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Project

BRITON FERRY GARAGES – REMEDIATION STRATEGY REPORT

Client

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1.0 INTRODUCTION

1.1 Introduction

Spectrum Geo Services (SGS) were requested by Swansea Garages Ltd. to prepare a Remediation Strategy for the proposed development at land located at Briton Ferry, Neath Port Talbot. Development proposals comprise garage units with associated access, parking, landscaping and infrastructure works.

1.2 Brief

A Remediation Strategy is required to address Neath Port Talbot County Councils planning conditions 5, 7 and 8 in their Approval of Full Planning, Decision Notice REVISION NUMBER 1, dated 10 February 2021

5 - No development shall commence on site until a remediation scheme to bring the site to a condition suitable for the intended use by removing any unacceptable risks to human health, buildings, other property and the natural and historic environment shall be prepared and submitted to and approved in writing with the Local Planning Authority. The scheme shall include all works to be undertaken, proposed remediation objectives, remediation criteria and site management procedures. The measures proposed within the remediation scheme shall be implemented in accordance with an agreed programme of works.

Reason:

To ensure that risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors, and to ensure compliance with Policies SP16 and EN8 of the Neath Port Talbot Local Development Plan.

7 - Prior to the beneficial use of the proposed development commencing, a verification report which demonstrates the effectiveness of the agreed remediation works carried out in accordance with Condition 5 shall have been submitted to and approved in writing by the Local Planning Authority.

Reason:

To ensure that risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors and to ensure compliance with Policies SP16 and EN8 of the Neath Port Talbot Local Development Plan.

8 - In the event that contamination is found at any time when carrying out the approved development that was not previously identified, work on site shall cease immediately and shall be reported in writing to the Local Planning Authority. A Desk Study, Site Investigation, Risk Assessment and where necessary a Remediation Strategy must be undertaken in accordance with the following document:- Land Contamination: A Guide for Developers (WLGA, WAG & EAW, July 2006). This document shall be submitted to and agreed in writing with the Local Planning Authority. Prior to occupation of the development, a verification report which demonstrates the effectiveness of the agreed remediation, shall be submitted to and agreed in writing with the Local Planning Authority.

Reason:

To ensure that risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other off site receptors, and to ensure compliance with Policies SP16 and EN8 of the Neath Port Talbot Local Development Plan.

1.3 Report Objectives

The remediation strategy presented herein includes an outline of the proposed works; requirements for the monitoring and verification of the works, and demonstration that the scheme will result in the removal of potential pollutant linkages. It also provides a pro-active remediation strategy setting out how any as-yet unidentified contamination will be properly identified, characterised and dealt with in the event that such contamination is encountered during the construction works.

The overall objectives of the Remediation Strategy are as follows:

- Set out the general principles and methods that will be adopted to reduce risks to future end users to an acceptable level, in line with the

proposed development plan as submitted to the Local Planning Authority;

- Outline management procedures which may be required to protect key receptors in the event of contamination being identified on the site; and,
- Provides a defined criteria and validation procedure for demonstrating that the remediation works have been implemented to a suitable degree.

1.4 Site Status and Proposed Development

The site is located at approximate national grid reference (NGR) SS 738 943 within Briton Ferry, South Wales. The site is bounded by Regent Street to the south. Victoria Street to the East and Shelone Road to the west.

The site is triangular in shape. The site consists of an open area, with zones of hardstanding and grass, and numerous existing garages.

The site is located in a mixed residential / commercial area. Land use immediately surrounding the site is detailed below.

- South - Remediated Former Gas Works beyond Regent Street West,
- East - Victoria Street beyond which are residential properties,
- West – Shelone Road, beyond which are further residential properties.

The development will comprise removing and replacing the existing garages with new units.

The site's location is shown in Figure 1.4.

