



Remediation Strategy Report

Prepared For: Manning Construction

Issue Date: June 2021

Job No: 15710/RS/3

REPORT TITLE : Remediation Strategy Report: Proposed Residential Development, Land Adjacent to Park Avenue, Glynneath

REPORT STATUS : Final

JOB NUMBER : 15710/RS/3

DATE : June 2021

REPORT REFERENCE : 120321-15710/RS/3-ISSUE 3

Document Revision Record

Issue Number	Date	Revision Details
1	12 th March 2021	For Review
2	12 th March 2021	Final
3	11 th June 2021	Amended Potable Water

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This document is reviewed annually and was last reviewed and authorised on 24/08/2020

All amendments made to this document are detailed on the Document Revision & Amendment Register BMS-CR-002 and authorised by the appropriate personnel.



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SECTION 1 Introduction and Proposed Development

1.1 Introduction

Manning Construction Limited is proposing the development of residential housing on land adjacent to Park Avenue, Glynneath.

Terra Firma (Wales) Limited have been commissioned by the Client to prepare a Remediation Strategy report for the site.

Previous investigations and assessments have identified that remediation of contamination is required for the development. This report presents a Remediation Strategy for the site based on these previous investigations and assessments.

1.2 Objectives

The objective of the Remediation Strategy is to detail the remedial steps that are required to render the site fit for its intended use.

In summary, the following remediation requirements have been identified and are covered in detail in this report.

- Installation of capping system in landscape and garden areas above made ground soils

1.3 Previous Investigations and Assessments

The Remediation Strategy is based on the findings of previous investigations and assessments. This report shall be read in conjunction with the following documents.

Geotechnical and Geoenvironmental Report 15710/2 (Terra Firma Wales Ltd, September 2020)

1.4 Roles and Responsibilities

Table 1.1 Roles and Responsibilities

Role	Organisation
Client	Manning Construction Limited
Local Authority	Neath and Port Talbot county Borough Council
Geotechnical & Geoenvironmental Consultant	Terra Firma Wales Ltd
Validator	Terra Firma Wales Ltd

1.5 Limitations and Exceptions of Investigation

This report has been prepared for the sole internal reliance of the Client and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geo-environmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

It is not within the scope of Terra Firma (Wales) Limited to:

- Provide Method Statements and Risk Assessments for the site remediation, preparation and development.
- Design, assess or install utility service trench fill and pipes for potable water supply beneath the site.

1.6 Quality Assurance

The quality and environmental aspects of the assessment and investigation comply with UKAS Accredited ISO 9001:2015 and ISO 14001:2015 standards.

The following subsection information has been summarised from previous investigation and assessments listed in **Section 1.3**.

The development site is irregular in shape and locates adjacent to Park Avenue, Glynneath. The site centres on an approximate National Grid Reference of 287770, 206560, occupying a plan area of approximately 0.8 Hectares.

A park locates to the west of the site and the rear of housing locates to the east of the site.

The site location can be seen on Figure 2.1.



Figure 2.1 Site Location

The site has historically contained a welfare hall, which was demolished after 2010.

2.3 Geology and Ground Conditions

The 1:10,560 scale British Geological Map of the area (Sheet SN 80 NE, 1966) was consulted for geology underlying the site. The site is shown to be underlain by Rocks of the Lower Coal Measures, near the conjectured outcrop of the Gnaipog (Garw) Coal Seam. This seam is recorded as 'thin'.

Bedrock is shown to have a superficial cover of Recent- Pleistocene alluvium.

The ground conditions encountered during the site investigation can in general be summarised as shown in **Table 2.1**.

Table 2.1 Summary of Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.0	-	0.3/0.9	0.3/0.9	MADE GROUND: Typically soft, sandy gravelly SILT/CLAY to silty sandy GRAVEL to BOULDERS to limestone aggregate to sandy SILT , to sandy GRAVEL to COBBLE including brick and concrete (May be deeper locally)
0.0/0.9	-	>2.0		SUPERFICIAL: Variable ranging from Firm to stiff sandy gravelly SILT/CLAY to medium dense to dense GRAVEL to BOULDERS

2.4 Radon

A British Geological Survey Radon Report identified that **Basic** Radon Protection is required at the site.

2.5 Hydrogeology and Hydrology

The nearest surface water feature comprises a stream immediately west of the site.

Superficial deposits beneath the site have an aquifer designation of secondary aquifer – A.

