



Remediation and Enabling Works Strategy  
Land off Don Street, Middleton

Reference:14-554-R2 Rev 6  
Date: November 2022



# REMEDIATION AND ENABLING WORKS STRATEGY

Land off Don Street  
Middleton

Prepared for:



KELLEN  
HOMES

**Report Ref: 14-554-R2 Rev 6**  
**Date Issued: November 2022**



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## QUALITY ASSURANCE

| PROJECT NUMBER | 14-554                                 |                                        |                                        |                                                                                       |                                                              |
|----------------|----------------------------------------|----------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------|
| VERSION        | Version 1                              | Version 2                              | Version 3                              | Version 4                                                                             | Version 5                                                    |
| REMARKS        | Final                                  | Updated with comments from client      | Allotment screening levels added       | Controlled waters and asbestos assessment amended. Raft foundations no longer planned | Updated to RE objectives and End of Waste Screening Criteria |
| DATE           | July 2021                              | August 2021                            | October 2021                           | Nov 2021                                                                              | October 2022                                                 |
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Cert No 18890

ISO 9001 (2015)  
ISO 14001 (2015)  
ISO 45001 (2018)



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| <b>PROJECT NUMBER</b> | 14-554                                 |  |  |
| <b>VERSION</b>        | Version 6                              |  |  |
| <b>REMARKS</b>        | Updated based on EA Comments           |  |  |
| <b>DATE</b>           | November 2022                          |  |  |
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## EXECUTIVE SUMMARY

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <b>Site Address</b>            | Don Street, Middleton, Manchester, M24 2DB                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>National Grid Reference</b> | E 388480, N 406300                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Site Area</b>               | 10.43 Ha.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Background</b>              | <p>E3P has been instructed by Kellen Homes to develop a remediation and enabling works strategy for the proposed residential development at the site located off Don Street, Middleton.</p> <p>The E3P Remediation and Enabling Earthworks Strategy has been produced in due consideration of the geoenvironmental site investigation and contaminated land assessments previously undertaken by E3P on behalf Kellen Homes.</p> |

## CONTAMINATED LAND RISK ASSESSMENT

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>Human Health Risk Assessment</b> | <p>A human health risk assessment has been previously undertaken on the site by E3P (report ref: 14-554-R1-1) which identified the following human health risks and suggested actions to be addressed at a remediation stage.</p> <p><b>Parcel A</b></p> <p>A cover system will be required along with localised hotspot removal for semi volatile TPHs and Naphthalene.</p> <p>The soils will also require careful management according to the asbestos risk mitigation conceptual site model.</p> <p>Mercury speciation is required.</p> <p><b>Parcel B &amp; C</b></p> <p>A cover system will be required along with localised hotspot removal for semi volatile TPHs and Naphthalene.</p> <p>Mercury speciation is required and asbestos lagging has been identified in one location that will require careful management.</p> <p>Topsoil from the northern third of parcel B (football pitch area) may be suitable for re-use in garden cover system. Further chemical analysis will be required to confirm this.</p> <p><b>Parcel D &amp; E</b></p> <p>A cover system will be required along with localised hotspot removal for TPHs and Naphthalene.</p> <p>The soils will also require careful management according to the asbestos risk mitigation conceptual site model.</p> <p>Where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.</p> |
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| <p><b>Controlled Waters Risk Assessment</b></p> | <p>A controlled waters risk assessment has been previously undertaken on the site by E3P (report ref: 14-554-R1-1) which identified the following controlled waters risks and suggested actions to be addressed at a remediation stage.</p> <p><b>Parcel A</b></p> <p>Two groundwater samples from below the former Rex Mill have been analysed for PFOA and PFOS neither were present at detectable levels.</p> <p>Removal of localised TPH impact within soils is required.</p> <p>No pollution linkage between the on-site heavy metal impact and the critical receptor has been identified.</p> <p>The proposed development will create hardstanding cover across the majority of the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.</p> <p><b>Parcel B &amp; C</b></p> <p>Removal of localised TPH and naphthalene hotspots within soils is required.</p> <p>No pollution linkage between the on-site heavy metals contamination and receptors can currently be made.</p> <p>The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.</p> <p><b>Parcel D &amp; E</b></p> <p>Removal and treatment of localised TPH and naphthalene impact within soils is required.</p> <p>No pollution linkage between the on-site heavy metals contamination and receptors can currently be made.</p> <p>The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.</p> <p>In light of the above, it is considered that the soils identified on-site do not pose a risk to controlled waters. Therefore, no further works are required.</p> |
| <p><b>Ground Gas</b></p>                        | <p>A ground gas risk assessment has been previously undertaken on the site by E3P (report ref: 14-554-R1-1) which identified the following gas risks and suggested actions to be addressed at a remediation stage.</p> <p><b>Parcel A</b></p> <p>Shallow mine workings are proven beneath the majority of the Parcel A sector, these workings will require stabilisation and consolidation by pressure grouting in accordance with CIRIA 758. This operation has the potential to displace and alter the ground gas regime, therefore further ground gas monitoring will be required upon completion of the drilling and grouting works.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



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| <p><b>Ground Gas</b></p>                          | <p>Where dwellings are to be constructed over stabilised mine workings, it is recommended that ground gas mitigation measures that are compliant (as a minimum) with CS2 / Amber 1 are required. However, the final design will be dependent on the subsequent post remediation ground gas monitoring and risk based assessment.</p> <p>The ground gas risk assessment and developed conceptual site model must consider any pathways induced as part of the site engineering design, specifically Ground Improvement must be considered within the context of stone columns and their ability to create a preferential pathway for ground gas migration.</p> <p>Vibro Stone Columns should be designed to ensure no preferential pathway for gas migration to a proposed dwelling, where potential risk is identified the ground improvement solution should be designed to ensure the risk is fully mitigated.</p> <p>Post remediation/ mine stabilisation detailed assessment is required utilising both real-time gas readings and gas flux equipment.</p> <p><b>Parcel B &amp; C</b></p> <p>Preliminary ground gas monitoring suggests that the site can be predominantly classified as green/CS1, and in these areas, it is considered that gas protection measures will not be required. However, it is likely that the areas that have undergone the most upfill (landfill and central sectors) will require Amber 1/CS2 specialist protection measures.</p> <p><b>Parcel D &amp; E</b></p> <p>Preliminary ground gas monitoring suggests that it may be possible to zone the site. Due to the presence of cohesive deposits, the potential for lateral migration of any gases will be limited which means a phased approach could be considered.</p> <p>Where areas of the site are classified as Green/CS1 it is considered that gas protection measures will not be required. However, localised areas of the site have been assessed as being Amber 1/CS2 and Amber 2/CS3 and properties within these areas will likely require specialist protection measures.</p> <p>Post remediation/ mine stabilisation detailed assessment is required utilising both real-time gas readings and gas flux equipment.</p> |
| <p><b>Coal Mining and Historical Workings</b></p> | <p>E3P has previously completed a Coal Mining Risk Assessment (report ref: 14-554-R1-1) which identified the following coal mining risks and suggested actions to be addressed.</p> <p><b>Parcel A</b></p> <p>The western sector will require drill and grouting by a specialist contractor to reduce the risk of instability at the surface in the event of a collapse in underlying historic coal workings.</p> <p>The eastern sector could not be fully investigated, however, there is potential for shallow unrecorded workings, therefore it is recommended that proof drilling is undertaken in this area when possible.</p> <p>A detailed drill and grout specification is required for the site.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



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| <b>Coal Mining and Historical Workings</b> | <p><b>Parcel B &amp; C</b></p> <p>No evidence of coal workings has been identified. It is assumed that the coal seams within this area are below unstable deep granular deposits, and the bedrock is heavily disturbed by a geological fault. Therefore it was not practicable to mine coal in these areas in the 18<sup>th</sup> and 19<sup>th</sup> centuries before mechanisation.</p> <p>No further works are required in Parcels B &amp; C of the site unless coal workings are found within the Higher Bent within Parcel A and are traced across into Parcel B&amp;C.</p> <p><b>Parcel D &amp; E</b></p> <p>Drill and grouting is required on the western side of the site to the Cannel Coal and Higher Bent. As rock cover increases to the east the grid can widen in line with the level of risk identified.</p> <p>A detailed drill and grout specification is required.</p> |
| <b>Potable Water Supply</b>                | <p>At this time, the site will require barrier pipe. This will need to be confirmed following the completion of a UKWIR risk assessment.</p> <p>Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Invasive Plants</b>                     | <p>Invasive plant species are historically known to be present along the River Irk. A full site survey to determine the presence and location of invasive plant species is required along with an eradication and control plan to be developed by a specialist.</p> <p>The eradication / control of invasive species will need to be validated upon completion of the works.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## GEOTECHNICAL ASSESSMENT

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <b>Relict Sub-Structures</b> | <p><b>Parcel A</b></p> <p>Significant foundations and infrastructure are still in-situ from the former Rex Mill.</p> <p><b>Parcel B &amp; C</b></p> <p>Limited below ground obstructions are anticipate due to limited buildings which have been on the site. Landfill material is present in the south of the site containing a significant thickness of geotechnically unsuitable material.</p> <p>Alluvial soils with organic intrusions require further investigation and delineation to ensure all compressible materials are removed beneath roads, infrastructure and hardstanding with foundations to be piled.</p> <p><b>Parcel D &amp; E</b></p> <p>Limited below ground obstructions other than below the lorry park in the north are anticipated.</p> <p>Extensive relict substructures, infrastructure and materials deemed geotechnically deleterious will require removal from beneath proposed structures and infrastructure to the depths and extents as defined within this specification.</p> |
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| <p><b>Adverse Ground Conditions</b></p> | <p>All potentially infilled ponds and historical features where deleterious/putrescible material is identified should be fully delineated and subject to the necessary remediation works.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Proposed Foundations</b></p>      | <p><b>Parcel A</b></p> <p>The most cost-effective option for the majority of Parcel A would likely be to re-engineer the Made Ground using vibro stone columns (VSCs) to support a shallow strip or spread foundation. Given the presence of shallow groundwater, a bottom fed vibro column would be recommended.</p> <p>Furthermore, the presence of underlying coal workings means that any loadings must not be transferred through the underlying coal seams or workings. Given the presence of underlying coal workings and hydrocarbon contamination on the site, the potential of the vibro stone columns to act as preferential pathways must be considered. Therefore, columns must be designed to ensure that they do not create any preferential migration pathways.</p> <p>The foundation solution must consider impacts to the offsite gas main to the north and river wall to the south and ensure mitigation within the design.</p> <p>Dessivated clay soils within tree influence will require removal.</p> <p><b>Parcel B &amp; C</b></p> <p>Given the need to complete extensive 'cut / fill works' it will be necessary to engineer all site derived materials to ensure the in-situ density exceeds 95% of the laboratory determined maximum dry density with verification testing to prove suitability for ground improvement by VSC. However, in areas in the north, traditional foundations may be possible depending on the extent of cut and fill.</p> <p>Where soft clay and organic material is present in the centre of the site (identified by Coopers in 2014), they must be excavated and the resulting void backfilled and re-engineered to 95% compaction to allow for VSC or driven piled foundations.</p> <p>The area of the former landfill contains geotechnically unsuitable and decaying material to a maximum proven depth of 4.6m, therefore this area is not suitable for VSC in its current state. Due to the age of the backfill material, the near-surface stratum has been subject to long term total self-weight settlement. However, as there has been no load applied to the material there has been no surcharge effect and the effective stress is low giving rise to the potential for differential settlement in the upper 3m. As a result, there is a requirement during the earthworks to lift, sort and process material in the near-surface with specific compaction parameters and geotechnical specifications that will ensure a required compaction. Partial depth treatment vibro stone columns could be utilised to support a caged ground beam.</p> <p>Within the deeper Made Ground, the overburden pressures of &gt;60 KPa have acted as surcharge pressures for the past 30years and as such long-term total and differential settlement is considered likely to have ceased.</p> |



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| <b>Proposed Foundations</b>        | <p>Where a plot may span a high wall a fully stiffened raft designed by a structural engineer could be adopted; however, consideration on the bulb of pressure being exerted needs to be taken to ensure that the stress from the applied loadings does not induce a loading onto the top of a high wall that could induce differential settlement.</p> <p><b>Parcel D &amp; E</b></p> <p>Given the need to complete extensive 'cut / fill works' it will be necessary to engineer all site derived materials to ensure the in-situ density exceeds 95% of the laboratory determined maximum with verification testing to prove suitability for ground improvement by VSC (where Possible). However, in areas of the north traditional foundations may be possible depending on the extent of cut and fill.</p> <p>Therefore, upon completion of these enabling works, it is likely that the most cost-effective option for the majority of the site would be to re-engineer the Made Ground using VSC to support a shallow strip or spread foundation.</p> <p>Desiccated clays that are subject to instability require removal from conjectured tree zone influence.</p> <p><b>All Areas</b></p> <p>The appointed remediation and enabling works contractor will refer to the Geotechnical Foundation Zoning Plan.</p> |
| <b>Highways and Infrastructure</b> | <p>All proposed adopted roads will be constructed in accordance with the geotechnical engineering requirements as defined within the MCHW Series 600. Specific engineering and compaction of materials will be completed in strict accordance with the geotechnical specification contained within this report.</p> <p>All materials outside of structural/infrastructure development will be engineered and compacted to ensure consolidation associated with self-weight settlement is limited to &lt; 50 mm in accordance with the E3P specification.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