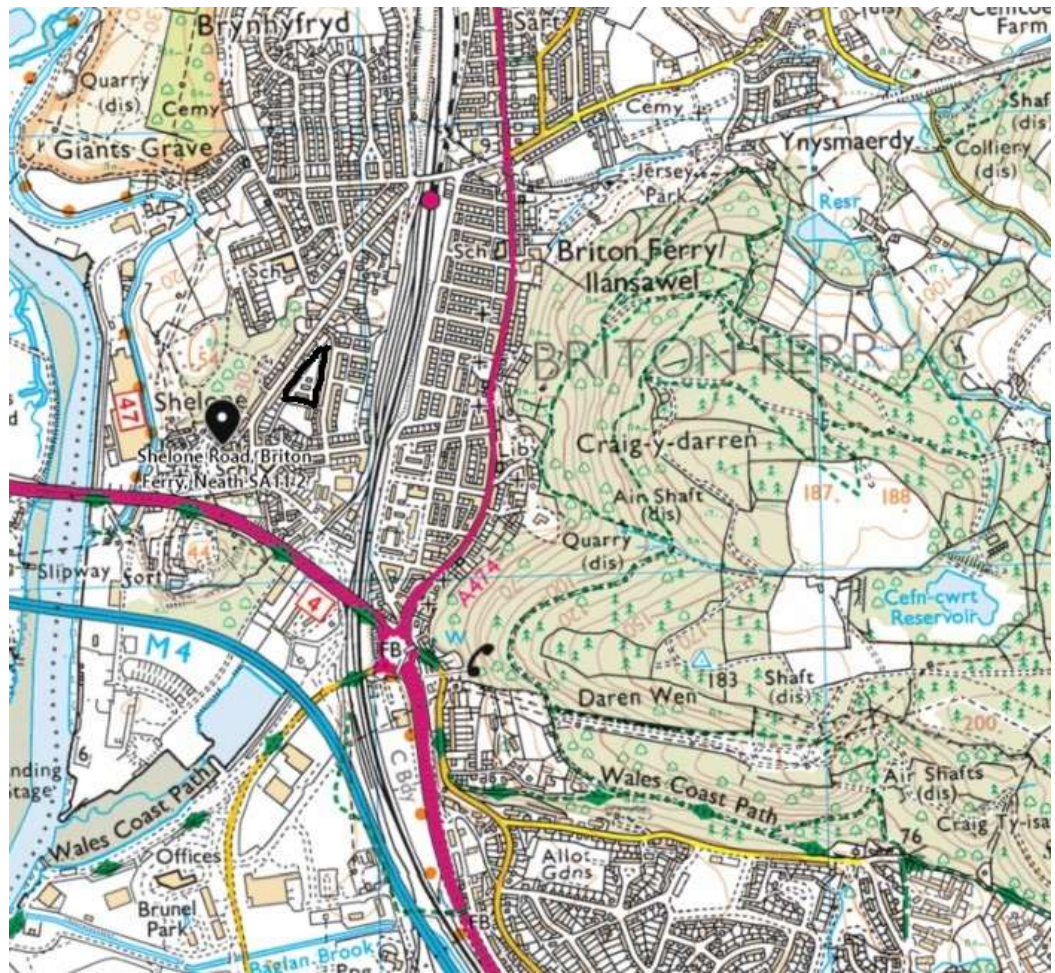


Figure 1.4: Site Location

1.6 Limitations

This report is subject to the report conditions created in Appendix A. The information contained within this report is intended for the use of Swansea Garages Ltd. and SGS can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2.0 EXISTING SITE INFORMATION

2.1 Geology

The site geology is based on information obtained from the published 1:10,660 and 1:50,000 British Geological Survey (BGS) geological mapping sheets (Swansea) Solid and on information from previous investigations.

Ground conditions at the site are anticipated estuarine alluvium underlain by glacial drift. The solid geology is expected to be of a sequence of Carboniferous Upper Coal Measures consisting of Lower Pennant and Rhondda beds. The map indicates two unnamed coal seams one on the northern site boundary and one 100m to the south of the site. Both conjecturally outcrop beneath the superficial deposits and based on the dip direction of the Rhondda beds to the north it is likely that the southern most coal seam will underlay the site. The site is located approximately 100m to the east of the Giants Grave Fault which runs in a north south orientation down throwing strata to the east and has a large effect on the stratigraphy of the region.

Previous investigations close to the site published mapped geology and BGS borehole data have indicated the Geological units and lithology thickness likely to be present at the site, details of this are summarised in Table 2.3.1.

Table 2.1: Summary of Site Geology:

Geological Unit or Lithology	Thickness (available Information)
Made Ground: Recent deposits expected to comprise of waste products from gas manufacture, clinker, coal rich materials, coke and reworked drift deposits.	Variable thickness up to 2.0 to 3.0m bgl expected possibly up to 4.50m within former gas holders.
Recent Deposits: Marine or Estuarine Alluvium consisting of clay and peat, then sand with gravel and sandstone fragments in a stiff brown silty sandy clay matrix.	Thickness varies from 1.0-10m.
Solid Geology: Carboniferous, Upper Coal Measures (Pennant), overlying Cefn Bryn Shales. Comprise of sandstone horizons separated by shale, siltstone, seat earth and coal.	Thickness not known. The site is located on a north-south trending fault. The downthrown side of the fault is to the east. The regional dip (30 to 40°) on both sides of the fault is northwards.

2.2 Hydrogeology

The Hydrogeology of the site is presented below in Table 2.3.2 and is based on the EAW Groundwater Vulnerability Map sheet 35, West Glamorgan together with an assessment of available geological information.

