



CONSULTING ENGINEERS

**CIVIL • STRUCTURAL
GEOTECHNICAL • ENVIRONMENTAL**

**REMEDIATION STRATEGY POLICY FOR
GRESFORD ROAD
LLAY, WREXHAM**

PREPARED FOR

**ANWYL HOMES &
BELLWAY HOMES LTD**

DECEMBER 2019

**REMEDIATION STRATEGY
17040/REM/001/A**

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DOCUMENT STATUS

Site Reference	Gresford Road, Llay, Wrexham
Title	Remediation Strategy
Client	Anwyl Homes & Bellway Homes Ltd
Project No.	17040/REM
Report Version	001
Date Issued	28 th November 2018
Issue Notes	Issued for comment and approval.
Report Version	Revised Issue A
Date Issued	20 th December 2019
Issue Notes	Updated following supplementary site investigation within plots 271 – 273.
Report Version	
Date Issued	
Issue Notes	
Report Version	
Date Issued	
Issue Notes	

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REMEDIATION STRATEGY

PROPOSED RESIDENTIAL DEVELOPMENT

GRESFORD ROAD, LLAY, WREXHAM

1.0 INTRODUCTION

- 1.1 *R.E. Fry & Associates (REFA) have been commissioned by Anwyl Homes and Bellway Homes to prepare a remediation strategy scheme for the required site development works at Gresford Road, Llay, Wrexham.*
- 1.2 *The site comprises of greenfield areas associated with Home Farm and a proposal for three hundred and sixty two (362 No.) plots with associated garden and landscaped areas are illustrated upon the appended planning layout (drawing reference PLA03/P). The site has previously been subject to a Geo-Environmental desk study and ground investigation conducted by REFA (report reference 17040/GEIR/A dated November 2018). A supplementary site investigation was also undertaken by REFA within the area of the former farm buildings which is detailed within letter report reference MD/17040 dated December 2018. Further supplementary investigation by REFA was also undertaken more recently within the area of plots 271 – 273 (report reference; MGD/17040/01 dated January 2020). This remediation strategy has been developed in order to allow safe development of the proposed development site and has been updated to reflect the supplementary site investigation.*
- 1.3 *This remediation strategy is intended to detail the minimum works which should be carried out within the development process to ensure that the ground conditions within the site do not represent a hazard to site operatives, residential end users or members of the general public.*

2.0 SITE CONDITIONS

- 2.1 *Prior to preparing this remediation strategy document a walkover survey of the site has been completed. The walkover survey has confirmed that the site still comprises of greenfield areas associated with Home Farm and an area of concrete hardstanding.*
- 2.2 *The site has been the subject to a program of ground investigation works undertaken by REFA which has identified that the majority of the site comprises of topsoil which has been proven to be present at thicknesses varying between 0.1 – 0.6m bgl. Localised made ground deposits have been identified in positions TP17, TP35, TP44-TP47, WS7 and BH3. Made ground material comprises of intermixed soils with anthropogenic materials such as brick and concrete and has been proven to depths varying between 0.7-2.0m bgl. No visual or olfactory evidence of contamination has been identified within the made ground however the presence of anthropogenic materials may indicate potential contaminants.*
- 2.3 *Underlying the topsoil and made ground deposits the natural strata mainly comprises of firm to stiff clays which have been proven to a maximum depth of 6.45m bgl. Natural deposits of brown silty clay gravelly fine to coarse sand has also been identified within the site and has been proven to a maximum depth of 7.45m bgl. Localised deposit of silt has been identified within position WS8 and proven to a maximum depth of 2.1m and within position WS6 brown clayey fine to coarse gravel was identified and proven to a maximum depth of 2.1m bgl.*