## REMEDIATION AND ENABLING WORKS

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Objectives</b>                     | <p>The remediation and enabling works will be delivered in a manner that will seek to ensure that the site is prepared to deliver the optimum foundation solution for the proposed structures, infrastructure and highways.</p> <p>The geotechnical foundation zoning plan and structural engineer's drawings should be referenced to determine the proposed foundation solution.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Remediation and Enabling Works</b> | <p>The site remediation and enabling works strategy provides a comprehensive specification for the regeneration of the land to negate identified pollutant linkages and construct a development platform that will be geotechnically suitable for the proposed end use. The salient features of the remediation and enabling works strategy are summarised as follows:</p> <ul style="list-style-type: none"> <li>✳ Implementing of all works in strict accordance with UK Environmental Permitting and local planning authority requirements.</li> <li>✳ Controlled removal of all trees and vegetation.</li> <li>✳ River Corridor Watching Brief</li> <li>✳ Delineation of Coopers Borehole WS17</li> <li>✳ Removal and treatment of all invasive plant species (as required) in accordance with specialist contractor method statement, validation and independent certification.</li> <li>✳ Delineation and removal of asbestos and volatile-impacted soil, validation testing of material that remains and removal of all unsuitable soils.</li> <li>✳ Segregation of organic topsoil deemed unsuitable for use within a residential garden and placement in an area of no sensitivity or removal from site in accordance with UK waste management legislation.</li> <li>✳ Management of all anthropogenic material impacted by trace asbestos fibre in a controlled and legislatively compliant manner.</li> <li>✳ Identification, delineation and removal of organic materials within infilled ponds, streams and rivers.</li> <li>✳ Removal of all structures, relict foundations and buried features in their entirety.</li> <li>✳ Removal of all materials considered geotechnically deleterious.</li> <li>✳ Excavation and processing of MADE GROUND in a controlled manner with the sorting, processing and segregation of identified deleterious materials to geotechnical specification.</li> <li>✳ Excavation and processing of the former landfill material;</li> <li>✳ Validation sampling testing to confirm material retained on-site poses no unacceptable risk to the residential end-users or wider environment.</li> <li>✳ Importation of suitable material (if required) to achieve the required development levels.</li> <li>✳ Replacement of material in accordance with the E3P enabling specification and engineering requirements.</li> <li>✳ Surface water monitoring program.</li> </ul> |



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| <b>Environmental Permit Compliance</b> | <p>Materials present from with the former registered landfill will need to be processed utilising the relevant treatment permits in order for the soils to reach end of waste status. The permit will need to be submitted to the National Permitting Team for approval.</p> <p>Materials from outside the area of the former landfill can be re-used in accordance with CL:AIRE Definition of Waste code of practice.</p> |
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## **BUILD PHASE REQUIREMENTS**

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Summary of Build-Phase Mitigation Requirements</b> | <p>The developer's works will also include the completion of the following additional elements:</p> <ul style="list-style-type: none"><li>✿ Provision of a 600 mm cover system using certified material with appropriate validation within proposed garden areas, comprising 450 mm subsoil (potentially site-won natural drift deposits) overlain by 150 mm topsoil.</li><li>✿ Provision of a 300 mm cover system using certified material with appropriate validation within proposed areas of public open space and soft landscaping.</li><li>✿ Gas monitoring is currently ongoing however an allowance for CS2/Amber 1 gas mitigation measures is recommended. Results will determine the final ground gas regime and required mitigation measures.</li><li>✿ Post remediation works gas monitoring to be completed within Parcel A to determine the required ground gas protection measures.</li><li>✿ Construction of appropriate potable water supply infrastructure.</li></ul> |
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## TABLE OF CONTENTS

|                                                                                                        |           |
|--------------------------------------------------------------------------------------------------------|-----------|
| <b>EXECUTIVE SUMMARY .....</b>                                                                         | <b>1</b>  |
| <b>1. INTRODUCTION .....</b>                                                                           | <b>11</b> |
| 1.1. Background .....                                                                                  | 11        |
| 1.2. Report Objectives .....                                                                           | 11        |
| 1.3. Scope of Works .....                                                                              | 11        |
| 1.4. Previous Works .....                                                                              | 11        |
| 1.5. Redevelopment Plan .....                                                                          | 12        |
| 1.6. Summary of Parties Involved .....                                                                 | 12        |
| 1.7. Regulatory Correspondence .....                                                                   | 13        |
| 1.8. Site Details .....                                                                                | 13        |
| 1.9. Site Summary .....                                                                                | 13        |
| 1.10. Summary of Reported Ground Conditions .....                                                      | 15        |
| <b>2. E3P CONTAMINATION RISK ASSESSMENT .....</b>                                                      | <b>19</b> |
| 2.1. Background .....                                                                                  | 19        |
| 2.2. Human Health Risk Summary .....                                                                   | 19        |
| 2.3. Controlled Waters Contamination Risk Summary .....                                                | 23        |
| 2.4. Ground Gas .....                                                                                  | 24        |
| 2.5. Potable Water Supply Infrastructure .....                                                         | 26        |
| <b>3. SITE REMEDIATION AND ENABLING WORKS .....</b>                                                    | <b>27</b> |
| 3.1. Contaminants of Concern (CoC) .....                                                               | 27        |
| 3.1.1. Metals, PAH, Non-Volatile Hydrocarbon (Petroleum Range) Compounds .....                         | 27        |
| 3.1.2. Asbestos .....                                                                                  | 27        |
| 3.1.3. Discussion of volatile Contaminants .....                                                       | 28        |
| 3.2. Identification Of Feasible Remediation Options .....                                              | 28        |
| 3.2.1. Objectives .....                                                                                | 28        |
| 3.2.2. Available Technologies .....                                                                    | 28        |
| 3.2.3. Selection of Technology Options .....                                                           | 29        |
| 3.3. summary of preferred remediation options .....                                                    | 33        |
| 3.4. Overview of Works .....                                                                           | 33        |
| 3.5. Validation Sampling Protocol .....                                                                | 54        |
| 3.6. Remediation Contractors Site Management and Responsibility .....                                  | 56        |
| <b>4. MATERIALS MANAGEMENT AND LEGISLATIVE COMPLIANCE .....</b>                                        | <b>57</b> |
| 4.1. Approach & Methodology .....                                                                      | 57        |
| 4.2. Mobile environmental treatment permit .....                                                       | 58        |
| 4.3. Operation No.1 - Primary 'Physical' Treatment .....                                               | 59        |
| 4.4. Operation No.2 – Manufacture of recycled aggregates .....                                         | 59        |
| 4.5. Operation No.3 – validation of fines .....                                                        | 60        |
| 4.6. Operation No.4 – Solidification & Stabilisation of Fines .....                                    | 61        |
| 4.7. Expected Waste Materials .....                                                                    | 62        |
| 4.8. Validation Criteria .....                                                                         | 64        |
| 4.8.1. Fines Material .....                                                                            | 64        |
| 4.9. Recycled Aggregates .....                                                                         | 65        |
| <b>5. ENVIRONMENTAL MONITORING AND VALIDATION .....</b>                                                | <b>67</b> |
| 5.1. Site Management .....                                                                             | 67        |
| 5.2. Completion .....                                                                                  | 67        |
| 5.3. Mitigation of Risk from Soils with Asbestos Fibres .....                                          | 68        |
| 5.3.1. Pre-Commencement Works .....                                                                    | 68        |
| 5.3.2. Control, Monitoring and Reporting of General Aerial Emissions from Dusts and Particulates ..... | 68        |



|                                                                                  |            |
|----------------------------------------------------------------------------------|------------|
| <b>6. GEOTECHNICAL ENGINEERING SPECIFICATION.....</b>                            | <b>71</b>  |
| 6.1. E3P Geotechnical Engineering Specification.....                             | 71         |
| 6.2. Locally-Won Fill Material .....                                             | 71         |
| 6.3. Classification of Fill Material .....                                       | 72         |
| 6.3.1. General Classification.....                                               | 72         |
| 6.3.2. Use of Fill Materials .....                                               | 74         |
| 6.4. General Requirements.....                                                   | 74         |
| 6.4.1. Construction of Fills – Highways.....                                     | 77         |
| 6.4.2. Construction of Fills – Adopted Highways, Estate Roads and Car Park ..... | 78         |
| 6.4.3. Unacceptable Material.....                                                | 79         |
| 6.5. Earthworks Material Tests .....                                             | 80         |
| 6.6. Specification for Ground Improvement by Vibro-Stone Column .....            | 80         |
| 6.7. Current and Proposed Site Topography and Slope Interaction .....            | 82         |
| <b>7. RECORD-KEEPING AND VERIFICATION.....</b>                                   | <b>83</b>  |
| 7.1. Record-Keeping .....                                                        | 83         |
| 7.2. Verification.....                                                           | 83         |
| <b>8. CONTINGENCY PLAN .....</b>                                                 | <b>84</b>  |
| 8.1. Previously Unidentified Contaminants .....                                  | 84         |
| <b>9. SECOND PHASE MITIGATION AND MANAGEMENT – BUILD PHASE.....</b>              | <b>85</b>  |
| 9.1. Placement Of Cover System .....                                             | 85         |
| 9.1.1. Procedure for Placement of Chemically Suitable Cover System .....         | 86         |
| 9.2. Ground Gas Protection Measures .....                                        | 89         |
| 9.3. Potable Water Supply – Contaminant Assessment Criteria .....                | 91         |
| <b>APPENDIX I LIMITATIONS.....</b>                                               | <b>92</b>  |
| <b>APPENDIX II GLOSSARY .....</b>                                                | <b>94</b>  |
| <b>APPENDIX III DRAWINGS .....</b>                                               | <b>97</b>  |
| <b>APPENDIX IV E3P REMEDIATION/ VALIDATION CRITERIA.....</b>                     | <b>98</b>  |
| <b>APPENDIX V E3P MATERIAL IMPORT CRITERIA .....</b>                             | <b>106</b> |
| <b>APPENDIX VI CONTRACTOR PRE-COMMENCEMENT CHECK SHEET .....</b>                 | <b>108</b> |
| <b>APPENDIX VII CONTRACTOR COMPLETION CHECK SHEET .....</b>                      | <b>111</b> |
| <b>APPENDIX VIII DEWATERING PLAN .....</b>                                       | <b>114</b> |



## **1. INTRODUCTION**

### **1.1. BACKGROUND**

E3P has been instructed by Kellen Homes to develop a remediation strategy and enabling works strategy for the proposed residential development at the site known as Don Street, located to the northeast of Middleton.

### **1.2. REPORT OBJECTIVES**

The objectives of this report are to:

- ✿ Prepare overview of contaminated land remediation requirements;
- ✿ Evaluate feasible remedial technologies;
- ✿ Assess the most-appropriate earthworks solution to ensure the delivery of the optimum development platform;
- ✿ Define validation criteria to demonstrate the successful implementation of a site remediation and enabling works plan;
- ✿ Specify geotechnical engineering performance requirements; and
- ✿ Ensure the safe, cost effective and regulatory compliant redevelopment of the site.

### **1.3. SCOPE OF WORKS**

The development of the risk management strategy for the subject site includes the following tasks:

- ✿ Identification of the relevant pollutant linkages;
- ✿ Review of site characteristics;
- ✿ Identification of geotechnical constraints;
- ✿ Development of remedial objectives;
- ✿ Selection of appropriate remedial technology; and
- ✿ Development of remedial strategy.

### **1.4. PREVIOUS WORKS**

The following phases of geoenvironmental investigations have previously been carried out at the site:

- ✿ REFA Consulting Engineers – Ground Investigation Report. Report Reference: 05122, dated September 2006; and,
- ✿ Coopers – Site Investigation Report. Report Reference: 5639si, dated 28th May 2013.
- ✿ E3P – Phase I and II Geoenvironmental Site Assessment Report Ref: 14-554-R1-2.



To inform the assessment of the potential risk to contaminated land within the context of the proposed residential development and to inform the preparation of the remediation strategy, the pertinent points from the above report are summarised within Section 2.

For the avoidance of any doubt, the above reports should be read both as a precursor to and in conjunction with this document.

## 1.5. REDEVELOPMENT PLAN

Kellen Homes intends to construct a low-rise residential development with associated gardens, estate roads and infrastructure. Drawing 14-554-002- (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



## 1.6. SUMMARY OF PARTIES INVOLVED

| Function/interest                     | Name of Party            |
|---------------------------------------|--------------------------|
| Local Planning Authority              | Rochdale Borough Council |
| Developer                             | Kellen Homes             |
| Geoenvironmental Consultant           | E3P                      |
| Main Contractor                       | Kellen Homes             |
| Remediation/Enabling Works Contractor | TBC                      |
| Human Health Regulator                | Rochdale Borough Council |
| Controlled Waters and Waste Regulator | Environment Agency       |



| Function/interest           | Name of Party            |
|-----------------------------|--------------------------|
| Highways Adoption Authority | Rochdale Borough Council |

## 1.7. REGULATORY CORRESPONDENCE

Kellen Homes are in the process of submitting a detailed planning application to the local planning authority for the proposed redevelopment of the site for low-rise residential housing with associated adopted estate roads and infrastructure.

It is presumed that as part of the planning approval process, the planning authority will undertake consultation with the pertinent statutory consultees, which will include:

- ✳ Environmental health/contaminated land officer at the local authority (or external adviser);
- ✳ Environment Agency planning liaison; and
- ✳ The Coal Authority.

## 1.8. SITE DETAILS

|                         |                                            |
|-------------------------|--------------------------------------------|
| Site Address            | Don Street, Middleton, Manchester, M24 2DB |
| National Grid Reference | E 388480, N 406300                         |
| Site Area               | 10.43 Ha.                                  |

All acronyms used within this report are defined in the glossary presented in Appendix II.

A site location plan is presented in Appendix VII as Drawing 15-554-001.