Table 2.2: Summary of Site Hydrogeology

Geological Unit	Aquifer Classification	Aquifer Characteristics	Source Protection Zone	Groundwater Abstractions
Made Ground	Not classified	Highly variable permeability and porosity. Perched water may be present with variable flow directions	No	None recorded within 1km of site
Glacial Drift and Estuarine Alluvium	Minor Aquifer	Variable permeability and porosity. Perched water may be present with variable flow directions	No	None Recorded within 1km of site
Carboniferous, Lower Pennant Beds	Minor Aquifer Cont	Variable permeability. Fractured or potentially fractured rock with low primary permeability. May contain a multi-layered aquifer system with separate water bodies in each sandstone horizon.	No Cont	None Recorded within 1km of site

Shallow groundwater is likely to be present in the made ground (1.5 to 2.0 m bgl). The shallow groundwater appears to flow west. Groundwater is also anticipated to be present in the Glacial Deposits. Waters with this unit also appear to flow west. There is however uncertainty with respect to the continuity between the two water bodies. The shallow groundwater appearing to be perched above the waters in the superficial deposits.

Groundwater flow direction in the Coal Measures is uncertain; there is likely to be a generally south westerly hydraulic gradient towards the sea, however fractures will have an impact on flow direction and rates.

Based on the EAW Groundwater Vulnerability map sheet 35 and the Envirocheck report, soils are described as being of a high leaching potential (U) over the site.

2.3 Hydrology

The hydrology of the study area and surrounding environs is presented in Table 3 and is based primarily on Ordnance Survey Maps and visual observations on information held by the EAW.

Table 2.3: Summary of Site Hydrology

Feature	Distance From Site	Flow	Classification	Abstractions	Discharge
Surface Runoff	N/A	Likely to infiltrate directly to ground.	N/A	N/A	N/A
Jersey Canal	250m west from the site.	Not Known	GQA Grade D (Fair) *	No Licensed abstractions within 1km of the site.	N/A
Neath River	400m m west from the site.	North east to south west to Baglan / Swansea bay.	Not Known	No Licensed abstractions within 1km of the site.	N/A

Notes: Based on information obtained from the Environment Agency Wales *GQA – General Quality Assessment scheme based on EA biological and chemical grading scheme. Watercourses are graded from A to F (A bring very good and F being bad).

The Jersey canal is located approximately 250m west of the site, it is uncertain whether the canals are tidally influenced; or in hydraulic continuity with the River Neath. The River Neath at its nearest point is approximately 400m west of the site, at this point the river remains tidally influenced.

2.4 Previous Reports

A number of previous investigations and assessments have been produced within or in close proximity to the study area:

In 1997 Neath Port Talbot County Borough Council (NPTCBC) were contacted by a resident who expressed concern over a 'Blue' material associated with soil in the garden of the property and the lack of plant growth in that area. Following initial contact and the action was taken by NPTCBC and works completed as summarised.

Following the complaint the Environmental Health Section of NPTCBC recovered an initial soil sample from the garden of 12 Regent Street West, Briton Ferry on 16.06.97. The sample revealed excessively high

concentration of Total cyanide (CN) 62,000mg/kg and Free CN 2,000 mg/kg.

On discovery of the elevated cyanide concentrations NPTCBC issued a door step questionnaire to 24 properties in the locality requesting information on visual evidence of contamination.

Following completion of the door step survey six of the properties had soils samples removed from the gardens and analysed for total and free cyanide. Two samples were recovered from each property. The exact locations from where the samples were retrieved and the reasons why the properties were chosen is not known. The properties sampled included the following:

28 Shelone Road
10 Regents Street
14 Regents Street
24 Regents Street
20 Victoria Street

The identity of the sixth property identified as G.S is unknown.

The 12 No. soil samples revealed levels of detection for total and free Cyanide (CN) below the guidance concentrations being used at the time (ICRCL trigger levels, for gardens and allotments).

Although none of the samples recorded concentration exceeding the guidance values used, it should be noted that the samples were in the majority retrieved from flower beds. The results are therefore unlikely to be representative of site wide conditions.

NPTCBC were in consultation with British Gas PLC Property Division regarding ownership of part of the land associated with the former Briton Ferry Gasworks site. Subsequent representation by British Gas stated housing land (Regent Street and Victoria Street) was appropriated to Council Borough of Neath via the Minister of Health on the 24.04.36, following an application by Neath Council under S.65 of the Housing Act 1925. The council then re-developed the site for housing (including Regent Street and Victoria Street). The lease of the site was assigned by The Wales Gas Board to the Council in 1967, although the Council had full control and management of the site since 1936.

**Earlswood Material Laboratory, 1997 (12 Regent Street West, Briton Ferry.
Investigation of Ground Contamination):**

In 1997 following the initial sample from No 12 Regent Street EML (now Jacobs) were commissioned by NPTCBC to undertake an investigation of the ground beneath No 12 Regent Street West. The purpose of the investigation was to assess the nature and extent of ground contamination.