The bedrock deposits beneath the site have an aquifer designation of secondary aquifer – A.

Deeper groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

The hydraulic gradient will be at its steepest during periods of heavy rainfall and aquifer recharge.

Groundwater was not recorded in exploratory holes.

2.6 Identified Contamination

2.6.1 Made Ground Soils

Laboratory soil test results highlight exceedances of arsenic, naphthalene, benzo(a)anthracene, chrysene, benzo(a)pyrene and dibenzo(ah)anthracene within made ground when compared to human health guidelines for a residential with plant uptake scenario.

The location containing naphthalene, the only volatile species to exceed guidelines, was excavated out for off-site disposal in 2014, therefore, all remaining exceedances can be considered non-volatile.

2.6.2 Ground Gasses

Basic Radon Protection has been recommended for the site. To mitigate against the risk to future site users from radon gas, basic protection measures will be required in all structures. Reference should be made to guidance publication BR 211:2015 for further details on required protection elements. Verification of the installed protection measures is highly recommended. Terra Firma Wales Ltd. offer a comprehensive ground gas protection system verification service.

SECTION 3 Sources of Contamination Requiring Remediation

The summary of the refined conceptual site model is presented in **Table 3.1** and based on findings of previous investigations and assessments, detailing significant pollutant linkages requiring remediation or mitigation.

Table 3.1 Summary of Significant Pollutant Linkages

Source		Pathway	Receptor
Contaminated Made Ground		Dermal Contact/Inhalation of Dust/Ingestion	Groundworkers
Contaminated Ground	Made	Dermal Contact/Inhalation of Dust/Ingestion	Neighbouring Sites during Earthworks
Contaminated Ground	Made	Dermal Contact/Inhalation of Dust/Ingestion/Plant Uptake	Future Site Occupiers/Visitors

SECTION 4 Proposed Remedial and Mitigating Measures

4.1 General

Based on the finding of previous investigations and assessments and the identified pollutant linkages the following remedial measures have been devised for the site.

Specific validation requirements for the proposed remedial measures are discussed in the following section.

4.2 Made Ground Soils

4.2.1 Protection of Construction & Maintenance Workers and Passers-by or Neighbouring Site Users

The potential production of soil dust containing contaminants during construction works presents a risk to construction and maintenance workers as well as passers-by or adjacent site users through, direct soil and dust ingestion, dermal contact, inhalation of dust and vapours.

A selection of mitigating measures is presented below to disrupt the contaminant pathway to the receptor.

- Dust suppression and measures to dampen the material
- Site perimeter screening
- Suitable PPE for site workers

It is therefore essential that the contractor puts in place adequate measures to ensure the safety of all workers.

These measures should be detailed in the contractor's Risk Assessment and Method Statements as well as the contractor's Construction Management Plan.

4.2.2 Protection of Future Site Users (Residents)

Future site users will be potentially at risk from direct soil and dust ingestion, dermal contact and inhalation of dust from soils containing contaminants, during excavation of made ground soils while undertaking gardening activities. Future site users are also at risk from the consumption of home grown produce grown within contaminated made ground soils.

Complete removal of the contaminant source would prove to be uneconomical given the low level of risk identified and the volume of affected soils therefore the installation of a capping system is proposed to interrupt the link between the source and receptor.

The capping system should be installed above Made Ground soils only in garden and landscaped areas and comprise 600mm thick capping layer of imported clean inert soils or suitable site won natural soil conforming to GACs.

Beneath areas of the site due to be covered by hard-standing or developed upon, we anticipate no remedial measures are required. This should be confirmed by the Local Authority.

Validation of the capping system and imported materials will be required.

4.2.3 Protection of Construction Materials (Potable Water Supply Pipes)

Potable water supply pipes are at risk of degradation when in contact with made ground soils containing contaminants.

It is recommended that a Potable Water Supplier should complete an assessment in accordance with UK Water Industry Research guidance; Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR Report Ref: 10/WM/03/21. The assessment should determine the selection of Water Supply Pipe material.

The potable water supplier, or their nominated contractor should undertake the assessment prior to connection. Records should be retained for the validation report.

4.3 Radon Gas

4.3.1 Protection of Future Site Users (Residents)

To mitigate against the risk to future site users from radon gas, basic protection measures will be required in all structures. Reference should be made to guidance publication BR 211:2015 for further details on required protection elements. Verification of the installed protection measures is highly recommended.