## 1.9. SITE SUMMARY

TABLE 1.1 SITE DESCRIPTION AND SETTING

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupancy/Use | <p>The site comprises an irregular shaped parcel of land with the River Irk flowing east west through the centre of the site. In the south there is an area that is currently utilised as HGV parking for the adjacent offsite Hexpol Building and open soft landscaped land.</p> <p>The area to the north of the river is rough scrub and landscaping with a football field in the north east.</p> <p>The site gently slopes down toward the River Irk from the north and south, steepening in gradient in proximity to the river embankment which is indicative of historical infilling to the landform.</p> <p>Japanese Knotweed and Himalayan Balsam have been identified along the banks of the River Irk.</p> <p>For ease, the site has been divided into the following five discrete zones in line with the previous report completed by Coopers in 2013. The parcels are:</p> |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                           |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <ul style="list-style-type: none"> <li> Parcel A - the former Rex Mill,</li> <li> Parcel B - former playing fields,</li> <li> Parcel C - apron between Rex Mill and former playing fields,</li> <li> Parcel D - Wagon/trailer park, open ground and Hexpol car park,</li> <li> Parcel E - Wooded area in the south eastern corner of the site.</li> </ul>                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                           |
| <b>Environmental Setting</b> | <b>Drift Geology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | There are multiple drift deposits overlying the bedrock on the site. These comprise of Alluvium and Diamicton in the north with Glaciofluvial sheet deposits in the vicinity of the River Irk. Glacial Till is present in the southern areas of the site. |
|                              | <b>Bedrock Geology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Pennine Lower Coal Measures Formation.                                                                                                                                                                                                                    |
|                              | <b>Hydrogeology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Secondary A aquifer within both the superficial and bedrock.                                                                                                                                                                                              |
|                              | <b>Hydrology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Secondary A aquifer within both the superficial and bedrock.                                                                                                                                                                                              |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | There is a surface water abstraction to the south of Parcel A in the River Irk relating to the adjacent Don Mill for use within cooling.                                                                                                                  |
|                              | <b>Flood Risk</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The River Irk flows east west across the centre of the site.                                                                                                                                                                                              |
| <b>Site History</b>          | <b>Subsidence Hazard</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Shallow coal mine workings within the site could cause potential ground instability and induce future subsidence events within the proposed development.                                                                                                  |
|                              | <p>Parcel A - Rex Mill situated in the north western corner of the site had been established in 1904 and was initially a cotton mill with a chimney and associated tanks prior to conversion into a cigarette manufacturing works in the middle of the 20th century. The River Irk had been canalised along the southern boundary of this mill and was previously noted to have a varied meander. Rex Mill was destroyed by arson in 2000.</p> <p>Parcel B &amp; C - The former playing fields were noted to be agricultural land with Spa Farm (&lt;1851). Many springs were noted between the fields and river within the anticipated river flood plain (apron between Rex Mill and the former playing fields). The fields were re-profiled to form the northern playing field by the farmer of Scowcroft farm during the 1980's. The southern playing field was raised initially by surplus reworked natural sand and clay from the northern playing field, as well as from licenced waste management activities from 1986 to 1988.</p> |                                                                                                                                                                                                                                                           |



|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site History</b>                    | Parcel D was historically re-profiled before being utilised as a lorry park and car park for the adjacent Hexpol site, whilst Parcel E has remained undeveloped with a marsh/ pond in the east.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Landfill Sites and Ground Gases</b> | <p>There is a historical landfill on-site (Parcel B) which operated from 1986 to 1988. Deposited wastes included inert, industrial and commercial waste. This is also noted as a registered landfill and was noted to have a large input.</p> <p>Any underlying coal workings are also a potential source of ground gas.</p> <p>Outside of the site boundary a BGS recorded landfill is located 35 m east of the site, which is also noted as a historical landfill that was active from 1967 to 1972 and accepted inert, industrial, commercial, household waste and liquid sludge.</p> <p>Furthermore, there was a historical landfill located 157 m south west of the site, however no further details are provided.</p> |
| <b>Radon</b>                           | The Envirocheck report indicates the site is situated in an area where less than 1% of homes are above the "Action Level" and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## 1.10. SUMMARY OF REPORTED GROUND CONDITIONS

E3P has prepared a detailed Site Investigation Report (Ref: 14-554-R1, dated May 2021). The summary of reported ground conditions is given in Table 1.2.

TABLE 1.2 SUMMARY OF GROUND CONDITIONS

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MADE GROUND</b> | <p><b>Parcel A</b></p> <p>Made Ground deposits were encountered within all exploratory hole locations to depths of between ground level and in excess of 5.45 m bgl although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl.</p> <p>Significant obstructions in the form of former foundations were encountered throughout the former mill site.</p> <p>Across the site Made Ground deposits generally comprised of a red sandy gravel with frequent cobbles of brick or a dark/light brown slightly clayey gravelly sand with gravel of brick, mudstone, concrete, glass and ash.</p> <p>A significant hydrocarbon odour and sheens were encountered in 3 locations one of which was in the location of the former tanks.</p> <p><b>Parcel B &amp; C</b></p> <p>Made Ground was encountered within the majority of exploratory holes to a maximum proven depth of 5.90 m bgl.</p> <p>The southern area of parcel B (former landfill) was found to comprise a brown sandy gravelly clay with inert wastes including brick, concrete, occasional coal, polythene sheeting, tyres, slag and vegetation including tree stumps. The former landfill was proven to a maximum depth of 4.00 m in CP303 with potential that it does proceed beyond this to beyond 5.45 m in WS311 however, this borehole was inconclusive due to poor recovery.</p> |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MADE GROUND</b> | <p>Towards the north of Parcel B, Made Ground was noted to comprise a re-worked sand fill which deepened towards the west to a maximum encountered thickness of 1.50 m. There were no significant anthropogenic materials encountered within this stratum.</p> <p>Within the historic Coopers investigation, an area of fill was encountered to a maximum proven depth of 2.60 m bgl in the area of the former pond on the northern boundary of Parcel B. This comprised circa 0.60 m of ash and clinker overlain by circa 1.30 m of reworked clay, reworked sand and topsoil. It was noted that the centre of the pond was not accessible therefore deeper Made Ground may be present in this location. E3P were unable to investigate this area further due to proximity to a medium pressure gas main.</p> <p>In the western area (Parcel C) the Made Ground comprised a clay bound brick fragmented backfill to a maximum proven depth of 2.70 m bgl. Occasional ash and clinker were also encountered.</p> <p><b>Parcel D &amp; E</b></p> <p>Made Ground deposits were encountered within all exploratory hole locations to a maximum proven depth of 5.45m in WS401.</p> <p>The shallow made ground deposits generally comprise asphalt, concrete or a reworked topsoil of dark brown slightly clayey medium sand with rootlets.</p> <p>The deeper Made Ground deposits generally comprise brown to black gravelly clay or brown to dark grey gravelly coarse sand. Gravel comprised mudstone, concrete and brick.</p> <p>Slight hydrocarbon odours were noted in the Made Ground in TP409 at 1.60 m and in TP411 between 0.20 m to 2.50 m bgl.</p> <p>The deeper Made Ground deposits generally comprise brown to black gravelly clay or brown to dark grey gravelly coarse sand. Gravel comprised mudstone, concrete and brick.</p> |
| <b>Topsoil</b>     | <p><b>Parcel A</b></p> <p>None</p> <p><b>Parcel B &amp; C</b></p> <p>Topsoil was encountered in the north of Parcel B (playing fields) to a maximum proven depth of 0.80 m bgl. This topsoil is deemed to be potentially reworked as part of the levelling in this area in preparation of the ground for a playing field.</p> <p><b>Parcel D &amp; E</b></p> <p>Reworked topsoil of dark brown slightly clayey medium sand or dark grey sandy clay with rootlets was noted across the eastern sector to depths of between 0.08 m and 0.40 m bgl.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DRIFT</b>       | <p><b>Parcel A</b></p> <p>The drift deposits varied across the site however, the majority of the site is underlain by granular deposits with sporadic beds of clay within in the upper 3 metres.</p> <p>The granular deposits varied in density from very loose to becoming dense typically beyond 3 m bgl, it is assumed that the loose deposits are caused by the shallow groundwater on the site.</p> <p><b>Parcel B &amp; C</b></p> <p>Drift deposits across the parcel b and c were encountered between ground level to a maximum proven depth of 28.00 m bgl. Deposits encountered typically comprise a loose to medium dense sand or sand and gravel with occasional bands of silty clay within some locations.</p> <p>Peat deposits were noted within three exploratory hole locations in the Coopers report within the west (Parcel C) between the depths of 1.30 m bgl and 3.00 m bgl with a maximum proven thickness of 0.30 m. E3p encountered peat within one exploratory hole location (WS301) within parcel c at a thickness of 0.20 m. However, within these areas E3P did identify organic alluvial silts at ~2.00m that will require further delineation &amp; geotechnical analysis.</p> <p><b>Parcel D &amp; E</b></p> <p>The drift deposits are varied, generally comprising soft low strength to stiff high strength sandy clay and loose to medium dense clayey medium sand to a maximum proven depth of 32.80 m bgl (rb408).</p> <p>The rotary boreholes generally recorded granular drift deposits at depth, comprising light brown fine to medium sand with occasional bands of clay and gravel.</p> |
| <b>Bedrock</b>     | <p><b>Parcel A</b></p> <p>The solid bedrock geology was encountered between 3.90 m and 14.90 m bgl. The solid geology comprises grey MUDSTONE interbedded with grey SANDSTONE and coal bands. Generally, the bedrock deepens from west to east with no significant topographical variance at the surface.</p> <p><b>Parcel B &amp; C</b></p> <p>The solid bedrock geology was encountered between 17.80 m and 28.00 m bgl and comprised light-grey MUDSTONE which is interbedded with grey SANDSTONE with occasional traces of coal.</p> <p><b>Parcel D &amp; E</b></p> <p>The solid bedrock geology was encountered as SILTSTONE in RB408 between 32.80 m and 47.00 m bgl.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Groundwater</b> | <p><b>Parcel A</b></p> <p>Groundwater that is likely in hydraulic continuity with the River Irk was encountered across the site between 1.00 m and 2.00 m bgl.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



|                    |                                                                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GROUNDWATER</b> | <p><b>Parcel B &amp; C</b></p> <p>Groundwater that is likely in hydraulic continuity with the River Irk was generally encountered between 2.00 m and 4.00 m bgl.</p> <p><b>Parcel D &amp; E</b></p> <p>Perched groundwater was encountered as seepages between 1.90 m and 5.00 m bgl.</p> |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## 2. E3P CONTAMINATION RISK ASSESSMENT

E3P has previously completed a Phase 1 and Phase 2 geoenvironmental assessment (report ref: 14-554-R1-1) and a supplementary assessment (ref: 14-554-L1-2) which identified contaminant issues which are discussed in this section.

### 2.1. BACKGROUND

E3P has completed a Tier 1 Qualitative Contaminated Land Risk Assessment to determine the potential risk to human health, controlled waters and the wider environ. This assessment is documented in full within the E3P Geoenvironmental Site Assessment report and, for clarity, is summarised in the following sections of this document.

### 2.2. HUMAN HEALTH RISK SUMMARY

#### PARCEL A

The E3P Tier 1 Qualitative Human Health Risk Assessment identified concentrations of the following determinants at or above the screening criteria for the assessment of no unacceptable degree of risk to human health within Parcel A

- ✳ Lead.
- ✳ Arsenic.
- ✳ Chrysotile.
- ✳ Naphthalene.
- ✳ Benzo(a)Anthracene.
- ✳ Benzo(b)Fluoranthene.
- ✳ Benzo(a)Pyrene.
- ✳ Dibenzo(a,h)Anthracene.
- ✳ Hydrocarbon Fractions C10-C35 (aromatic).

Coopers identified elevated naphthalene in TP1 at 0.50 m bgl in Parcel A.

REFA identified elevated naphthalene in TP5, TP6, BH1, BH2, BH3 and BH4 in Parcel A.

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils.



With regards to the elevated naphthalene and TPH in TP204 and naphthalene within Coopers TP1 and REFA TP5, TP6, BH1, BH2, BH3 and BH4 these present a potential volatilisation to indoor air risk. These areas are therefore considered to be localised hotspots related to the former tank/ chimney area. Therefore, during a process of cut/fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.

Elevated total mercury has been identified in the shallow granular Made Ground at TP519 at 0.30 m bgl. During remediation and enabling works, speciated mercury analysis should be completed to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a hotspot and place in an area of low sensitivity such as POS. Alternatively, if it is proven that there is no elemental mercury, a clean cover system will be sufficient.

Asbestos in the form of chrysotile has also been identified within one localised area at WS203 at 1.50m bgl within Made Ground deposits. Asbestos quantification was undertaken to further assess where these soils may be placed, this indicated detected fibres at 0.002%. No visual signs of ACM were encountered during the ground investigation; it is therefore likely that only trace fibres are present. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 2.1. Where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk-based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.

All proposed garden and landscaped areas within the development are to be installed with a 600 mm chemically suitable cover system, which will ensure that future site users will be at no unacceptable risk from the identified contaminant exceedances.

FIGURE 2.1 ASBESTOS CONCEPTUAL SITE MODEL



## PARCEL B & C

The E3P Tier 1 Qualitative Human Health Risk Assessment identified concentrations of the following determinants at or above the screening criteria for the assessment of no unacceptable degree of risk to human health within Parcel B & C.

-  Arsenic;
-  Mercury;
-  Zinc;
-  Asbestos (Chrysotile and Amosite);
-  Naphthalene;
-  Benzo(a)anthracene;
-  Chrysene;
-  Benzo(b)Fluoranthene;
-  Benzo(a)pyrene;
-  Dibenzo(a,h)Anthracene; and
-  Hydrocarbon Fractions C16-C35 (aromatic).