The fieldwork took place on the 11-12th August 1997, nine boreholes were completed at No. 12 Regent Street to depths between 0.5m-3.0m bgl. Groundwater was encountered at depths between 1.1m and 1.30m below ground level (bgl). During the investigation olfactory evidence of contamination was noted frequently in the made ground. Additionally at one location oily odours were noted in the Peat stratum identified below the Made Ground.

Chemical analysis revealed the Topsoil and Made Ground across the site to be heavily contaminated with cyanides, arsenic, PAH's, phenols and sulphates. Lower levels of other heavy metals, sulphur and mineral oils were also recorded.

The report recommended that additional investigations should be undertaken on the adjoining properties (Nos. 10 and 14 Regent Street West) to determine whether contamination extends beyond No 12. The report details removal of all 2.5m of Made Ground from the site would be ideal though in reality impractical. The suggested remedial works involve the use of a barrier layer between the ground surface and the contaminated soil. The report suggests that a 750mm thick barrier would be sufficient, comprising:

150mm topsoil
300mm clean subsoil.
Geotextile filter membrane
300mm clean single size gravel, and
geotextile filter membrane

The report provides an alternative method to reduce the size of excavation by using a 150mm reinforced slab over 150mm thick hardcore bed, which would provide suitable cover; this was subsequently employed at No. 12 Regent Street following the investigation.

Celtic Technologies Limited, (Victoria Street, Briton Ferry, Neath Port Talbot County Borough Council). Factual Environmental Assessment Site Investigation Report. R428B/02/1744. 2002 (Final).

Celtic Technologies Limited was commissioned by Lattice Property Holdings LTD (LPH) on behalf of Transco to produce an Environmental Assessment Site Investigation Report on land at Victoria Street, Briton Ferry. This report is presented in Appendix C.

The objective was to quantify the nature and extent of solid, liquid or gaseous phase contamination at the Victoria Street site in Briton Ferry. The investigation did not investigate the land outside the current Wales and West Utilities Limited boundary. The report detailed that the primary site use between the 1890's to the 1970's was for gas storage. The report states that land to the south of the site (within the NPTCBC site boundary) was involved in gas manufacture from approximately 1870 to the 1940's. Areas to the south and east were formerly part of the earlier gas works but their use is stated as unknown in the Celtic 2002.

Site works were carried out on site between 26th June and 6th July 2002. The investigation comprised nine cable percussive boreholes to depths between 3.10m and 10.70m bgl. Nineteen trial pits and two hand dug pits were excavated to depths between 1.00m and 3.00m bgl. The trial pits and hand dug pits were excavated to provide representative solid and liquid samples, locate below ground structures, locate waste material and assess the made ground and site geology. All of the boreholes were installed with groundwater monitoring wells.

Three of the boreholes were installed in the two former Gas Holders on site. Two of the boreholes were installed with twin monitoring wells to discreetly monitor water in the made ground and the superficial deposits.

The results of the investigation indicated the site was underlain by made ground which extended to a maximum depth of 4.3m bgl. This was encountered inside a gas holder. Outside of the holders made ground extended to a maximum depth of 2.75m bgl. Beneath the made ground alluvial deposits were proved. These extended to a maximum of 4.7m bgl. Beneath these deposits Glacial Deposits were encountered. These were proven to depth of 10.7m bgl.

Groundwater was encountered within the Made Ground at its interface with the Alluvial deposits. Groundwater was also encountered within the Glacial Deposits. The CELTIC report states that the waters in the Glacial Deposits are confined by the overlying Alluvial clays. Review of the results of the monitoring indicates that there is however uncertainty with

respect to this statement and the partial continuity between the two water bodies may occur at the site.

Forty-five representative soil samples were retrieved during the investigation. The samples were analysed for a range of toxic and phototoxic metals, inorganics, aromatics, PAH and TPH. Elevated Levels of the following determinants were encountered as shown below. Details of the exploratory excavation locations are given in the Celtic Report.

Maximum Concentrations Reported In CELTIC Technologies Ltd Report

Determinant	Maximum Concentration
arsenic	920mg/kg (BH1)
Lead	10,700mg/kg (BH1)
Mercury	4.3mg/kg (TP7)
Selenium	17mg/kg (BH1)
Copper	5,240mg/kg (BH1)
Zinc	46,000 (HP1)
TPH	8,400mg/kg (TP2/3)
Total PAH	1,189mg/kg (BH1)
Free cyanide	38mg/kg (TP16)
Complex cyanide	287mg/kg (HP1)
Elemental sulphur	6,300mg/kg (BH9)
Water soluble sulphate	6,955mg/kg (BH9)

The spatial distribution of these maximum concentrations is varied across the site. However there does seem to be a connection between the former gasworks structures and elevated levels of analysed determinants, though the relationship and distribution is not clear.