SECTION 5 Validation of Remedial and Mitigating Measures

The following remedial measure will require verification and inclusion within a Validation Report:

- Capping system (importation of soils and installation)
- Radon gas protection system (design and installation)
- Potable water supply pipe (assessment and installation)

5.1 Capping System

Following the importation and placement of 600mm of clean inert material in the soft landscaped and gardens areas of all plots, verification of the capping thickness should be undertaken.

Validation of the capping system will comprise photographic evidence clearly showing the thickness and depth of individual strata. In addition, samples will be obtained at this point for validation testing of imported soils in accordance with **Section 5.1.1**.

The soft landscaped and garden areas of 1 in every 2 plots should be validated.

A validation report including a description of the works undertaken, validation photographs and chemical validation test results shall be presented upon completion.

5.1.1 Imported Soil Validation

Importation of soils will be required to provide a capping layer of clean inert material in identified landscaped and garden areas. If suitable site won natural soils are identified these, too, could be considered.

All imported soils, aggregate or stone that are not virgin quarry stone should be validated as suitable for use. Imported materials exempt from validation testing should be accompanied by a transfer note. Transfer notes should be retained and submitted for inclusion within the Validation Report upon completion of the works.

The provider should supply a laboratory analysis report to confirm that the soil/aggregate/stone is suitable for use. Depending on the source and available test data, it may be prudent to independently sample and analyse the materials (if practical) prior to being brought to site.

Sampling and analysis of the soil/aggregate/stone once imported will be required in addition to any taken at source.

In accordance with publication 'Requirements for the Chemical testing of Imported Materials for Various End Uses and Validation of Cover Systems' the number of representative samples required for analysis is dependent on the volume of each source soil. For a volume between 20m³ and 250m³ four samples should be taken. For a volume greater than 250m³, 4 samples per 250m³ should be taken. Where quantities exceed 1000m³ The CLO/EHO should be contacted to agree a sampling scheme.

All samples should be analysed for the determinants listed in **Table 5.1**.

Table 5.1 Validation Criteria

Determinant	Units	Guideline Value (Residential)	Source
Inorganic			
Arsenic	mg/kg	37	1
Boron	mg/kg	290	1
Cadmium	mg/kg	11	1
Chromium III	mg/kg	910	1
Chromium VI	mg/kg	6	1
Copper	mg/kg	2400	1
Lead	mg/kg	200	2
Mercury	mg/kg	40	1
Nickel	mg/kg	180	1
Selenium	mg/kg	250	1
Zinc	mg/kg	3700	1
Cyanide	mg/kg	8	3
Asbestos	%	Non Detected	-
Organics – Phenol & PAH			
Phenol	mg/kg	120	1
Naphthalene	mg/kg	2.3	4
Acenaphthylene	mg/kg	170	4
Acenaphthene	mg/kg	210	4
Flourene	mg/kg	170	4
Phenanthrene	mg/kg	95	4
Anthracene	mg/kg	2400	4
Fluoranthene	mg/kg	280	4
Pyrene	mg/kg	620	4
Benzo(a)anthracene	mg/kg	7.2	4
Chrysene	mg/kg	15	4
Benzo(b)fluoranthene	mg/kg	2.6	4
Benzo(k)fluoranthene	mg/kg	77	4
Benzo(a)pyrene	mg/kg	2.2	4
Indeno(123cd)pyrene	mg/kg	27	4
Dibenzo(ah)anthracene	mg/kg	0.24	4
Benzo(ghi)perylene	mg/kg	320	4
Organics – TPH			
PH C5 – C6 Aliphatic	mg/kg	42	4
PH C6 – C8 Aliphatic	mg/kg	100	4
PH C8 – C10 Aliphatic	mg/kg	27	4
PH C10 – C12 Aliphatic	mg/kg	130	4
PH C12 – C16 Aliphatic	mg/kg	1100	4
PH C16 – C21 Aliphatic	mg/kg	65000	4
PH C21 – C35 Aliphatic	mg/kg	65000	4
PH C5 – C7 Aromatic	mg/kg	70	4
PH C7 – C8 Aromatic	mg/kg	130	4
PH C8 – C10 Aromatic	mg/kg	34	4
PH C10 – C12 Aromatic	mg/kg	74	4
PH C12 – C16 Aromatic	mg/kg	140	4
PH C16 – C21 Aromatic	mg/kg	260	4
PH C21 – C35 Aromatic	mg/kg	1100	4
1 - LQM/CIEH Suitable For Use Level (S4UL) 2015			
2 - Defra Category 4 Screening Level (Provisional value)			
3 - Environment Agency CLEA v1.06 Derived Value (Now withdrawn)			
4 - S4UL threshold based on 1% soil organic matter			

5.2 Ground Gas Protection System

To mitigate against the risk to future site users from radon gas, basic protection measures will be required in all structures. Reference should be made to guidance publication BR 211:2015 for further details on required protection elements. Verification of the installed protection measures is highly recommended. Terra Firma Wales Ltd. offer a comprehensive ground gas protection system verification service.