The previously completed Coopers report also identified heavy metal and PAH impact mainly centred around the area of the former landfill and naphthalene exceedances within TP11 in the very west and TP41 in the south of the Parcel B & C.

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils.

With regards to the elevated naphthalene, these present a potential volatilisation to indoor air risk. These elevated concentrations have only been identified within a few small areas of the site outside of the landfill and are therefore considered to be localised hotspots. Therefore, during a process of cut/fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.

Elevated total mercury has been identified in the Made Ground at TP342 0.20 m and TP501, TP505, TP507 (Parcel B & C). During remediation and enabling works, speciated mercury analysis should be completed to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation. If elemental mercury is identified, it may be necessary to delineate and excavate the soils as a hotspot and place in an area of low sensitivity such as POS. Alternatively, if it is proven that there is no elemental mercury, a clean cover system will be sufficient.



Asbestos in the form of chrysotile has also been identified within localised areas in shallow Made Ground deposits. Asbestos quantification should be undertaken to further assess where these soils may be placed. ACM was encountered during the ground investigation within TP323 from 1.00 m to 2.50 m in the form of potential asbestos lagging. Therefore, a specialist contractors will be required to identify and remove any visible ACM. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 2.1. Where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk-based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.

All proposed garden and landscaped areas within the development are to be installed with a 600 mm chemically suitable cover system, which will ensure that future site users will be at no unacceptable risk from the identified contaminant exceedances.

## PARCEL D & E

The E3P Tier 1 Qualitative Human Health Risk Assessment identified concentrations of the following determinants at or above the screening criteria for the assessment of no unacceptable degree of risk to human health within Parcel D & E.

- ✳ Lead;
- ✳ Asbestos (Chrysotile, Amosite & Crocidolite);
- ✳ Naphthalene;
- ✳ Chrysene;
- ✳ Benzo(a)Anthracene;
- ✳ Benzo(b)Fluoranthene;
- ✳ Benzo(a)Pyrene; and,
- ✳ Dibenzo(a,h)Anthracene.

Coopers identified elevated naphthalene at WS5 and elevated concentrations of TPH C21-C35 Aromatic were identified in TP49. Elevations concentrations of TPH were also recorded in WS17, however this location is outside of the site boundary.

Chrysotile was identified in Coopers TP48; however quantification was not completed. Chrysotile was also identified in Coopers WS10; however this is located outside of the site boundary.

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils.

With regards to the elevated naphthalene at TP409 and WS5, this presents a potential volatilisation to indoor air risk. Therefore, during a process of cut/fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.



Visual and olfactory evidence of contamination has been identified in six locations in the west of the site, therefore a watching brief should be completed during remediation works to monitor the locations where visual or olfactory hydrocarbon impact has been identified during all phases of investigation completed to date.

Asbestos has also been identified throughout the Made Ground deposits. No visual signs of ACM were encountered during the ground investigation. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 2.1. Where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk-based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.

All proposed garden and landscaped areas within the development are to be installed with a 600 mm chemically suitable cover system, which will ensure that future site users will be at no unacceptable risk from the identified contaminant exceedances.

## **FURTHER WORKS**

It is concluded that the site will be suitable for the proposed residential end use subject to the completion of the supplementary assessments and the following build-phase mitigation items:

- ✳ Further investigation of inaccessible areas.
- ✳ Mercury Speciation of soils within TP342 (Parcel A and B).
- ✳ Management of soils to ensure that all materials impacted by asbestos fibres are placed in areas of low sensitivity during the site enabling works.
- ✳ Use of potable water supply infrastructure that will be compliant with United Kingdom Water Infrastructure Risk (UKWIR) assessment criteria.
- ✳ Construction of a 600 mm clean cover system to all areas of private garden in accordance with the detailed methodologies herein.

## **2.3. CONTROLLED WATERS CONTAMINATION RISK SUMMARY**

A Tier 1 Controlled Water Risk Assessment was completed by E3P as part of the E3P Geo-Environmental Site Assessment, the findings of which are summarised as follows:

### **Parcel A**

Two groundwater samples from below the former Rex Mill have been analysed for PFOA and PFOS neither were present at detectable levels.

Removal of TPH impact within soils is required.

No pollution linkage between the on-site heavy metals contamination and receptors can currently be made.

The proposed development will create hardstanding cover across the majority of the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.

### **Parcel B & C**

Removal of TPH and naphthalene impact within soils is required.



No pollution linkage between the on-site heavy metals contamination and receptors can currently be made.

The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.

#### **Parcel D & E**

Removal and treatment of TPH and naphthalene impact within soils is required.

No pollution linkage between the on-site heavy metals contamination and receptors can currently be made.

The proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated and the risk posed to controlled waters receptors going forward.

In light of the above, it is considered that the soils identified on-site do not pose a risk to controlled waters. Therefore, no further works are required.

## **2.4. GROUND GAS**

Ground gas has been assessed by E3P as part of the E3P Geoenvironmental Site Assessment. The assessment was completed in accordance with the methodology outlined with the CIRIA publication C665, utilising the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions and gas assessments are summarised below.

### **PARCEL A**

The GSVs for the monitoring positions for Parcel A are summarised in Table 2.1.

TABLE 2.1 GAS RISK PROFILE AND LOCATION

| LOCATION | MAX CH <sub>4</sub><br>(% v/v) | GSV<br>(l/hr) | MAX CO <sub>2</sub><br>(% v/v) | GSV<br>(l/hr) | CLASSIFICATION |
|----------|--------------------------------|---------------|--------------------------------|---------------|----------------|
| WS201C   | Flooded                        |               |                                |               |                |
| WS202B   | 0.10                           | 0.00052       | 2.20                           | 0.01144       | Green/CS1      |
| WS205    | Flooded                        |               |                                |               |                |
| WS206    | 0.10                           | 0.00013       | 0.20                           | 0.00026       | Green/CS1      |
| WS207    | 0.10                           | 0.00026       | 0.10                           | 0.00026       | Green/CS1      |
| WS208    | 0.10                           | 0.0001        | 0.10                           | 0.0001        | Green/CS1      |

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Shallow mine workings are proven beneath the majority of the Parcel A sector, these workings will require stabilisation and consolidation by pressure grouting in accordance with CIRIA 758. This operation has the potential to displace and alter the ground gas regime, therefore further ground gas monitoring will be required upon completion of the drilling and grouting works.

Where dwellings are to be constructed over stabilised mine workings, it is recommended that ground gas mitigation measures to be compliant (as a minimum) with CS2 / Amber 1 are required. However, the final design will be dependent on the subsequent post remediation ground gas monitoring and risk-based assessment.



The ground gas risk assessment and developed conceptual site model must consider any pathways induced as part of the site engineering design, specifically Ground Improvement must be considered within the context of stone columns and their ability to create a preferential pathway for ground gas migration.

Vibro Stone Columns should be designed to ensure no preferential pathway for gas migration to a proposed dwelling, where a potential risk is identified the ground improvement solution should be designed to ensure the risk is fully mitigated.

## PARCEL B & C

The GSVs for the monitoring positions for Parcel B&C are summarised in Table 2.2.

TABLE 2.2 GAS RISK PROFILE AND LOCATION

| LOCATION | MAX CH <sub>4</sub><br>(% v/v)       | GSV<br>(l/hr) | MAX CO <sub>2</sub><br>(% v/v) | GSV<br>(l/hr) | CLASSIFICATION |
|----------|--------------------------------------|---------------|--------------------------------|---------------|----------------|
| WS301    | 0.10                                 | 0.00079       | 2.00                           | 0.0158        | Green/CS1      |
| WS303    | 0.10                                 | 0.00052       | 0.10                           | 0.00052       | Green/CS1      |
| WS304    | 0.10                                 | 0.00052       | 0.20                           | 0.00104       | Green/CS1      |
| WS306    | 0.10                                 | 0.0001        | 7.90                           | 0.0079        | Amber 1/CS2    |
| WS307    | 0.30                                 | 0.00039       | 0.90                           | 0.00117       | Green/CS1      |
| WS308    | 0.10                                 | 0.01134       | 5.10                           | 0.57834       | Amber 1/CS2    |
| WS311    | 2.20                                 | 0.00572       | 4.70                           | 0.01222       | Amber 1/CS2    |
| WS313    | Monitoring Wells Destroyed – No Data |               |                                |               |                |
| WS314    |                                      |               |                                |               |                |
| WS315    |                                      |               |                                |               |                |
| WS317C   |                                      |               |                                |               |                |
| WS318    |                                      |               |                                |               |                |
| WS319    |                                      |               |                                |               |                |
| WS320    |                                      |               |                                |               |                |
| WS322    |                                      |               |                                |               |                |

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Preliminary ground gas monitoring suggests that the site can be predominantly classified as green/CS1, and in these areas it is considered that gas protection measures will not be required. However, it is likely that the areas that have undergone the most upfill (landfill and central sectors) will require Amber 1/CS2 specialist protection measures as detailed below.

It should be noted that a significant number of the monitoring wells have been destroyed therefore it is likely that additional monitoring will be required to confirm the ground gas regime and requirements of any gas mitigation measures for the proposed residential buildings.



## PARCEL D & E

The GSVs for the monitoring positions for Parcel D&E are summarised in Table 2.3.

TABLE 2.3 GAS RISK PROFILE AND LOCATION

| LOCATION | MAX CH <sub>4</sub><br>(% v/v) | GSV<br>(l/hr) | MAX CO <sub>2</sub><br>(% v/v) | GSV<br>(l/hr) | CLASSIFICATION |
|----------|--------------------------------|---------------|--------------------------------|---------------|----------------|
| WS401    | 0.1                            | -0.00126      | 0.4                            | -0.00504      | Green/CS1      |
| WS402    | 0.1                            | 0.00273       | 1.6                            | 0.04368       | Green/CS1      |
| WS403    | 0.1                            | 0.00351       | 3.9                            | 0.13689       | Green/CS1      |
| WS404    | 0.1                            | 0.00318       | 2.4                            | 0.07632       | Green/CS1      |
| WS405    | 0.1                            | 0.00133       | 3.7                            | 0.04921       | Green/CS1      |
| WS406    | 9.5                            | 0.1672        | 2.6                            | 0.04576       | Amber 2/CS3    |
| WS407    | 1.9                            | -0.01938      | 6.2                            | -0.06324      | Amber 1/CS2    |
| WS408    | 1.3                            | -0.01508      | 5.9                            | -0.06844      | Amber 1/CS2    |
| WS409    | 0.1                            | 0.00176       | 6.8                            | 0.11968       | Amber 1/CS2    |
| WS410    | 0.1                            | 0.00112       | 1.8                            | 0.02016       | Green/CS1      |
| WS411    | 0.1                            | 0.0029        | 3.4                            | 0.0986        | Green/CS1      |

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

WS406 has been assessed as being Amber 2/CS3 due to elevated methane (>5 % v/v). WS407, WS408 and WS409 have been assessed as being Amber 1/CS2 due to elevated methane (>1 % v/v) and or elevated carbon dioxide (>5 % v/v).

Preliminary ground gas monitoring suggests that it may be possible to zone the site. Due to the presence of cohesive deposits, the potential for lateral migration of any gases will be limited which means a phased approach could be considered.

Where areas of the site are classified as Green/CS1 it is considered that gas protection measures will not be required. However, localised areas of the site have been assessed as being Amber 1/CS2 and Amber 2/CS3 and properties within these areas will likely require specialist protection measures.

This is a preliminary assessment, and the final ground gas assessment will be issued as an addendum on completion of the monitoring.

It must be noted that drilling and grouting of mine workings may displace gasses and therefore post remediation / stabilisation gas monitoring is required to inform the developed CSM and gas risk model.

## 2.5. POTABLE WATER SUPPLY INFRASTRUCTURE

A contaminant risk assessment completed in accordance with the UKWIR assessment framework identified elevated concentrations of potentially volatile/soluble hydrocarbon compounds and it will be necessary to delineate the impacted soils where present at locations that could potentially impact the potable water infrastructure should be suitable to remediation with robust validation testing.

If unacceptable concentrations remain post-remediation, then potable water infrastructure should be constructed in accordance with a suitably robust risk assessment and design compliant with UKWIR.



### 3. SITE REMEDIATION AND ENABLING WORKS

#### 3.1. CONTAMINANTS OF CONCERN (COC)

##### 3.1.1. METALS, PAH, NON-VOLATILE HYDROCARBON (PETROLEUM RANGE) COMPOUNDS

The human health risk drivers for the carcinogenic PAHs, heavy-end TPHs and metal CoC are:

- ✳ Direct contact with the soil source by future on-site residents; and
- ✳ Ingestion of impacted soils by future on-site residents.

Therefore, a cover system is considered to be an appropriate remediation technique to address these impacts, as the installation of a cover system to unsurfaced areas of the site will sever the pathway of contact for human health receptors. A cover system is not considered to be required in future hardstanding areas or beneath buildings, as it can reasonably be assumed that the presence of a hardstanding will prevent direct contact.

##### 3.1.2. ASBESTOS

Asbestos has been identified in ten locations. Asbestos in form of chrysotile and amosite has been identified in WS203 at 1.50 m bgl located Parcel A, TP305 at 0.50 m and TP351 at 1.00 m bgl located in parcel B & C, TP401 at 0.50 m, TP407 at 0.60 m, TP409 at 0.50 m, TP409 at 2.20 m, WS402 at 1.20 m, WS406 at 3.00 m and WS407 at 1.50 m bgl located within Parcel D & E.

It should be assumed that asbestos fibres are present throughout the Made Ground on site. The risk to chronic human health associated with the elevated concentrations of loose chrysotile and fibres (<0.001%) can be mitigated through the installation of a suitable cover system in all proposed landscaping and hardstanding to remove any potential for direct exposure to impacted soils.