BH1 which is located on the southern boundary of the Wales and West Utilities Limited land recorded the maximum concentrations of determinants. These included PAH's, benzene, arsenic, lead, selenium, copper.

TPH was recorded at its maximum concentration in TP2 and TP3 which were excavated adjacent to BH1. This area of the site is situated north of the former retort houses (1877-1938) associated with the former Briton Ferry gas works.

Four of the soil samples tested for leachability (using NRA method) for a range of determinants. The following determinants were above levels of detection pH 7.9mg/l (TP14), total organic carbon 4.1mg/l (TP9),

conductivity uS/cm (BH1), total sulphate 155mg/l (TP2/3), ammonium 3mg/l (BH1) and iron 1.1mg/l (BH3). There seems to be a relatively low leaching potential for most contaminants across the site.

Two rounds of water monitoring were completed at the site. Maximum concentrations are as follows:- total organic carbon 1,301mg/l (BH5 shallow), conductivity uS/cm 14,950mg/kg (BH3), TPH 0.13mg/l (BH5 shallow), thiocyanate 2.3mg/l, total sulphate as SO₄ 670mg/l (BH9), total ammonium 37.9mg/l (BH9), Arsenic 0.17mg/l (BH8), cadmium 0.05mg/l (BH8), lead 4.9mg/l (BH8) selenium 0.02mg/l (BH8), copper 5.6mg/l (BH8), nickel 0.66mg/l (BH8), zinc 11.7mg/l (BH8). Apart from BH9 and BH3 the elevated concentrations indicated above were recorded in samples taken from the perched water.

The report provides factual information on the ground investigation undertaken at the site in Briton Ferry. It states the primary site use was gas storage and later gas distribution. The investigation describes areas to the south and east of the Celtic site boundary which is now replaced with residential housing with gardens which were once part of the former Gas Works, but the extent and nature of contamination were outside the scope of investigation. The CELTIC report also indicated that potential contaminated soil and ground water could affect the properties of Regent Street West and Victoria Road, which had been developed onto the footprint of the former gas work site.

2.5 Interpretive Ground Investigation Report. Ref. 2012R2_Rev2. October 2020.

2.5.1 Soils Assessment

Risk Assessments in accordance with are undertaken on the basis of the assessment of the linkages between Source-Pathway-Receptor. Where one of these does not exist, then there is no perceived risk of contamination.

Based upon the results obtained herein, as shown in Table 8.1, there would appear to be a SOURCE, as concentrations of arsenic, lead, PAH Benzo(a) pyrene and PAH Dibenzo (ah) anthracene exceed values for POSresi.

Asbestos was noted in three locations, where soil contained loose insulation and loose fibres of Chrysotile asbestos.

It is recommended that a remediation assessment is undertaken regarding the elevated arsenic, lead and PAH which are likely to

require some hotspot removal and capping in accordance with BRE requirements. With regards asbestos fibres hotspot removal is recommended, together with an asbestos management plan for ongoing groundwork, due to the potential for re-occurrence at the site.

2.5.2 Waters Assessment

Values of chemical compounds recorded during the laboratory testing, have been compared to current standards and guidelines, as shown in Table 8.2. Most current guidelines relate to drinking water standards, or where these are absent, to surface water standards.

It is clear that the perched waters at the site have some degree of contamination.

WS05 has elevated concentrations of dissolved cyanide and arsenic, elevated PAH values and “heavy” aromatics. Though total Aromatics do not exceed guidelines.

WS12A noted elevated dissolved cyanide and arsenic and “heavy aromatics”. Similarly to WS05 total Aromatics do not exceed guidelines. In general these would be classed as “mineral oils”.

The conclusions and recommendations of this report have been compiled based on our general understanding of the site, previous reports, information available at the time of writing and the written conceptual model presented.

The desk study information has detailed that the dominant land use at the site in Briton Ferry has been as open fields and private garages, with the land to the immediate south as a gas works. That Gas work related industry has spanned approximately 100years. The site layout has changed some-what over this period, with areas to the south and east of the site being replaced by residential housing. However, it remains clear that the primary source of contamination in the area of this site is likely to be due to the Gas Work industry.

The assessment of the site has indicated that direct contact, ingestion and inhalation of contamination by the occupants of the site is a potential pollutant linkage, particularly with regards asbestos fibres. It is considered that this risk can be mitigated by hot-spot removal and an asbestos management plan. Groundworkers should be made aware of the asbestos risks and those associated with heavy metal (arsenic and lead) contamination. Foundations for garages with anticipated low loadings should be kept above the water table.

Additional to risk to human health and third-party property the soil and groundwater conditions present beneath the residential properties may also pose a risk to groundwater in the Glacial Deposits. However, this investigation has noted what appears to be an absence of Glacial Deposits. In addition, the Clays and Peats between the Made Ground and the weathered bedrock will act as an aquiclude, preventing downward migration of contaminants. SGS recommend the borehole wells be decommissioned in accordance with NRW Guidelines.

