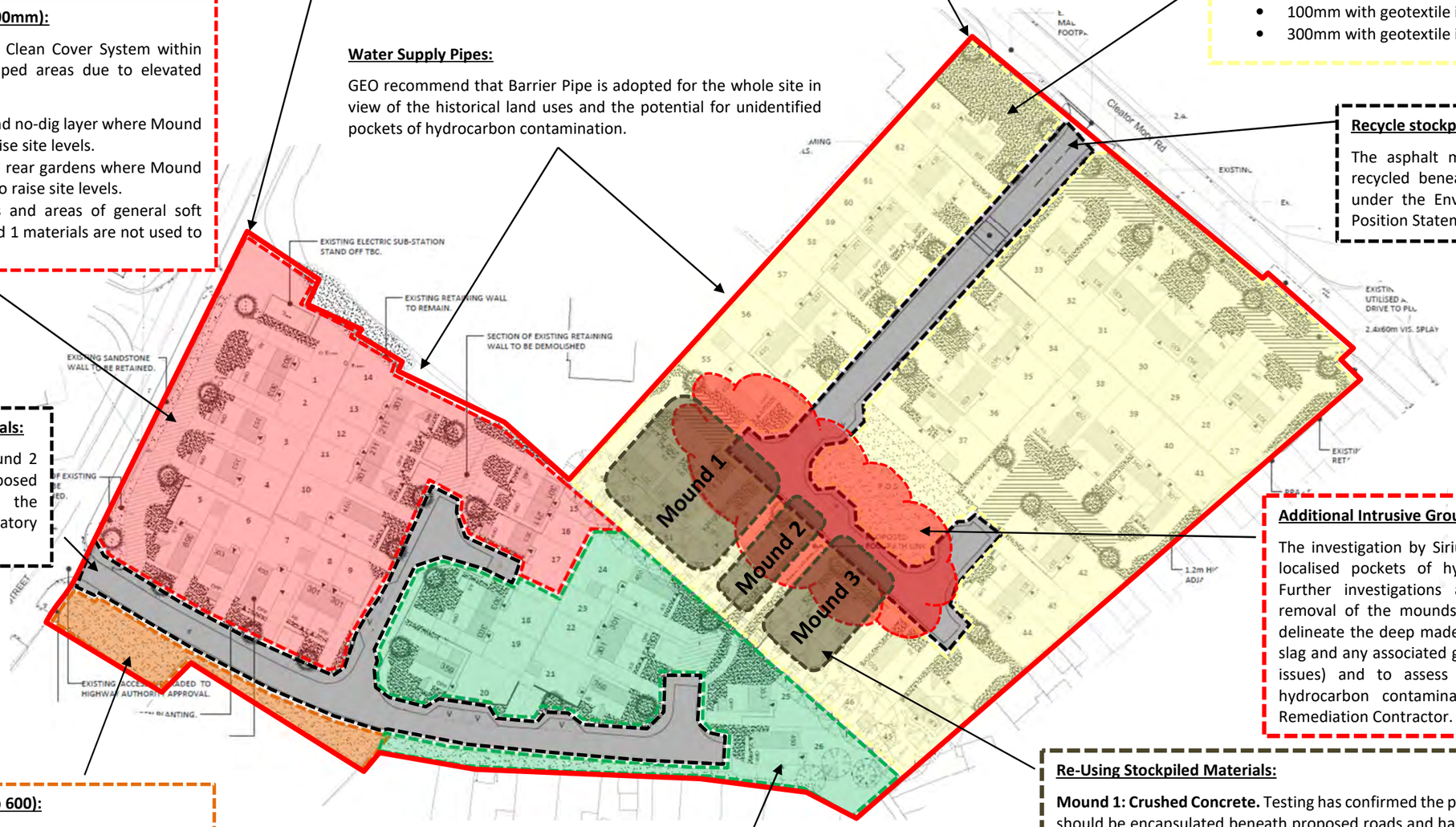
- 600mm with geotextile and no-dig layer where Mound 1 Materials are used to raise site levels.
- 600mm with geotextile in rear gardens where Mound 1 materials are not used to raise site levels.
- 300mm in front gardens and areas of general soft landscaping where Mound 1 materials are not used to raise site levels.

Water Supply Pipes:

GEO recommend that Barrier Pipe is adopted for the whole site in view of the historical land uses and the potential for unidentified pockets of hydrocarbon contamination.

Recycle stockpiled Asphalt Materials:

The asphalt materials within Mound 2 could be recycled beneath proposed roads and pavements under the Environment Agency's (EA) 'Regulatory Position Statement 075'.



Recycle stockpiled Asphalt Materials:

The asphalt materials within Mound 2 could be recycled beneath proposed roads and pavements under the Environment Agency's (EA) 'Regulatory Position Statement 075'.

Additional Intrusive Ground Investigations Required:

The investigation by Sirius identified deep made ground with localised pockets of hydrocarbon contamination and slag. Further investigations are considered necessary following removal of the mounds, to further investigate and possibly delineate the deep made ground, determine the extent of the slag and any associated geotechnical risks (potential expansion issues) and to assess any risks associated with possible hydrocarbon contamination. Could be completed by the Remediation Contractor.