Where asbestos is identified at concentrations above <0.001%, (within four locations WS203, TP305, TP401 and WS402) a hotspot excavation will be required, and the impacted Made Ground will require placement >1.00 m beneath an area of low sensitivity such as public open space in accordance with the E3P conceptual site model (Figure 2.1). Where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk-based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.

All ACM-impacted soils must be managed so as to ensure no airborne fibre release during construction or placement of impacted material in such a manner as to ensure no future exposure risk.

Soils will be placed in areas of no unacceptable future risk in accordance with the E3P validation method.

Potential asbestos lagging was identified within the landfill area in Parcel B, this material, along with any other asbestos-containing material that are identified during the site remediation and enabling work must be dealt with in strict accordance with the Control of Asbestos Regulations (CAR) 2012, UK Waste Management Legislation and the Environmental Protection Act 1994. Due to the close proximity of residential dwellings, asbestos in air monitoring in accordance with HSG248 may be required to confirm that no asbestos fibres have been generated from the enabling works activities.

Should off-site disposal be required, then additional asbestos quantification and waste classification testing should be undertaken to ensure that it is classified correctly and disposed at a suitably licensed facility.



### **3.1.3. DISCUSSION OF VOLATILE CONTAMINANTS**

Volatile TPHs and naphthalene present a potential volatilisation to indoor air risk. Elevated concentrations have been identified within E3P TP204, TP351 and TP409, Coopers TP1, TP11, TP41, WS5 and REFA TP5, TP6, BH1, BH2, BH3, BH4, therefore considered to be localised hotspots.

During a process of cut & fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity or for further treatment / off-site disposal if required.

In addition to the above, in regard to the elevated concentrations of Total Mercury identified within E3P TP342, Coopers TP25, TP27, WS2 and REFA TP8, BH1, BH2, BH3 it is also recommended that speciation is completed in order to determine the type of mercury and if it does indeed present a vapour risk. Further risk assessment should be completed to determine its placement on site, and should it be volatile a hotspot removal should be undertaken to delineate the extent of impact and soils should be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.

Where a potentially unacceptable degree of risk is identified, the impacted soils should either be remediated or alternatively the proposed dwellings should be designed with appropriate mitigation measures to remove the potential pollution linkage.

## **3.2. IDENTIFICATION OF FEASIBLE REMEDIATION OPTIONS**

### **3.2.1. OBJECTIVES**

The remediation works must be completed in a safe and sustainable manner that ensures that the post remediation condition of the site poses no unacceptable risk to controlled waters or the wider environs. The developed Conceptual Site Model must ensure no complete pollutant linkage to ensure successful implementation.

The remediation works must be completed in a manner that promotes sustainable re-use of material in a manner that minimises waste and maximises retention of material on-site.

The works should be designed and implemented in a manner that ensure no risk to an identified receptor during the works in terms of odour, air quality or noise impact.

Works should be designed, planned and implemented in a manner that ensures full compliance with all pertinent waste management and environmental permit legislation.

### **3.2.2. AVAILABLE TECHNOLOGIES**

Remedial technologies other than hotspot removal will be not required due to the discrete locations and levels of exceedances detected across the site. If widespread contamination is identified during enabling works, available techniques to break the source-pathway-receptor linkage, and therefore reducing the risk to human health are summarised in Table 3.1



TABLE 3.1 SOIL REMEDIATION TECHNOLOGIES

| REMEDIAL TECHNOLOGY             | CLASSIFICATION                              | APPLICATION       | MEDIUM             | LINKAGE ELEMENT AFFECTED                          |
|---------------------------------|---------------------------------------------|-------------------|--------------------|---------------------------------------------------|
| Capping                         | Containment                                 | In situ           | Soil               | Pathway interruption                              |
| Electro-remediation             | Physical                                    | In situ / ex situ | Soil               | Removes source                                    |
| Soil washing                    | Physical                                    | Ex situ           | Soil               | Source management                                 |
| Soil vapour extraction          | Physical                                    | In situ           | Soil               | Removes source                                    |
| Ex-situ bioremediation          | Biological                                  | Ex situ           | Soil               | Removes source                                    |
| Thermal desorption              | Thermal                                     | Ex situ           | Soil               | Removes source                                    |
| Vitrification                   | Thermal                                     | In situ           | Soil               | Removes source / breaks pathway                   |
| Stabilisation / Solidification  | Chemical                                    | In situ / ex Situ | Soil               | Pathway Interruption                              |
| Excavation and offsite disposal | Civil Engineering                           | Ex situ           | Soil / groundwater | Removes source                                    |
| Enhanced Bioremediation         | Chemical / Biological / Natural attenuation | In situ           | Soil / groundwater | Removes source / breaks pathway                   |
| Monitored Natural Attenuation   | Natural attenuation                         | In situ           | Soil / groundwater | Pathway interruption / eventual removal of source |
| Vacuum Enhanced Recovery        | Physical / Chemical                         | In situ           | Soil / groundwater | Removes source / breaks pathway                   |
| Air sparging / Biosparging      | Physical / Biological                       | In situ           | Soil / groundwater | Removes source / Pathway interruption             |
| In situ oxidation               | Chemical                                    | In situ           | Soil / groundwater | Removes source / Pathway interruption             |

### 3.2.3. SELECTION OF TECHNOLOGY OPTIONS

Several remedial technologies have been considered in addressing the contaminant linkages of concern identified at the site, as summarised in Table 3.2.

In order to assess which of these technologies are most viable for this particular project, each technology has been reviewed on the basis of applicability, permissibility, cost, timescale and acceptability (including sustainability).



A combination of remediation solutions and technologies will be required to address and treat the numerous contamination issues identified on this site.

Aspects of sustainable remediation are also included within the review element of applicability.

Sustainable remediation is, 'the practise of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process', (as defined within 'A Framework for Assessing the Sustainability of Soils and Groundwater Remediation', produced by Sustainable Remediation Forum UK, dated March 2010).



TABLE 3.2 ASSESSMENT OF REMEDIATION TECHNOLOGIES APPLICABILITY

| REMEDIAL TECHNOLOGY             | APPLICABILITY | REGULATORY APPROVAL / PERMITRY | COST | TIME-FRAME | SCORE | SUITABILITY COMMENT                                                                                                                                                       |
|---------------------------------|---------------|--------------------------------|------|------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Capping                         | 5             | 5                              | 5    | 5          | 20    | Essential remediation solution to remove direct exposure pathways.                                                                                                        |
| Electro-remediation             | 1             | 1                              | 1    | 1          | 4     | Technique unlikely to treat identified contaminants of concern in an efficient manner.                                                                                    |
| Soil washing                    | 1             | 1                              | 1    | 1          | 4     | Technique unlikely to treat identified contaminants of concern in an efficient manner.                                                                                    |
| Soil vapour extraction          | 1             | 1                              | 1    | 1          | 4     | Landfill to be remediated by excavation for geotechnical purposes meaning such a solution is limited in terms of viability.                                               |
| Ex-situ bioremediation          | 4             | 4                              | 3    | 3          | 14    | Considered viable to treat soils to ensure residual concentrations pose reduced risk in terms of vapour inhalation and migration in dissolved phase to controlled waters. |
| Thermal desorption              | 1             | 2                              | 2    | 2          | 7     | Limited application due to nature and depth of material and ability to achieve required results.                                                                          |
| Vitrification                   | 1             | 1                              | 1    | 1          | 4     | Technique unlikely to treat identified contaminants of concern in an efficient manner.                                                                                    |
| Stabilisation / Solidification  | 4             | 4                              | 4    | 4          | 16    | The additional of stabilisation and binding agents will limit volatilisation and impede migration.<br>Considered viable.                                                  |
| Excavation and offsite disposal | 5             | 5                              | 1    | 5          | 16    | Limited by cost being prohibitive. Small quantities of material that cannot be treated will be removed.<br>Likely to form one aspect of the remediation approach.         |
| Enhanced Bioremediation         | 4             | 4                              | 1    | 3          | 12    | Considered viable to treat soils to ensure residual concentrations pose reduced risk in terms of                                                                          |



| REMEDIAL TECHNOLOGY           | APPLICABILITY | REGULATORY APPROVAL / PERMITRY | COST | TIME-FRAME | SCORE | SUITABILITY COMMENT                                                                                                                               |
|-------------------------------|---------------|--------------------------------|------|------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |               |                                |      |            |       | vapour inhalation and migration in dissolved phase to controlled waters.                                                                          |
| Monitored Natural Attenuation | 4             | 3                              | 5    | 1          | 13    | Likely to form one aspect of the remediation solution. Long term monitoring to demonstrate residual impact poses no significant and ongoing risk. |
| Vacuum Enhanced Recovery      | 1             | 1                              | 1    | 1          | 4     | Technique unlikely to treat identified contaminants of concern in an efficient manner.                                                            |
| Air sparging / Biosparging    | 1             | 1                              | 1    | 1          | 4     | Technique unlikely to treat identified contaminants of concern in an efficient manner.                                                            |



### 3.3. SUMMARY OF PREFERRED REMEDIATION OPTIONS

Based on the options appraisal, it is considered that the following combination of remediation technologies provides the most sustainable, viable and economic solutions that will ultimately result in the successful remediation for the site:

- ✚ Construction of low permeability **capping system** to limit infiltration of precipitation to reduce mobility of soluble phase impact and ensure no direct exposure pathway to future receptors.
- ✚ Construction of dwellings with **specialist membranes** and mitigation measures to ensure no ingress of volatile phase hazardous compounds into a dwelling;
- ✚ **Ex-situ bioremediation** of materials excavated from the landfill and treatment plant for sorting and separation on-site in accordance with a Mobile Treatment License (MTL) by a specialist contractor;
- ✚ **Solidification and stabilisation** to bind compounds within the soil matrix to reduce volatilisation and migration into the dissolved phase. Works to be completed by a specialist contractor in accordance with a MTL / EP;
- ✚ **Offsite removal** of hazardous materials which cannot be treated will be required, this operation needs to be limited to materials that cannot be treated on-site to promote sustainability and ensure viable regeneration;

### 3.4. OVERVIEW OF WORKS

Prior to the commencement of works on site, the contractor must establish all necessary plant, equipment and site welfare facilities as is necessary to complete the contract within the agreed timescales to the rationale as outlined in the following subsections.

For the avoidance of any doubt, the proposed operations as set out herein document the required performance objectives and validation sampling protocols; however, the specific methods of work deployed to ensure the remediation objectives are achieved in a compliant manner on site will be the responsibility of the appointed contractor.

#### RE-1 – Pre-commencement Supplementary Site Investigation

Inaccessible areas during site investigations will require further investigation. This includes densely vegetated areas within Parcel A, B and C along with areas to the north and west of sectors D and E where the site was still active during the time of site investigations.

The remediation strategy will then require updating based on the findings of these further works.

A plan showing inaccessible areas is presented within Figure 3.1.

Mechanically excavated trial pits will be advanced in targeted locations with additional chemical analysis of the soils completed to confirm no unacceptable risk to human health and controlled waters.

Further delineation works should be undertaken around WS303 (Parcel C) and WS401 (Parcel D), given the elevated concentrations of cyanide (51ug/l) and zinc (250 ug/l) within the groundwater to identify any potential soil sources.



Following the completion of the supplementary site investigation works, an updated copy of the remediation strategy will be supplied to the EA and LA for review.

Prior to the commencement of any site development activities, it will be the responsibility of the developer (or their nominated contractor) to ensure that all reports associated with applicable contaminated land and remediation planning conditions have been submitted to the regulatory authorities for their written approval.

All excavated materials<sup>1</sup> generated during the site enabling works and development activities which are either re-used at other locations within the development boundary or are subject to treatment prior to replacement at the same point are considered a waste. Where any excavated material is defined within the scope of the CL:AIRE Definition of Waste Code of Practice (DoWCoP), meets a suitable for use criteria and will be re-used at the site of origin, this material may achieve 'end of waste' status through full conformance with the DoWCoP. This includes the generation of a Materials Management Plan and a subsequent peer review and declaration submission from a CL:AIRE approved 'Qualified Person'. This also includes any clean, naturally occurring soils (sub/topsoil) from a suitable off site donor location for re-use on the development.



With specific reference to this development, materials excavated within the licenced landfill area do not meet the scope of the DoWCoP and will remain as a legal waste until 'end of waste' status is achieved through other means. For those landfill materials considered inert in nature such as concrete, bricks, ceramics, glass, stone etc. these can be separated from the excavated material and then further processed in line with the Waste & Resources Action Programme (WRAP) Quality Protocol for the Production of Recycled Aggregates from Inert Waste to achieve 'end of waste' status. Any excavated materials considered as 'non-conforming' and unsuitable for re-use in the development will be separated, placed into suitable holding containers in readiness for offsite recovery or disposal in line with the waste 'Duty of Care' requirements. Any fine matrix material generated as part of the screening process to segregate the various fractions of excavated landfill waste do not currently have a defined end of waste criteria to allow their subsequent re-use on site. In the absence of any criteria, the developer or nominated contractor will therefore be required to make an approach to the Environment Agency to seek a case specific agreement and end of waste criteria to meet the Waste Framework Directive 'end of waste' test. This should take the form of detailed risk-based approach, defined waste treatment activities<sup>2</sup> and post treatment validation/criteria testing to confirm this material is suitable for use and would exhibit similar geotechnical and geoenvironmental properties to that off naturally occurring materials (i.e. does not generate gasses, leach metals, pH imbalance etc.) ensuring no environmental or human health impact.

<sup>1</sup> Excluding clean, naturally occurring topsoil that will be re-used at the same development for the same purpose.