- 2.4 Within the desk study information numerous infilled features have been identified within close proximity to the site therefore a programme of ground gas monitoring has been carried out and completed. A full ground gas monitoring programme has identified CS1 (NHBC Green) ground gas conditions however the site is located within an area that requires basic radon ground gas precautions and therefore these are required in all properties within the proposed development.
- 2.5 Within positions TP32 and TP33 evidence of animal remains have been identified within the made ground material. On the identification of animal remains the trial pits were terminated and backfilled immediately. These remains will require reporting to the APHA who will then in turn contact the Duty Vet for the appropriate disposal of animal remains prior to the development proceeding.
- 2.6 Supplementary site investigation was undertaken within the rear garden areas of plots 271 – 273 in December 2019 to re-evaluate the requirement for a clean capping system within the garden areas of these plots. The topsoil had been removed during the development works to reveal natural clay strata and trial pits confirmed that no made ground deposits were present within the garden areas of plots 271 – 273 and the strata comprised solely of natural clay strata proven from ground level to at least 1.3m bgl. No visual or olfactory evidence of contamination was observed within the natural clay strata and reference to the initial desk study has confirmed no evidence to suggest naturally arising elevated concentrations of contaminants within the natural strata. It was therefore confirmed that a clean capping system is not required within the garden areas of plots 271 – 273. The full details of this investigation are provided in report reference MGD/17040/01, dated December 2019 and the remediation plan has been updated to reflect the results of the supplementary site investigation (drawing reference; 17040/25/A).

3.0 CHEMICAL ANALYSIS

- 3.1 The intrusive investigations and subsequent chemical analysis has identified two extremely marginal exceedances of the adopted assessment criteria for arsenic within TP44 – 0.4m and for lead in sample TP46 – 0.2m. These relate to localised deposits of made ground and the Local Authority have specifically requested that where areas of made ground deposits are present then there will be a requirement for a capping within the garden and landscaped areas affected.
- 3.2 Made ground samples were screened for the presence of asbestos fibres and no asbestos fibres have been identified. Therefore no remedial works are required in relation to asbestos fibres.
- 3.3 All remaining chemical analysis did not identify any elevated concentrations of PAH compounds or hydrocarbons throughout the site and therefore no remediation is required in terms of PAH or TPH contamination.

4.0 PROPOSED REMEDIATION MEASURES

- 4.1 The contractor will maintain an accurate record of the materials excavated and removed from the site as part of any site preparation works including details of where the materials are disposed of. This information will be supplied to the engineer and will form part of the validation report.

- 4.2 *The previous ground investigations have identified marginal exceedances of arsenic and lead within localised made ground deposits within the site. Following the request of Wrexham Council where made ground deposits are present within garden areas the made ground should be reduced to completely remove or expose underlying natural strata or reduce to accommodate at least 600mm of clean inert material in all private rear garden areas. Within the landscaped and front garden areas, levels should be reduced or raised to accommodate 450mm of clean inert material. All capping layers should consist of at least 150mm of topsoil material which can be sourced from the site.*
- 4.3 *The works are to be monitored by an independent engineer who will ensure that the following verification procedures are adopted:-*
- *Liaison with the appointed groundwork contractor, inspection and general monitoring of the works;*
 - *Previous ground investigation has identified topsoil deposits across the majority of the site and chemical analysis confirm that it is suitable for re-use within the proposed development;*
 - *If imported topsoil is required for the development then ground works should verify the source of surface topsoil imported to the site and commission a program of chemical testing to determine the suitability of this material for use in a residential with plant uptake environment;*
 - *If topsoil material is required to be imported to the site then this should comprise of inert topsoil material which satisfies the requirements of this land use as described in Tables 2 and 3 below;*
 - *Verify the source of subsoil imported to the site and commission a program of chemical testing to determine the suitability of this material for use in a residential with plant uptake environment;*
 - *It is the contractor's responsibility to assess any materials proposed for importation to the site and ensure that they meet the criteria set out later in this document. This may include laboratory testing or the review of investigation data and laboratory testing carried out by others. Any laboratory testing shall clearly demonstrate that the soils tested are uncontaminated and suitable for use in residential garden areas as prescribed in tables 2 and 3 below;*
 - *This data will be supplemented by field and laboratory testing undertaken by the engineer during the remediation works. All test data obtained will be collated by the engineer for inclusion in the validation report;*
 - *Where the site works identify any suspicious or unusual ground conditions these must be reported to the engineer for further inspection, sampling and assessment to determine their suitability for retention within the site area. Where unusual or suspicious ground conditions are encountered these will be referenced within the final validation report;*

- Previous ground investigation has identified the presence of animal remains and these are identified on the appended remediation plan. Other areas of potential burial sites were indicated by the landowner but no animal remains have been identified. The ground workers should maintain a watching brief throughout the ground works across the site to identify any potential animal remains during excavation works. If animal remains are identified then excavation works should cease and they should be backfilled immediately and contact should be made with the APHA and the duty vet to arrange appropriate disposal.