Clean Cover System (300mm to 600):

The GIR by GEO recommended a Clean Cover System within areas of soft landscaping gardens due to elevated contamination. This included:

- 300mm with general soft landscaped areas.
- 600mm with geotextile and no-dig layer where Mound 1 Materials are used to raise site levels.

No Specific Remediation Required:

The GIR by GEO did not identify any significant made ground or elevated contaminants, therefore no specific remediation is required. However, a minimum c.100mm of topsoil is advised in the proposed gardens and soft landscaped areas.

Re-Using Stockpiled Materials:

Mound 1: Crushed Concrete. Testing has confirmed the presence of trace asbestos. The material should be encapsulated beneath proposed roads and hardstand. Consideration can be given to use beneath soft landscaping and gardens; however, it will need to be capped by a robust 600mm Clean Cover System in these areas.
Mound 2: Asphalt. Testing has confirmed the presence of coal tar and trace asbestos. The material could be recycled beneath proposed roads and pavements under the Environment Agency's (EA) 'Regulatory Position Statement 075'.
Mound 3: Topsoil. Testing has confirmed that the topsoil in Mound 3 is suitable for re-use within proposed gardens and areas of soft landscaping.

Website: www.geoenvironmentalengineering.com
Email: info@geoenvironmentalengineering.com
Telephone: 07883 440 186

Appendix II

- Soil Validation Criteria for Imported Soils
- Environment Agency Regulatory Position Statement 075 (re-use of coal tar)

Soil Validation Criteria for Imported Soils

		Generic Assessment Criteria Residential With Plant Uptake			
Determinand	**Unit**	**GAC at 1% SOM**	**GAC at 2.5% SOM**	**GAC at 6% SOM**	**GAC Ref:**
Arsenic (total)	mg/kg	37	37	37	LQM S4UL
Cadmium (total)	mg/kg	10	10	10	CLEA SGV
Chromium (III)	mg/kg	910	910	910	LQM S4UL
Chromium (VI)	mg/kg	6	6	6	LQM S4UL
Copper (total)	mg/kg	2400	2400	2400	LQM S4UL
Lead (total)	mg/kg	200	200	200	LQM C4SL
Mercury (total)	mg/kg	40	40	40	LQM S4UL
Nickel (total)	mg/kg	130	130	130	LQM S4UL
Selenium (total)	mg/kg	250	250	250	LQM S4UL
Zinc (total)	mg/kg	3700	3700	3700	LQM S4UL
pH	N/A	<6.5	<6.5	<6.5	BRE
Sulphate (2:1 water soluble)	mg/l	>500	>500	>500	BRE
Cyanide (total)	mg/kg	34	34	34	ATRISK SSV
Phenols (total)	mg/kg	120	200	380	LQM S4UL
Total Organic Carbon (TOC)	% w/w C	-	-	-	-
PAH					
Naphthalene	mg/kg	2.3	5.6	13.0	LQM S4UL
Acenaphthylene	mg/kg	170	420	920	LQM S4UL
Acenaphthene	mg/kg	210	510	1100	LQM S4UL
Fluorene	mg/kg	170	400	860	LQM S4UL
Phenanthrene	mg/kg	95	220	440	LQM S4UL
Anthracene	mg/kg	2400	5400	11000	LQM S4UL
Fluoranthene	mg/kg	280	560	890	LQM S4UL
Pyrene	mg/kg	620	1200	2000	LQM S4UL
Benzo(a)anthracene	mg/kg	7	11	13	LQM S4UL
Chrysene	mg/kg	15	22	27	LQM S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	4	LQM S4UL
Benzo(k)fluoranthene	mg/kg	77	93	100	LQM S4UL
Benzo(a)pyrene	mg/kg	2.2	2.7	3.0	LQM S4UL
Indeno(123cd)pyrene	mg/kg	27	36	41	LQM S4UL
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.30	LQM S4UL
Benzo(ghi)perylene	mg/kg	320	340	350	LQM S4UL
PAH (total of USEPA 16)	mg/kg	-	-	-	-
BTEX & TPH					
MTBE	mg/kg	49	84	160	CL:AIRE GAC (2010)
Benzene	mg/kg	0.087	0.17	0.37	LQM S4UL
Toluene	mg/kg	130	290	660	LQM S4UL
Ethylbenzene	mg/kg	47	110	260	LQM S4UL
m & p-Xylene	mg/kg	56	130	310	LQM S4UL
o-Xylene	mg/kg	56	140	310	LQM S4UL
VPH Aromatic (>EC5-EC7)	mg/kg	70	140	300	LQM S4UL
VPH Aromatic (>EC7-EC8)	mg/kg	130	290	660	LQM S4UL
VPH Aromatic (>EC8-EC10)	mg/kg	34	83	190	LQM S4UL
EPH Aromatic (>EC10-EC12)	mg/kg	74	180	380	LQM S4UL
EPH Aromatic (>EC12-EC16)	mg/kg	140	330	660	LQM S4UL
EPH Aromatic (>EC16-EC21)	mg/kg	260	540	930	LQM S4UL
EPH Aromatic (>EC21-EC35)	mg/kg	1100	1500	1700	LQM S4UL
EPH Aromatic (>EC35-EC44)	mg/kg	1100	1500	1700	LQM S4UL
VPH Aliphatic (>C5-C6)	mg/kg	42	78	160	LQM S4UL
VPH Aliphatic (>C6-C8)	mg/kg	100	230	530	LQM S4UL
VPH Aliphatic (>C8-C10)	mg/kg	27	65	150	LQM S4UL
EPH Aliphatic (>C10-C12)	mg/kg	130	330	760	LQM S4UL
EPH Aliphatic (>C12-C16)	mg/kg	1100	2400	4300	LQM S4UL
EPH Aliphatic (>C16-C35)	mg/kg	65000	92000	110000	LQM S4UL
EPH Aliphatic (>C35-C44)	mg/kg	65000	92000	110000	LQM S4UL
Subcontracted analysis					
Asbestos (qualitative)	-	Presence	Presence	Presence	N/A