<sup>2</sup> Treatment must be undertaken in line with the Environment Agency Environmental Permit 'SR2008 No 27: Mobile Plant for the Treatment of Soils and Contaminated Material, Substances or Products'. Prior to works commencing, the permit holder (appointed contractor) will notify the EA of the plan to use the permit through the issue of the MPP2 Permit Deployment Form.

### **RE-3 – Decommission Historical Abstraction Wells**

If any former groundwater abstraction wells are located during the remediation and enabling works, these should be decommissioned in accordance with the EA guidance note 'Good Practice for Decommissioning Redundant Boreholes and Wells'.

### **RE-4 – Temporary De-watering from Excavations to Combined Sewer**

It is likely that temporary dewatering will be required on the site from excavations. The management of the temporary discharge of surface water will be managed within a separate River Corridor Strategy.

The Urban Regen Dewatering Plan is included in Appendix VIII.

### **RE-5 – Assessment of On-site Bunds**

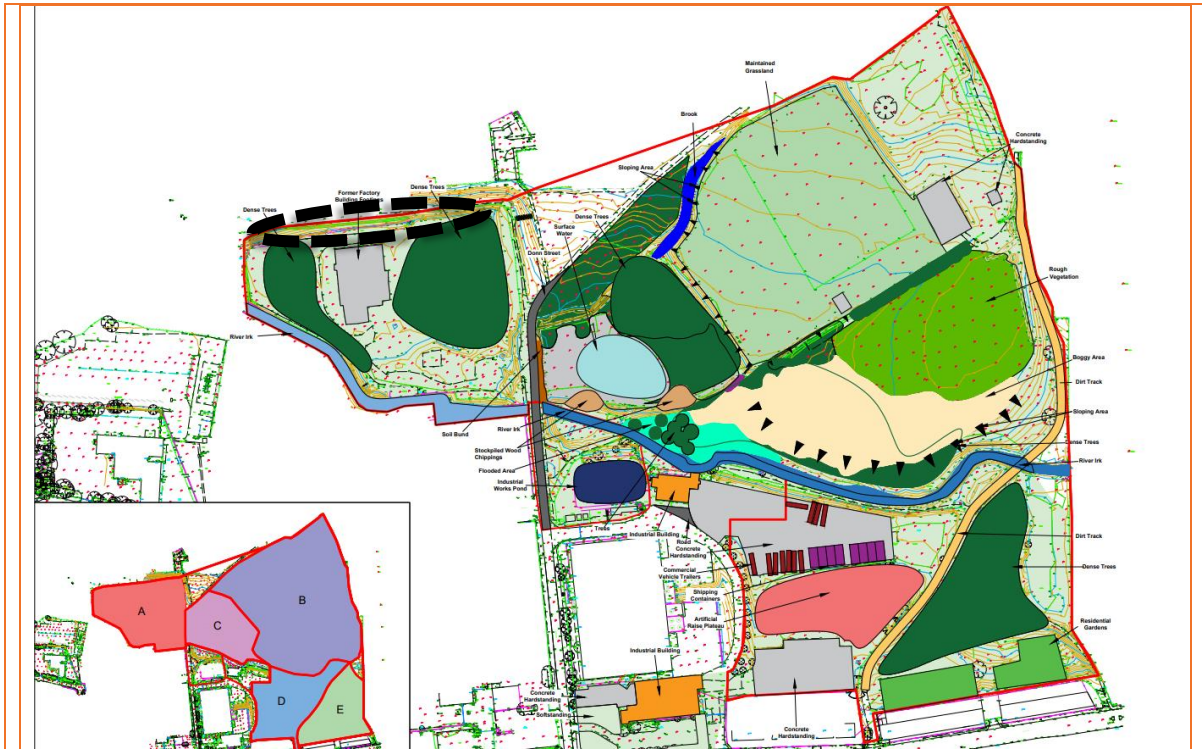
There are multiple bunds across the site. The material within these is unknown at this time and therefore needs to be investigated and assessed as part of the remediation works.

Mechanically excavated trial pits will be completed to obtain samples from the bunds at a frequency of 1 sample per 1000 m<sup>3</sup>.

If any contaminant exceedances are identified, these will be delineated and assessed prior to placement in an area of low sensitivity or removal from the site.

**FIGURE 3.2 – APPROXIMATE AREAS OF IDENTIFIED BUNDS**





### RE-6 – Environment and Nuisance Control

Management of all works is required so as to ensure that no environmental nuisance is created through dust emissions, noise or vibration levels.

All works are to be completed in a manner as not to create any structural risk to the adjacent highways.

Temporary works are to be implemented as necessary to support excavations throughout the duration of the works.

In the event that a complaint is made in respect of dust emissions, noise or vibration levels, remedial measures and a programme of ongoing monitoring should be agreed upon with the local authority and implemented on-site.

### RE-7 – Risk to Infrastructure and River Irk

Site works should be completed in a manner that ensures no risk of disturbance to the adjacent infrastructure or the River Irk.

It is recommended that biweekly sampling is undertaken upstream and downstream of the site during the remediation and enabling works, suggested sampling points are provided in Figure 3.3. Samples will also be collected from the on-site pond.

The water samples will be analysed for the following contaminants:



- ✳ Heavy Metals
- ✳ Total Solids
- ✳ Ph
- ✳ Sulphate
- ✳ Speciated Polyaromatic Hydrocarbons
- ✳ Total Petroleum Hydrocarbons
- ✳ Cyanide
- ✳ Suspended Solids

A surface water management plan for the site is recommended. This should be provided to the EA when available.

**FIGURE 3.3 SUGGESTED RIVER SAMPLE LOCATIONS – (RED CIRCLES)**



### **RE-8 – Identification, Isolation and Treatment of Invasive Plants**

Invasive plant species have historically been identified along the River Irk. The remediation contractor must satisfy themselves with respect to the extent of all species deemed invasive prior to the commencement of works on site. The contractor shall employ a suitably qualified expert to investigate the presence of invasive plant species on or adjacent to the site. Once all invasive plant species are identified, these will be treated in strict accordance with an approved method statement to be submitted to the supervising consultant for review prior to the instigation of any works.



Where invasive plant species are identified at the site boundary, a suitable barrier shall be installed to prevent any future reinfestation of the subject site.

Upon completion of the eradication of all invasive species, a validation report should be prepared documenting all identified invasive plant species, their location and the treatment methodology. Where materials are removed from site, all waste transfer notes/duty of care certificates should be included within the validation statement.

### **RE-9 – Site Clearance Operations**

Post-demolition general site clearance and provision of welfare, offices and site security are to be determined as per the contract requirements.

Large areas of Parcel A and areas of Parcel B & C are currently overgrown with vegetation. This should be removed in a controlled manner with full compliance with any ecological mitigation measures that are required for the works. Any such measures are outside the scope of this report.

All vegetation should either be stockpiled at a pre-agreed location or alternatively removed from site in accordance with waste permitting regulations.

All root networks are to be removed in accordance with the requirements of the NHBC/LABC.

### **RE-10 – River Corridor Watching Brief**

During the remediation works a watching brief must be in place along the river corridor between the area of the former landfill and the River Irk.

If visual or olfactory evidence of contamination is identified this will require assessment, delineation and validation by the consulting engineer. If contamination is proven to underlie the current trees along the river corridor, then the EA will need to be notified.

The area to undergo the watching brief is shown within Figure 3.4



FIGURE 3.4 WATCHING BRIEF AREA (BLACK HATCHING)



## RE-11 – Delineation of WS17

Elevated concentrations of TPH have been recorded in Coopers boreholes WS17, which is located just outside the boundary of area D.

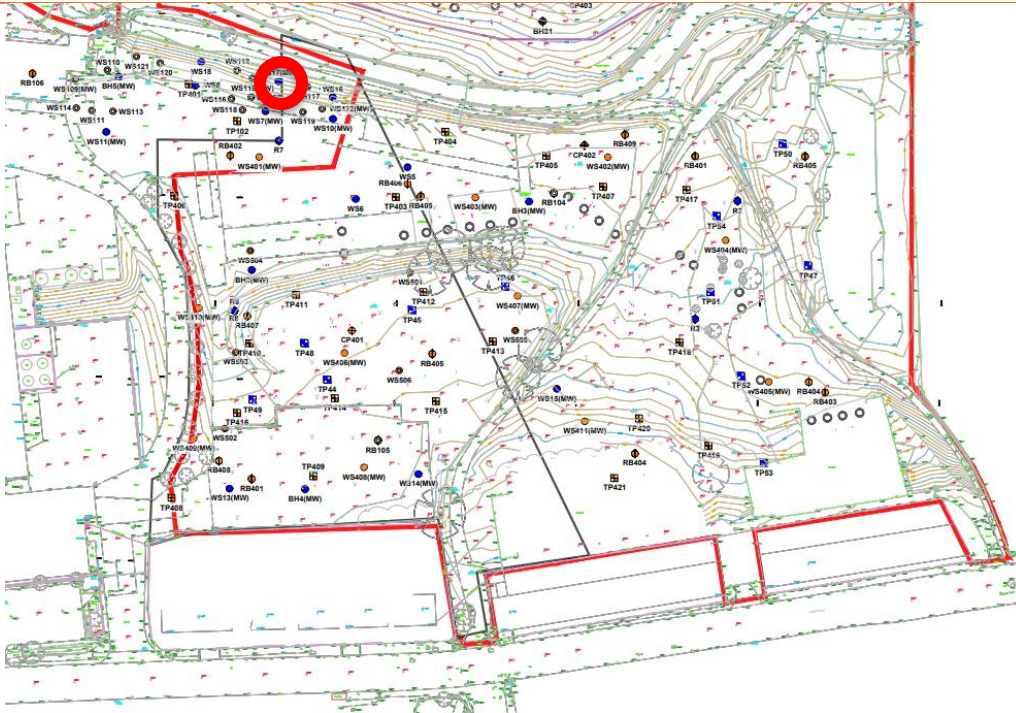
As part of the remediation works the area on the boundary of the site in close proximity to WS17 will require further investigation and any contamination delineating and assessing.

If elevated concentrations are identified, these soils will require treatment or removal from site.

The location of WS17 is circled red on Figure 3.5.



**FIGURE 3.5 WS17 CIRCLED RED**



## RE-12 – Recovery of Topsoil within Parcel B

Topsoil from the northern third of parcel B (football pitch area) may be suitable for re-use in garden cover system. Further chemical analysis will be required to confirm this.

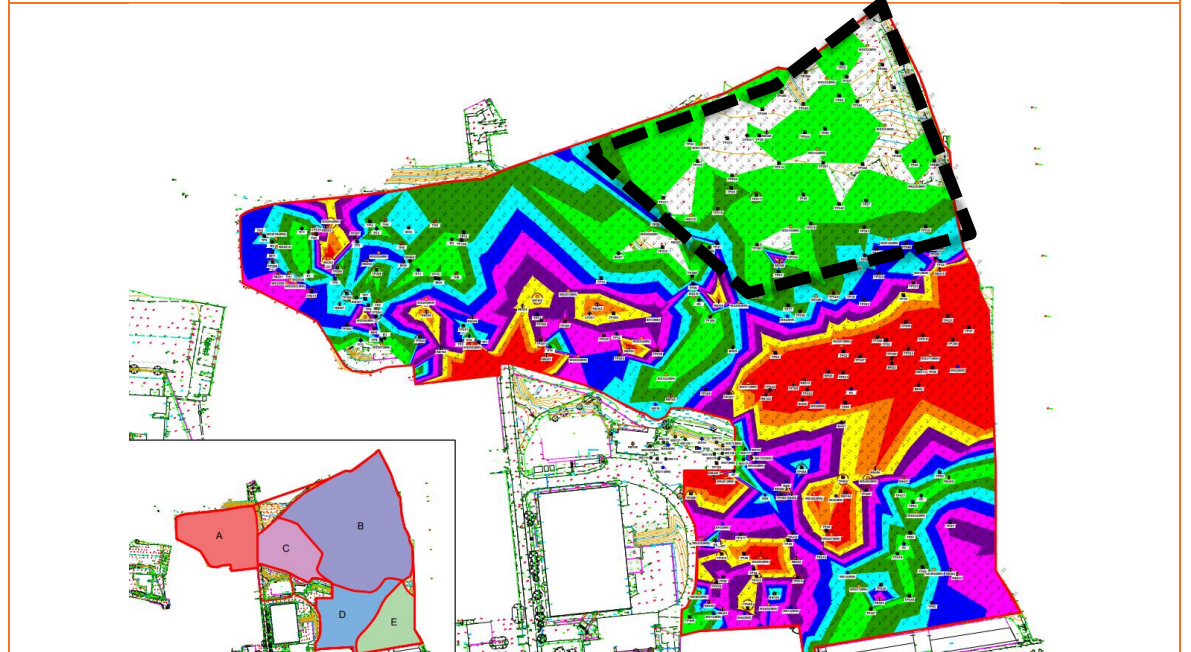
The contractor should seek to maximise the recovery of this material to promote sustainable construction through careful segregation and subsequent stockpiling of the natural soils.

All recovered topsoil should be covered with a suitable geotextile to limit cross-contamination from anthropogenic elements during remediation, enabling and construction. This will significantly contribute to maximising the recovery and reuse of material.

All material will be subject to validation testing by the supervising consultant in accordance with the testing specification set out herein.



FIGURE 3.6 AREA OF POTENTIAL RE-USABLE TOPSOIL (AREA INSIDE BLACK DASHED LINE) ON THE DEPTH OF MADE GROUND PLAN



### RE-13 – Delineation, Excavation and Treatment of Identified Asbestos Impact

Detectable asbestos fibres have been identified in discreet locations; however, due to the nature and age of the filled material, it must be assumed that trace fibres are present throughout the Made Ground. The E3P Developed Conceptual Site Model demonstrates a suitable method for management of soils to negate any future risk.