- 4.4 Where garden levels are to be raised, natural clean uncontaminated site arising material can be utilised for these purposes, or where unavailable, clean inert material may be imported to the site from a certified source. Where any materials are imported to site it will be necessary for these materials to be sampled and tested in accordance with the procedures detailed below to confirm their suitability for use within a residential environment.
- 4.5 Details of the remediation measures are shown upon appended drawing number 17040/25/A for reference.

5.0 **VERIFICATION**

- 5.1 The engineer will liaise with the appointed ground works contractor and inspect the site during the works and upon completion.
- 5.2 Topsoil where required will be placed at a minimum thickness of 150mm. Validation of the surface capping will be undertaken by trial hole excavation. Trial holes will be required to ensure that suitable thickness of a clean capping is provided to a depth of 600 mm for rear gardens and 450 mm in landscaped areas. The thickness of topsoil/subsoil and presence of underlying natural strata should be validated in accordance with the requirements below.
- 5.3 Representative samples of the materials imported to the site and encountered during the validation assessment will be subject to sampling and chemical analyses based upon table 1 below.

Table 1: Sampling Frequency		
Material	Sampling Frequency	Specification
Bulk Capping	1 sample per 150m ³	Clean inert natural material to approval (if required)
Topsoil	1 sample per 50m ³	Certified horticultural topsoil

- 5.4 Validation of the thickness of the capping material will be undertaken on the basis of one trial hole in each of the private gardens and one trial hole in every four front gardens. Validation will be required to prove a minimum 600mm thickness in private rear gardens and 450mm thickness in front garden and landscaped areas.
- 5.5 Samples recovered from the remediation works will be analysed by an appropriately certified laboratory using UKAS and MCERTS accredited testing procedures for selected chemical determinands based upon public guidance and the results of the ground investigation works. The range of determinands to be assessed and their assessment criteria are shown in tables 2 and 3 below.

Table 2: Assessment Criteria Screening Value	
	Assessment Criteria (mg/kg)
Arsenic	37 ³
Cadmium	11.0 ³
Chromium (total)	910 ³
Copper	2400 ³
Lead	200 ¹
Mercury	40 ³
Nickel	180 ³
Selenium	250 ³
Zinc	3700 ³
Total Cyanide	34.0 ²
Phenol	380 ³
pH	-
SOM	-
¹ DEFRA : SP1010 : Category 4 Screening Levels	
² Atkins Atrisk SSV residential with home grown produce (6% SOM)	
³ LQM and CIEH S4UL's for Human Health Risk Assessment (Registration No. S4UL 3265) residential with home grown produce (6.0% SOM)	
ND – None Detected	

Table 3: Assessment Criteria Screening Values Speciated PAH	
	Assessment Criteria¹ (mg/kg)
Acenaphthene	1100
Acenaphthylene	920
Anthracene	11000
Benzo[a]anthracene	13.0
Benzo[a]pyrene	5.0 ²
Benzo[b]fluoranthene	3.7
Benzo[ghi]perylene	350
Benzo[k]fluoranthene	100
Chrysene	27.0
Dibenz[ah]anthracene	0.30
Fluoranthene	890
Fluorene	860
Indeno[123-cd]pyrene	41.0
Naphthalene	13.0
Phenanthrene	440
Pyrene	2000
¹ LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (6.0% SOM)	
² DEFRA : SP1010 : Category 4 Screening Levels	

- 5.6 All samples of general bulk filling, topsoil and subsoil will be subject to the full range of analyses set out in Tables 2 & 3 and subsequent assessment for the suitability of the material will be based upon the assessment criteria indicated.
- 5.7 Testing for hydrocarbons will be undertaken on imported capping material only where the presence of hydrocarbons is suggested from an assessment of the source of material. Testing for hydrocarbons will be undertaken on samples of any revised site strata to demonstrate satisfactory remediation of the areas identified as being visually impacted by hydrocarbons. The assessment criteria are set out in Tables 4 and 5 below.