5.3 Potable Water Supply Pipes

A copy of the potable water supply pipe assessment, along with evidence of the water supply pipe installation, should be retained for inclusion in the Validation Report.

Photographic evidence of the installation shall be provided by the **groundworker** for inclusion in the Validation Report.

SECTION 6 Working Practices

6.1 Protection of Construction Workers

In order that construction workers are protected during site works across the site the following should be adhered to:

1. Compliance with health and safety regulations
2. Provision of Method Statements and Risk Assessments
3. Compliance with Control of Substances Hazardous to Health (COSHH) Assessment
4. Good level of Personal Protection Equipment (PPE)
5. Good level of hygiene by site workers
6. Dust suppression measures
7. Emergency contingencies should be defined prior to commencement of site works

6.2 Protection of the Environment

During the remediation and construction periods, there is a risk to the environment and adjacent sites from de-watering, excavations, moving contaminated soil, drainage misconnections, discharges of perched groundwater to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washing and oil or chemical spills.

A drainage plan should be devised, identifying manholes to prevent pollutants accidentally reaching surface water sewers. Temporary drainage measures may need to be put in place.

The contractor(s) must also strictly adhere to the Pollution Prevention Guidelines for Working at Construction and Demolition Sites (PPG6). This publication gives both advice and guidelines which should be followed with regards to the planning and preparation of site works, site drainage, delivery and storage of construction materials, the management of waste, good housekeeping in particular to prevent runoff of silt and other fines into nearby water courses, refuelling, concrete and what to do in the event of an emergency.

Within the documentation prepared by the contractor(s), the following information should be provided, but not limited to:

- Project Description
- Key participants/contractor(s)
- Technical procedures
- Phasing of works and approximate timescales
- Site plans to scale
- Details of consents or license needed
- Health and Safety, COSHH Assessment, Method Statements and Risk Assessments
- Emergency contingencies

In addition, the following precautions should also be taken.

- All potential chemicals and associated risks and emergency procedures for spills/leaks should be considered in the site risk assessment and the details provided to all site employees.
- Any potential pollutant materials or chemicals/detergents used on site should be adequately stored in suitable containers, with clear labelling.
- Any oil or hazardous substance containers and associated pipe works should be enclosed within a bund.
- Care taken during delivery of materials, with correct supervision and labelling detailing the substance and its quantities.

- All delivery drivers should be informed of procedures and restrictions.
- Any materials on delivery should be covered to ensure there is no spillage.
- Any detergents, paints, chemicals etc should not be allowed to be discharged into surface drains or water courses.
- Washing out and cleaning of concrete/cement plant should be carried out in a contained area with adequate measures to collect all run-off water.
- Security and prevention of vandalism, especially of oil drums/containers.

6.3 Management & Disposal of Soils

During site works excavations of the made ground are anticipated.

All materials excavated should be managed and stored appropriately in a controlled manner to ensure protection of site construction workers and neighbouring site users, and to prevent the transfer of contamination to other areas of the site.

If possible, and if levels allow, and excavated made ground should be retained on site and relocated beneath areas of hardstanding. This would provide the most sustainable approach and avoid landfill and haulage fees, disruption and aggravation of local residents caused by haulage lorries, and would avoid unnecessary CO₂ emissions.

Any movement and transfer of materials on site should be documented in materials management plan, in accordance with 'CL:AIRE Definition of Waste: Development Industry Code of Practice (DoW CoP)'.

Alternatively, excavated made ground may be disposed of at landfill. Prior to disposal classification of the material will need to be completed in accordance with Environment Agency protocol detailed in 'Technical Guidance WM3 – Waste Classification - Guidance on the Classification and Assessment of Waste'.

A contaminated land specialist should supervise and document any earthworks on site.

Waste transfer and disposal must be undertaken by an authorised person. A waste transfer note must accompany each load and records should be maintained for inspection if required



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