However, it must be noted, where asbestos concentrations exceed the initial assessment criteria indicated in the developed E3P site CSM, further risk-based assessment will be completed within the context of the critical receptor to determine the actual risk to both chronic human health and immediate workplace exposure.

The contractor must ensure that all personnel working on site are trained in the identification of ACM and the risks associated with impacted soils.

Potential asbestos lagging was identified within the landfill area in Parcel B, this material, along with any other asbestos-containing material that is identified during the site remediation and enabling work must be dealt with in strict accordance with the Control of Asbestos Regulations (CAR) 2012, UK Waste Management Legislation and the Environmental Protection Act 1994. Due to the close proximity of residential dwellings, asbestos in air monitoring in accordance with HSG248 may be required to confirm that no asbestos fibres have been generated from the enabling works activities

Validation sampling of the processed Made Ground should be completed to demonstrate compliance with the developed conceptual site model.

This process should be completed under strict controls to be devised and employed by the nominated contractor to ensure no potential for fibre release into ambient air.

If necessary, reassurance air testing in accordance with the requirements of HSG248 should be completed during the operation to move the soils to demonstrate the deployment of the required control procedures and safe working methods.



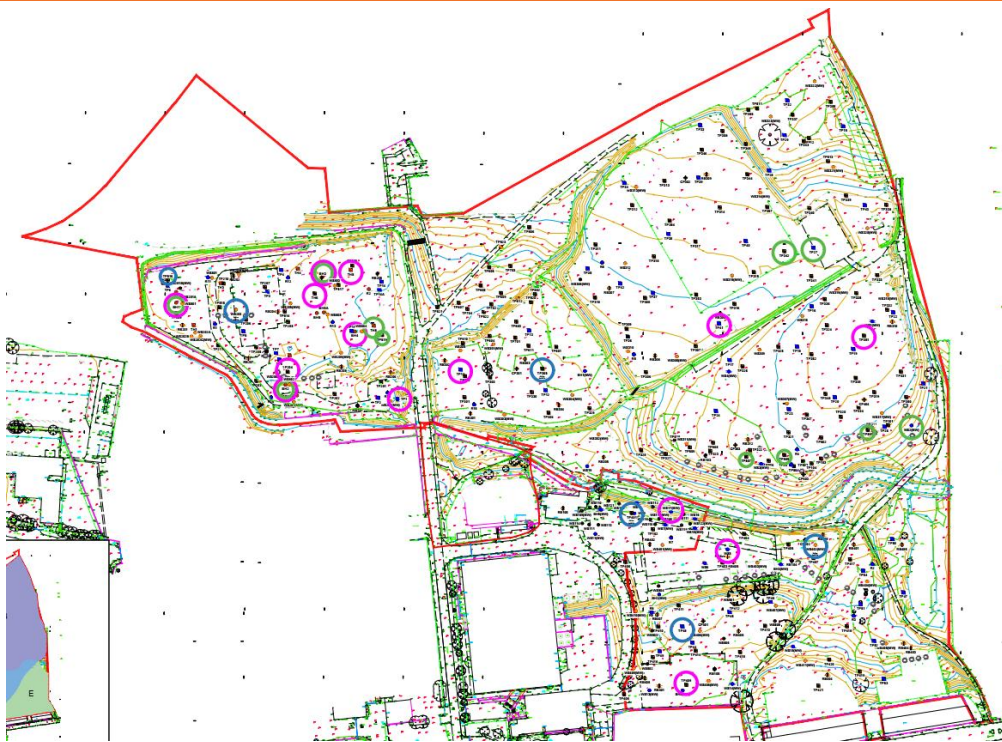
The location of known asbestos impacted soil are shown in Figure 3.5.

Locations requiring hotspot delineation due to quantification being above <0.001% are:

- ✳ WS203 at 1.50 m bgl (0.002%) - Parcel A
- ✳ TP305 at 0.50 m bgl (0.002%) - Parcel B & C
- ✳ WS402 1.20 m bgl (0.001%) - Parcel D & E
- ✳ TP516 0.80 m bgl (0.001 %) – Parcel A

Further investigation and quantification are required where asbestos was identified at Coopers TP48 in Parcel D & E.

FIGURE 3.7 LOCATION OF IDENTIFIED ASBESTOS IMPACT (BLUE)



#### **RE-14 – Delineation, Excavation, Treatment and Disposal of Potential Volatile Contaminants**

E3P has identified elevated levels of naphthalene, and low-end TPH above human health targets for residential end retention within plots and/or within gardens and landscaped areas. Such contaminants present a potential volatilisation to indoor air risk. These elevated concentrations have only been identified within isolated areas of the site and are therefore potentially localised hotspots as outlined below:

Elevated naphthalene has been identified within:



- ✳ TP204 at 0.80 m bgl (5 mg/kg) - Parcel A
- ✳ Coopers TP1 at 0.50 m bgl (4.8 mg/kg) - Parcel A
- ✳ TP351 at 1.00 m bgl (17 mg/kg) - Parcel B & C
- ✳ TP409 at 2.20 m bgl (14 mg/kg) - Parcel D & E
- ✳ Coopers TP11 at 0.15 m bgl (3.2 mg/kg) – Parcel B & C
- ✳ Coopers TP41 at 0.20 m bgl (8.9 mg/kg) – Parcel B & C
- ✳ Coopers WS5 at 1.30 -1.90 m bgl (2.8 mg/kg) – Parcel D & E
- ✳ REFA TP5 at 0.50 m bgl (3.1 mg/kg) – Parcel A
- ✳ REFA TP6 at 0.30 m bgl (5.0 mg/kg) – Parcel A
- ✳ REFA BH1 at 0.50-1.00 m bgl (10 mg/kg) – Parcel A
- ✳ REFA BH2 at 0.50-1.00 m bgl (3.1 – 8.5 mg/kg) – Parcel A
- ✳ REFA BH3 at 0.50-1.00 m bgl (4.1 – 6.1 mg/kg) – Parcel A
- ✳ REFA BH4 at 0.50-1.00 m bgl (3.4 – 4.9 mg/kg) – Parcel A

Elevated volatile TPHs have been identified within:

- ✳ TP204 at 0.80 m bgl (9100 mg/kg) - Parcel A

Therefore, during a process of cut fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on-site in an area of no future sensitivity. Alternatively, vapour proof membranes can be installed in affected plots as long as the contaminants do not pose risks to controlled waters.

Heavy end hydrocarbon impact was identified in Coopers TP49 (TPH Ali C21-C35 3000 mg/kg). This does not pose a vapour risk, however a watching brief should be completed to ensure the absence of a specific contaminant source.

Hydrocarbon compounds had been noted extensively within the Rex Mill area of the site (Parcel A) by REFA, however these were not noted during the works undertaken by Coopers. A watching brief should be completed in the locations of REFA BH1, BH2, BH3, BH4, TP5 and TP6 where elevated concentrations of naphthalene were previously identified.

A significant hydrocarbon odour and sheen was also encountered at TP204 (in the area of the former tanks in the south of the Parcel A) between 0.30 m and 1.10 m bgl. Material deemed to be impacted through either visual or olfactory observations or as a result of notable PID readings (> 50 ppm) will be excavated and stockpiled on an impermeable membrane. The membrane will be placed upon a clay containment bund and covered to negate the risk of soil leaching and dispersal of any odours and/or vapours.

A watching brief should also be undertaken in the location of Coopers TP44 (Parcel D & E) where a strong diesel odour was recorded to delineate and excavate any impact recorded.

Supplementary works completed in 2022 in the north of Parcel C recorded hydrocarbon odours in



TP522, TP523, TP609 and TP611 along with a slight sheen on the water. A watching brief will be required to confirm the absence of any significant impact in these locations.

An E3P engineer will regularly monitor the stockpiled material with a PID to determine the need for boundary monitoring (albeit not anticipated). This material will then be subject to detailed laboratory analysis to determine the suitability for reuse or the requirements for off-site disposal.

Upon completion of the delineation and excavation, the sides and base of the resulting void(s) where impacted material is present will be chemically validated to confirm that no impacted materials remain in situ.

Validation samples will be collected at 2 linear metre centres from the side and base of the excavation. A minimum of two samples will be taken from any base or sidewall of the excavation.

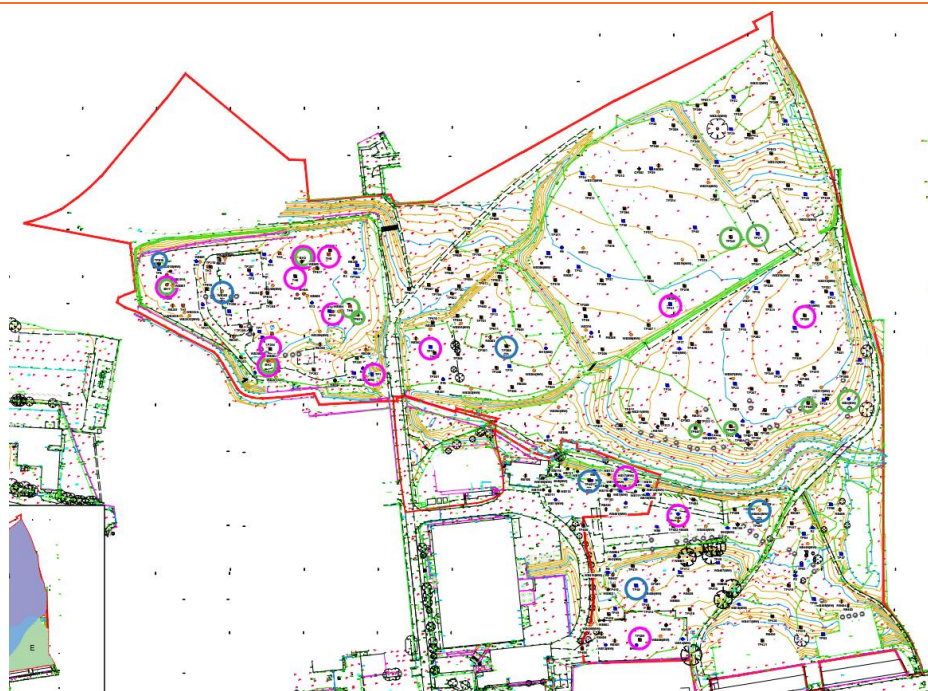
Furthermore, when considering the prior land use, as yet unidentified potentially volatile/soluble phase compounds cannot be discounted. The proposed remediation works will include the full depth turnover of all Made Ground under the supervision of an independent geoenvironmental consultant from E3P.

In the likely event that any as yet unidentified contaminant is identified, this will be the subject of further investigation including laboratory analysis and subsequent assessment of risk within the context of the agreed parameters. Where a theoretical risk to either human health, controlled waters or the wider environs is identified, appropriate remediation works are to be instigated.

Photographs of each area subject to excavation/delineation should be provided in the remediation validation report.

The locations of known volatile impacted soil are shown in Figure 3.8.

FIGURE 3.8 LOCATION OF IDENTIFIED VOLATILE CONTAMINATION (PINK)



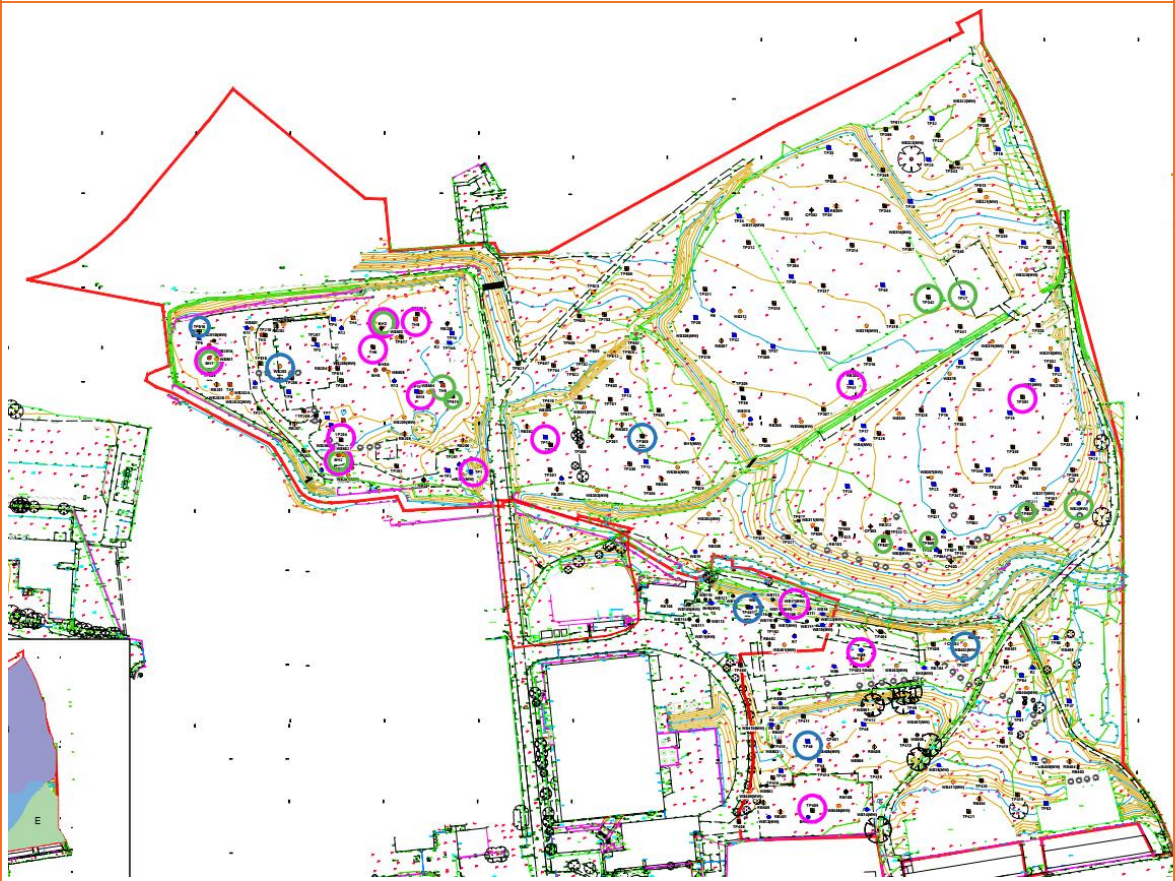
### RE-15 – Speciation of Mercury

Elevated total mercury has been identified within the Made Ground deposits in TP342 (Parcel B & C) and TP501, TP505, TP507 (Parcel B & C), TP519 (Parcel A). This will require speciation to assess if elemental mercury is above the GAC of 1.2 mg/kg.