The test results indicate that contamination of the water is not site-wide and appears to be in perched zones. Indeed, given the direction of groundwater flow, the elevated values at WS05 would be expected at the southern boundary – which has not been found to occur. Thus, it is likely to be a discrete perched water with little chance of lateral migration.

Migration of dissolved contaminants to surface water is considered to be unlikely, as the direction of movement would be through the former gas works, which have been previously remediated, and which therefore would likely attenuate the contaminants.

It is recommended that a remediation assessment is undertaken regarding the elevated arsenic, lead and PAH which are likely to require some hotspot removal and capping in accordance with BRE requirements. With regards asbestos fibres, hotspot removal is recommended, together with an asbestos management plan for ongoing groundwork, due to the potential for re-occurrence at the site.

The CMRA indicates that there is low risk of past Coal working beneath the site, at depths which would affect or inform foundation choice.

3.0 REMEDIATION APPROACH

3.1 Risks Requiring Remedial Action

The objective of the remediation strategy is to demonstrate that all significant identified pollutant linkages relevant to the proposed development have been removed, or that exposure to such linkages has been reduced to an acceptable level. This strategy is consequently required to address:

- Potential for exposure of future site users to contaminants within the Made Ground by ingestion, inhalation (of solely dust in this instance as the identified substances are not volatile) and direct contact
- Protection of underlying Aeolian Sands aquifer which is designated by the NRW as a Secondary A Aquifer;
- Protection of building materials from aggressive ground conditions, and;
- Protection of groundworks contractors and others who may be at risk due to contamination and hazardous materials during demolition, site preparation and construction.

3.1.1 *Made Ground*

The presence of a source of soil contamination has been identified by two phases of intrusive investigation and subsequent laboratory analysis of samples obtained from the site. The presence of elevated concentrations of arsenic, asbestos, benzo[a]pyrene, dibenzo(a)anthracene and lead indicates that existing made ground is potentially unsuitable for use at, or close, to the surface of the proposed development within a POSRsi assessment.

Consequently, a remediation strategy is required to address removal of the following pollutant pathways:

- direct contact or ingestion of soil, or inhalation of dust, and;
- inhalation of fibres.

3.1.2 Risks to Ground workers

Risks to ground workers associated with the general made ground can, in general, be addressed as a precautionary measure through use of appropriate personnel protective equipment and the adoption of good practices on site.

A discovery strategy is presented in Section 5 of this report with further risk management procedures outlined in Section 6.

4.0 REMEDIATION STRATEGY

4.1 Introduction

An options appraisal indicates that the risk to human health posed by elevated contaminants present within the shallow Made Ground soils would be adequately dealt with by the implementation of a localised clean cover system. This approach is both a robust solution regarding human health, as well as a more sustainable solution with regard to the transport and landfill requirements associated with other options, such as excavate and remove would require.

Where asbestos was noted, supervised removal is recommended.

An evaluation of the arsenic, BaP, DaA and lead concentrations, utilising a spreadsheet derived to enable the calculation of the depth of a cover system (BRE 465)² indicates that a maximum thickness of 510mm would be required at TP23. Table 4.2 indicates the cover thicknesses required. This does not take into account any clean imported materials which may be required to raise the level of the site with regards drainage or layout requirements.

The presence of garage buildings in other areas of the site will effectively break the exposure pathway in these areas.

A procedure is also set out below that provides a proactive approach with respect to any previously unidentified contamination that is encountered during the construction phase and details the requirements to mitigate risks posed to ground workers during the construction phase.

4.2 Cover System

The cover system would be designed to provide a long-term reduction in the exposure of future site users to the contaminated near surface soils across the site. This would be achieved via the provision of a sufficient thickness of cover to minimise the likelihood of future disturbance and mixing with the underlying Made Ground.

Location	Contaminant	Cover Thickness 9mm)
TP22	Arsenic	68
TP23	Lead	510
TP27	Arsenic	279
TP30	Arsenic	118
WS03	BaP	361

Table 4.2: Cover System Thicknesses

As there are significant areas of the site which do not require a Cover System, the import of suitable clean cover materials is proposed comprising the depths of suitable materials to be placed as per drawing SGS/21012/01. The cover system can comprise a combination of imported inert materials as required by the development.

Soils for import will be sourced from uncontaminated sites and tested at an approximate rate of 1 sample per 100m³. Details of each proposed source, the supplier and associated chemical analysis should be independently validated by a suitably qualified and experienced geo-environmental engineer independent of the contractor prior to import. The analytical suite should be not less than that listed in Appendix B, with consideration given to the need for any additional testing based on the origin. In addition, imported soils shall be visually free of foreign materials such as plastics, wood, glass, metals, and tarmac, etc.