Table 4: Assessment Criteria Screening Values TPH (CWG)

TPH	Assessment Criteria (mg/kg)
Aliphatic EC 5-6	160
Aliphatic EC >6-8	530
Aliphatic EC >8-10	150
Aliphatic EC >10-12	760
Aliphatic EC >12-16	4300
Aliphatic EC >16-35	11000
Aliphatic EC >35-44	11000
Aromatic EC 5-7	300
Aliphatic EC >7-8	660
Aromatic EC >8-10	190
Aromatic EC >10-12	380
Aromatic EC >12-16	660
Aromatic EC >16-21	930
Aromatic EC >21-35	1700
Aromatic EC >35-44	1700
*Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (6.0% SOM)	

Table 5: Assessment Criteria Screening Values BTEX

	Assessment Criteria (mg/kg)
Benzene	0.37
Toluene	660
EthylBenzene	260
M/P Xylenes	320
O Xylene	330
Methyl tert-Butyl Ether	20 ¹
Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (6.0% SOM) ¹ Atkins Atrisk SSV residential with home grown produce (6% SOM)	

6.0 TIMESCALE

6.1 The implementation of the Remedial Strategy is subject to approval of the Local Authority and the implementation will be undertaken as soon as feasibly possible.

7.0 REPORTING

7.1 Upon completion of the works a full and final validation report will be prepared and submitted to the local authority and other regulatory authorities in order to satisfy them that the works have been completed successfully and to allow for any appropriate planning conditions to be discharged.

7.2 The validation report will also be submitted to the NHBC for approval in accordance with NHBC Handbook Chapter 4.1.

7.3 This report will include the following:-

- A description of all works undertaken;
- An accurate record of excavations and ground movements;
- Details of the disposal of any arisings from the site;
- The results of all chemical testing and contamination assessments;
- A photographic record confirming the removal of any potentially contaminated areas and the thickness of capping placed;
- Confirmation that the works have been completed in accordance with this remediation strategy.

Signed for and on behalf of
R E FRY & ASSOCIATES LIMITED

A handwritten signature in black ink, appearing to read "M. Dowling", with a stylized flourish at the end.

M Dowling (MGeol)



NOTES:
Basic radon gas precautions
required in all properties. If
any animal remains are identified
during groundworks then works
should cease and the APHA and
Duty Vet should be consulted.

- KEY
- Approximate site boundary
 - Front garden landscaped areas where ground levels should be reduced or raised to accommodate 450mm of clean inert capping. Capping should consist of at least 150mm of topsoil.
 - Rear garden areas where ground levels should be raised or reduced to allow for at least 600mm of clean inert capping. Capping should consist of at least 150mm of topsoil.
 - Approximate location where animal remains have been identified and will require appropriate disposal in accordance with APHA and Duty Vet guidance.
 - Approximate areas where landowner has indicated where animal remains may be present but not identified during the site investigation.

revision	Revision details	Date
suffix		
A	REMOVED REQUIREMENTS FOR CAPPING SYSTEM IN PLOTS 271-273	20.12.19



Drawing Stage	Drawing Status	
☐ Draft	Comments	☒ Tender
☒ Issued	Information	Construction
☐ Preliminary	Approval	As Built

This drawing is not authorised unless signed as checked & approved

Client
Anwyl Homes/Bellway Homes

Job title
Gresford Road
Llay

Drawing title
Remediation Plan



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Chkd	Appvd	date	scale	drawn
		20.12.19	1:1000@A1	AP

DRAWING No	17040/25	rev
		A

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Any discrepancies to this drawing discovered on site should be reported to REFA immediately. IF IN DOUBT ASK!



ISSUED FOR
PLANNING

Grand Total:	181 Units	190568 ft²
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