Notes: Results to be reviewed against appropriate SOM value.

Regulatory position statement 075

The movement and use of treated asphalt waste containing coal tar

If you comply with the requirements below, we will allow the final use of treated asphalt waste containing coal (AWCCT) tar in certain construction operations without an environmental permit. We will also relax the hazardous waste reporting requirements for the place of end-use of treated AWCCT. This RPS does not cover the 'treatment' of AWCCT.

Background

This regulatory position statement (RPS) applies to the use of treated asphalt waste containing coal tar (AWCCT) in construction operations for hard paving structures such as roads, pavements, footways, car parks or airfields.

Asphalt waste is created when material is removed from paving structures, for example in the repair and refurbishment of roads and pathways. Where the binder used within the structure is bitumen only, asphalt waste is usually non-hazardous. However where the binding agents contain coal tar and exceed the relevant hazardous waste threshold, the asphalt waste will be classed as hazardous waste. In this document, the term AWCCT refers to asphalt waste that contains coal tar and is classed as hazardous.

AWCCT is commonly treated by crushing, grinding and screening, following which it is then used again in the construction of paving structures similar to those from which the waste arose for example roads or pathways. The use of AWCCT in these construction applications is a waste recovery operation that requires a permit under the Environmental Permitting (England and Wales) Regulations 2010. However it is considered disproportionate to require a permit. The environmental risk of the activity is low and capable of being adequately controlled by means of suitable general rules. This RPS allows the use of AWCCT in construction provided the criteria specified below are met. **It does not cover the treatment of AWCCT**.

This RPS also provides a consignee quarterly returns derogation to the place of end use that simplifies the requirement of sending a quarterly return to the Environment Agency. All other requirements of the Hazardous Waste Regulations still apply, including the requirement to complete consignment notes.

Our approach

We will not pursue an application for an environmental permit for the use of AWCCT in construction operations for hard paving structures where:

- The treated AWCCT meets the requirements of clause 948, ex-situ cold recycled bound material, within the Specification for Highways Works Series 900, or clauses 810 to 880 for cement and other hydraulically bound mixtures within the Specification for Highway Works Series 800.
- The material is used only in bound sub-surface layers e.g. sub-base, base and binder layers. **Use in surface applications is not allowed.**
- You meet the relevant objectives of the Waste Framework Directive;

> '… ensuring that waste management is carried out without endangering human health, without harming the environment and in particular:
> (i) without risk to water, air, soil, plants or animals;
> (ii) without causing a nuisance through noise or odours; and
> (iii) without adversely affecting the countryside or places of special interest.'

We will also allow a simplified quarterly consignee return for consignments of AWCCT received at a place of end use, as follows:

- All consignments of AWCCT received at a single place of end use in a three month period can be summarised into a single, one-line consignee return, using the postcode nearest to the place of end use.

See RPS 135 for an explanation on how to report the summary consignee return for AWCCT.

Enforcement

In not pursuing an application for a permit or the above aspects of the Hazardous Waste Regulations, we will not normally take enforcement action unless the activity has caused, or is likely to cause, pollution or harm to health. For a more detailed explanation of this enforcement position, please see our Enforcement and Sanctions statement.

If compliance with the Hazardous Waste Regulations and the rules of this RPS are not being adhered to, we will consider retracting this position statement.

This statement is based on our understanding of the relevant legislation. It applies to England only. You can get advice on the approach being taken in Wales from Natural Resources Wales.

Further advice

Further advice on dealing with hazardous waste can be found on www.gov.uk.

This position will be reviewed in June 2016 by which time we will have reviewed the suitability of this RPS to be used as the basis for a new exemption.

MWRP RPS 075 Version: 4
Issued: September 2014

Doc ref: LIT 10118

GEO Environmental Engineering Ltd

Geotechnical and Environmental
Consultants
&
Drilling Experts

Website: www.geoenvironmentalengineering.com
Email: info@geoenvironmentalengineering.com
Telephone: 07883 440 186