The POSResi Criteria in Appendix C will be applied, based on individual sample results except where soils are sourced from a single large site, where statistical analysis may be appropriate. These criteria are derived based on current industry standard criteria within the context of a residential development including plant uptake.

4.2.1 Cover System Verification

Post-remediation verification of cover thickness will be required.

Verification testing of the cover thickness once it has been placed on site is proposed within residential. At this stage it is envisaged that several hand-dug trial holes will be excavated at randomly selected locations across the site in order to verify the cover thickness.

This will be undertaken with supervision from a suitably qualified and experienced geo-environmental engineer independent of the contractor. This will then be used, in conjunction with pre- and postplacement level surveys, to demonstrate that the required cover has been placed in all areas.

Any non-compliance against the remedial targets presented in Appendix C or with remediation strategy requirements, will be discussed as necessary with the local authority and an acceptable resolution agreed.

4.2.2 Capping Considerations

Should any materials be required to be removed from site, it will remain the responsibility of the Contractor (as waste producer) to identify a suitable disposal facility and arrange appropriate transport to the disposal facility.

4.4 Borehole Decommissioning

All installed boreholes on site will require decommissioning prior to development, in line with current Environment Agency guidance (no specific guidance from the NRW is available).

5.0 DISCOVERY STRATEGY

5.1 Introduction

The objective of the Discovery Strategy is to ensure that a methodology is in place to identify, manage and deal with any previously unidentified areas of contamination which may be encountered during future site works.

The strategy is consequently required to address the following:

- The identification of previously un-encountered ground contamination during the site development works including the requirement for further assessment and implementation of appropriate risk management methodologies to ensure the protection of human health and controlled waters; and,
- Protection of groundwork contractors and others who may be at risk due to contamination and hazardous materials encountered during site preparation and construction.

In common with all brownfield sites, there is the potential for other contamination to be present within the soils beneath the site over and above that identified during the site investigation. Assessment based on trial pit/borehole data cannot provide a complete picture and as such, a detailed pro-active 'watching brief' will be needed to be maintained by the Contractor during excavation works. The Contractor for the works will be responsible for providing an experienced banksman to observe and control excavations.

In addition, the supervising person must be suitably trained and experienced in order to identify the presence of other visible or olfactory evidence of contamination including hydrocarbons and asbestos.

5.2 Outline Approach

Should any evidence of previously unidentified contamination be found, the contractor should seek further specialist advice from a suitably qualified and experienced geo-environmental engineer independent of the contractor.

Visual and olfactory inspection shall be used to identify potentially impacted soils. Following agreement on a plan of action it is possible that a conventional delineation exercise can be used to segregate impacted soil from the surrounding material. The discovery and management of

potentially impacted soils should be dealt with on a case-by-case basis in order to address the specific nature of the ground conditions uncovered. However, a general approach is described below:

- Suspicious ground conditions are identified by groundworker(s) and the works are halted in this area;
- Contractor assesses the requirement for any additional health and safety or environmental management control measures;
- The site manager is informed of the identification of potential contamination who will inform the client and SGS to agree a proposed methodology for managing the impacted materials;
- Requirements for additional sampling and risk assessment is confirmed with the contractor, SGS, and Contaminated Land Officer for the Local Planning Authority;
- Additional remedial action, if necessary, and programming of the works will be agreed with the Local Planning Authority;
- Any findings of potentially contaminated materials will be reported to the local authority and included within the Verification Report for the works.

5.3 Asbestos

In the case of asbestos, the identification of any more hazardous forms of asbestos might trigger requirements for alternative handling requirements, in compliance with the Control of Asbestos at work Regulations and other provisions. Whilst asbestos has been identified in 3 No. samples only, given the nature of the material identified on site, the potential remains for additional asbestos containing materials to be encountered during the development works.

In the event of previously unidentified asbestos containing materials being encountered on site during the groundworks the following procedures should be implemented:

- Works should cease immediately in the vicinity of the identified asbestos;
- The affected area should be fenced off and covered with plastic sheeting if necessary;
- The site manager informed of the identification of potential contamination who will inform SGS or specialist asbestos consultant to agree a proposed methodology for managing the impacted materials;

- Specialist advice should be obtained from an asbestos consultant with regard the identification of the asbestos and risk management procedures;
- Agreement will be sought between the Contractor, the Specialist Asbestos Consultant, client, SGS, and Local Planning Authority with regard to the additional site procedures and risk management required to appropriately manage the identified asbestos containing materials;
- This document will be updated in line with the additional requirements for risk management in the light of this additional information.

6.0 RISK MANAGEMENT PROCEDURES

6.1 Introduction

The following sections outline the requirement for risk management procedures to protect the following key receptors during the construction phase.

- Risks to Ground Workers; and,
- Occupiers of Neighbouring Sites.

6.2 Risks to Ground Workers

Risks to ground workers associated with the general Made Ground can, in general, be addressed as a precautionary measure through use of appropriate personnel protective equipment and the adoption of good practices on site including:

- Toolbox talks for all groundworks to raise awareness;
- Appropriate PPE, and;
- Adoption of good hygiene practices during groundworks.

Such approaches should aid in reducing exposure to the contaminants on-site. Although it is considered that the site would pose no short-term acute toxicological risks to workers, there is the potential for it to add to an overall life-term burden from repeated exposure.

6.3 General Site Practices

Throughout the duration of the groundwork good site practices will be adopted to ensure the following:

- Adequate dust suppression across the site to minimise dust generation;
- Minimisation of tracking across areas of soft cover (soils and made ground);
- Implementation of street sweeper to minimise mud on areas of hardstanding on site and in the surrounding road network; and,
- The movement of made ground materials will be minimised during periods of extended dry weather where possible.

6.4 Off-Site Disposal

The removal of materials off site should be avoided where possible. However, should materials require to be disposed off-site, the following procedure should be adhered to:

- Lorries should be sheeted prior to leaving site;
- All lorries leaving site should be checked and washdown if necessary, to prevent the transfer of soils to the surrounding road network;
- It will remain the responsibility of the contractor to identify a suitable disposal facility for Made Ground materials leaving site.

7.0 VERIFICATION

An integral part of the remediation strategy proposed for the site involves suitable monitoring of the works to ensure they are undertaken as specified, to demonstrate the achievement of the remediation objectives and to document all aspects of the remediation work.

The remediation works will be controlled by the appointed contractor. The following records will be maintained on site, and provided as necessary to the regulatory authorities for approval:

- Results of testing of all soils proposed for import, including information on the source location and quantity imported. Laboratory test results are to be approved by a competent person before the soils are brought to site;
- Chain of custody documentation for any soils imported;
- Record of disposal of any unsuitable soils or hazardous / contaminated materials, including waste transfer documentation if applicable;
- Records of health, safety and environmental controls and any variations to the original strategy/specification;
- Results of any additional contamination testing should unexpected and suspect materials be identified during groundworks, including laboratory quality assurance accreditation information;
- Details of the actions taken to store, contain, treat, dispose or re-use any contaminated materials encountered during groundworks deemed unsuitable for use on the site;
- Copies of all relevant correspondence with the regulatory authorities during the course of the works;
- Record of post-remediation verification of soil thickness, and;
- Photographic records as required.

The above works will be required to be documented within a Verification report which will require sign off from the Local Authority to discharge planning conditions.

If at any time during remediation, suspected contamination is identified, the local authority Contaminated Land Officer and SGS will be contacted in order to agree a strategy for its treatment.

APPENDIX A

Drawings

Remediation Details

SGS/21012/01

APPENDIX B

Report Conditions

APPENDIX A - REPORT CONDITIONS

Remediation Strategy

This report is produced solely for the benefit of Swansea Garages Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections.

No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to SGS. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted. The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX C

Analytical Suite for the Importation of Soils

Analytical suite for the importation of soils

The below suite is to be used for the testing of imported soils to the site.

pH/SO₄

Metals and metalloids

Arsenic

Chromium VI

Chromium III

Copper

Lead

Mercury

Nickel

Zinc

Speciated PAHs

Acenaphthene

Acenaphthylene

Anthracene

Benz[a]anthracene

Benzo[a]pyrene

Benzo[b]fluoranthene

Benzo[g,h,i]perylene

Benzo[k]fluoranthene

Chrysene

Dibenz[a,h]anthracene

Fluoranthene

Fluorene

Indeno[1,2,3-c,d]pyrene

Naphthalene

Phenanthrene

Pyrene

Phenol

Cyanide

*TPH (C8-C40)**

*** Dependent Option**

TPHCWG Hydrocarbon fractions

Aliphatic >EC5-EC6

Aliphatic >EC6-EC8

Aliphatic >EC8-EC10

Aliphatic >EC10-EC12

Aliphatic >EC12-EC16

Aliphatic >EC16-EC35

Aliphatic >EC35-EC44

Aromatic >EC5-EC7 (benzene)

Aromatic >EC7-EC8 (toluene)

Aromatic >EC8-EC10

Aromatic >EC10-EC12
Aromatic >EC12-EC16
Aromatic >EC16-EC21
Aromatic >EC21-EC35
Aromatic >EC35-44
Aromatic and Aliphatic >EC44-EC

* If a screening total hydrocarbons result exceeds 500 mg/kg, detailed TPH CWG analysis may be undertaken to assess risk. Any soils showing visible or olfactory evidence of contamination will be rejected. Soils containing fragments of plastic, metal, timber (treated and untreated), brick, concrete and other foreign objects should also be rejected as unsuitable.

APPENDIX D

BRE Cover Thickness Calculations