In addition to the above, elevated concentrations of total mercury were identified within Coopers TP25, TP27, WS2 and REFA TP8, BH1, BH2, BH3.

Elemental mercury is a vapour risk; if present, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on-site in an area of no future sensitivity.

FIGURE 3.9 LOCATION OF ELEVATED TOTAL MERCURY (GREEN)



### RE-16 – Excavation, Breaking and Processing of All Above- and Below-Ground Structures

Obstructions, relict foundations and infrastructure (apart from live services) are to be removed from the areas of proposed residential development, to include plot footprints, rear gardens, private driveways, adopted highway and utilities infrastructure (road box) in their entirety.

Artificially hard materials should be broken out and crushed. Stockpiles will be made, validation testing undertaken, and site-won material reused on-site where required. Materials will be processed as per the specifications provided in Section 5 using licensed plant.



The E3P drawings denote the extent of known historic features with obstructions; however, it will be the contractor's responsibility to remove all obstructions.

Obstructions encountered within the near-surface soils will be chased to their full depth and removed; if not possible, the obstruction must be surveyed with the location communicated to E3P, the client and the developer.

Where natural soils are present at a relatively shallow depth, extreme care should be taken to ensure that the natural cohesive deposits remain undisturbed with a full reduced-level survey to be completed to map the depth of filled/processed material.

### RE-17– Investigation of Potentially Impacted Soils

Hydrocarbon odours have been identified across the site, in particular in the following locations:

- 📍 Coopers - TP44, WS17, WS18
- 📍 E3P – WS202B, WS203, TP204, TP348, TP409, TP411, TP501, TP503, TP504, TP506, TP510, TP516, TP522, TP523, TP604, TP609, TP611, TP704, CP401

These areas require further investigation to see if there is a risk posed to site end users or controlled waters assessment. If visual/olfactory evidence of contamination is identified, this will be the subject of further investigation including laboratory analysis and subsequent assessment of risk within the context of the agreed parameters. Where a theoretical risk to either human health, controlled waters or the wider environs is identified, appropriate remediation works are to be instigated.

FIGURE 3.10 LOCATION OF IDENTIFIED VISUAL/OLFACTORY IMPACT (RED)



Prior to the commencement of the main earthworks (where possible), all known former infilled ponds, streams and rivers should be clearly identified and demarked and investigated to assess the nature of materials and extent of any deleterious elements. A targeted investigation will be completed using mechanically excavated trial pits.

All materials that are deemed to be organic – and thus exhibiting unsatisfactory geotechnical properties – must be removed, with the resulting excavation to be backfilled with materials deemed compliant with the E3P Geotechnical Performance Specification with appropriate compaction for the intended land use.

If the infilled features are identified, samples will be collected to assess the soils against the remediation target values for human health and controlled waters present in Appendix IV. If any previously unidentified contamination is encountered, this will be dealt with in line with RE-14.



### **RE-19– Delineation, Excavation and Treatment of Former Historic Landfill Materials**

A historic landfill is recorded on-site within Parcel B & C. Once general site clearance operations have been complete, the contractor will delineate the material defined as waste associated with the historic landfill in the east of the site.

As part of the remediation works, the landfill area will be processed in order to ensure the remaining soils don't pose a risk to human health or controlled waters. Human health screening levels have been developed for the site however, the risk to controlled waters needed to be considered. Following discussion with the EA it was decided that Level 3 Site Specific Remediation Targets needed to be generated for the landfill material. The Assessment for how these were generated is presented within letter report 14-554-L5 dated 22<sup>nd</sup> November 2022.

Once excavated, the waste will be sorted to remove any hazardous elements and materials that can be recycled in a regulatory compliant manner. The material will then be subject to further testing to assess its suitability to remain on site. The screening levels for the soils are presented within Appendix IV.

The primary objective will be to remove compressible material that can be subject to future degradation and thus consolidation inducing subsidence beneath the proposed estate road and utility infrastructure.

Management of the waste materials delineated from the historic landfill will be carried out as discussed in Section 4.

### **RE-20 – Removal of Deleterious Material**

The E3P Ground Investigation identified plastic sheeting and other potentially deleterious wastes across all parcels albeit minimal across the majority of the site.

All potentially deleterious materials will be delineated, stockpiled and removed from the site by the contractor to a licensed waste facility. Prior to the commencement of the main works, the contractor, under the supervision of E3P, will undertake to complete further confirmatory ground investigations to satisfy themselves with regards to the extent of any buried anthropogenic deleterious materials that are unsuitable for retention within a low-rise residential development.

Further works to be completed to assess the extent of any anthropogenic materials will be reported to the EA.

### **RE-21 – Cut-And-Filling of MADE GROUND to Development Levels**

The overarching aim of the remediation and enabling earthworks will be the construction of a development platform that will ensure suitability for vibro stone columns (VSC).

Depending on ground conditions, it is likely that VSC can be used in all areas where the Made Ground depth does not exceed 8 m. The columns will support a double reinforced foundation, where the columns extend beyond 6 m a reinforced ring beam will be required.

The Made Ground is noted to be present to substantial depth in some areas of the site (> 2 m). It is considered that it will be possible to utilise vibro stone columns (VSC) within areas of segregated and placed granular Made Ground to treat the currently unknown potential for differential settlement and ensure a uniform safe allowable bearing pressure (ABP) in the order of 125 kN/m<sup>2</sup>.



The minimum depth of turnover is 3.00 m from the underside of the foundation in areas of cut and 3.00 m from the existing level in areas of fill (stockpiles are exempt from this through as they will be fully treated to process material) if natural ground conditions are identified the turnover can cease with formation assessed by the engineer.

Furthermore, the potential high wall from the former opencast need to be considered with regard to the interaction of the foundation and angle of the high wall with respect to differential settlement upon completion of final development levels in accordance with BRE.

Where shallow natural ground conditions are encountered, a traditional build may be suitable however, this is subject to proposed levels.

Where the proposed enabling works levels require the current landform to be cut, extreme care should be taken so as not to disturb the underlying stratum prior to the placement of the appropriate platform, in compliance with the E3P Geotechnical Specification.

Where the development levels require material to be filled, site derived Made Ground must be sorted in a controlled manner prior to replacement, in accordance with the requirements of this specification for the intended land use.

The maximum dry density must be determined in laboratory conditions utilising UKAS-accredited testing prior to the commencement of filling and compaction works. In-situ density testing is required to demonstrate compliance with the E3P Geotechnical Performance Specification.

#### **RE-22 – Placement and Compaction of Upfill Material to Facilitate Ground Improvement by VSC**

Where plots are to be prepared in a manner that will facilitate ground improvement by VSCC, materials must be either compliant with the specified grading requirements for a nominally placed and tracked granular aggregate, or alternatively, they should be engineered to a defined geotechnical standard.

Materials compliant with VSC grading for granular backfill: granular matrix are to be graded with all particles < 125 mm with no more than 10% fines (0.63 micron).

Non-compliant material requiring engineering to geotechnical design: material is to be placed and engineered in accordance with the correct method for the Series 600 classification (1, 2 or 6) with moisture contents to be controlled within acceptable design limits. In-situ density to be confirmed to be > 95% of the laboratory determined maximum (2.5 kg) with < 5% air void ratio.

#### **RE-23 – Construction of Temporary Working Platform**

Where plots are to be prepared in a manner that will facilitate ground improvement by VSC, a temporary working platform will be constructed.

The specific design for such a platform should be obtained from E3P; however, as a minimum, this will comprise:



- ✳ Proof rolling of the subgrade to ensure a California bearing ratio (CBR) > 3%; and
- ✳ Placement of 300 mm of certified 6F2 to be rolled and compacted to ensure a CBR > 6%.

### RE-24 – Replacement of Materials, Geotechnical Engineering Requirements

Material is to be backfilled in strict compliance with the E3P Geotechnical Engineering Specification as presented in detail within Section 5 of this report, which generally requires the reinstatement and compaction criteria presented in Table 3.3.

Unless specific instruction is issued from the client, plots should be prepared for a strip foundation where the target founding stratum is identified to be present at a depth of 1.5 m below finished floor level (FFL). Consideration is to be given to the need to construct a strip foundation ~200–400 mm into the natural stratum and the contractor remediation elevations.

TABLE 3.3 GEOTECHNICAL ENGINEERING WORKS SCHEDULE

| LAND USE                                                       | CONSTRUCTION REQUIREMENT       | REQUIREMENT                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Footprint of Proposed Structure (2 m on All Elevations)</b> | Pile Foundation                | Backfill using general method compaction to CBR of 5%.                                                                                                                                                                                                                                                                                                           |
|                                                                | Vibro-Stone Column             | Particle size distribution (PSD confirmed as < 125 mm with no more than 10% fines (0.63 micron).<br><br><b>Or</b><br>Compaction to achieve > 95% of the laboratory determined maximum dry density (DD) with < 5% air void ratio.<br><br>CBR > 6% with suitable pile mat.<br><br>PSD testing of backfill material at 1 sample per 2000 m <sup>3</sup> to confirm. |
|                                                                | Traditional Spread Foundation  | Ensure no disturbance of natural soil at shallow depth.                                                                                                                                                                                                                                                                                                          |
| <b>Highways</b>                                                | Adopted Estate Road/Drainage   | Manual of Contract Documents for Highways Works (MCHW) Series 600 ensuring CBR > 5% in subgrade (engineered fill).                                                                                                                                                                                                                                               |
| <b>Driveways</b>                                               | Private Drives and Car Parking | Method compaction to CBR > 5%.                                                                                                                                                                                                                                                                                                                                   |
| <b>Gardens and Public Open Space</b>                           | N/A                            | Method compaction to ensure no settlement.                                                                                                                                                                                                                                                                                                                       |

### RE-25 – Preparation of Ground for Vibro-Stone Columns Within Tree Influence

Where trees are present, or within their total zone of influence, the contractor must ensure that all cohesive soils are removed to the required depth with the subsequent replacement with a granular blanket to fully mitigate the potential for volumetric instability in the clay soils.



The zone of tree influence will be indicated within the foundation zoning plan and all resultant excavations and subsequent backfilling must be inspected and approved by E3P.

The depth of the granular blanket required will be determined prior to the commencement of the works and in full agreement of the client, but will nominally be equal to or in excess of  $2.5 \times$  foundation width.

#### **RE-26 – Importation of Bulk Fill**

Where there is a net shortfall of material required to achieve the proposed ground levels, it will be necessary to import natural inert soils and aggregate as per the engineering requirements (Section 5).

Imported material must be certified as suitable for use in strict accordance with the E3P chemical and geotechnical performance criteria (See Section 5) and in conjunction with the required duty of care notes and waste transfer exemption.

If recycled aggregates are imported, then laboratory testing should be completed to demonstrate compliance with the Waste and Resources Action Programme (WRAP) protocol.

Where inert soils are imported, laboratory testing should be completed in accordance with the requirements of the pertinent environmental permit (i.e. U1 Standard Rules) or CL:AIRE MMP for the reuse of clean, naturally occurring soils.

#### **RE-27 – Post Remediation Gas Monitoring Parcel A**

Upon completion of the grouting works within the underlying coal seams and remediation works, further gas monitoring wells will need to be installed within Parcel A and a post remediation gas assessment undertaken.

#### **RE-28 – Preparation of Garden for Cover System**

As part of the land remediation works, garden areas will be prepared in a manner that will facilitate the placement of the clean cover system during the development phase of the works. The preparation of the areas requiring clean cover is critical in ensuring delivery of the site in a manner that will ensure no risk to the proposed end-users.

Where Made Ground is deemed unsuitable for retention in a garden, the area will be subject to a reduced-level dig to remove unsuitable material to a minimum depth of 600 mm below finished garden level or verified natural stratum (whichever is the shallower).

Excavated soil will be stockpiled pending the results of the appropriate validation testing (to be completed in accordance with this specification) prior to reuse in an area of no sensitivity or, where necessary, this material will be removed from the site in accordance with UK waste management legislation.

The placement of certified subsoil and topsoil will be completed as part of the developer works/build-phase mitigation plan. All garden areas where a cover system is required will be subject to plot-specific independent validation.



### **RE-29 – Provision of Subsoil**

Natural drift deposits (predominantly granular soils) are deemed suitable for use within the upper 600 mm of clean cover to residential gardens and areas of soft landscaping. It is therefore deemed viable to reuse materials that are cut as part of the wider earthworks or through a soil inversion (regulated by an MMP) to generate the required volumes of material.

The garden and landscaped areas will require depth validation to satisfy the requirement of the Council of Mortgage Lenders (CML) in order to demonstrate that the appropriate thickness has been provided as a growing medium.

### **RE-30 – Provision of Topsoil**

Topsoil from the northern third of parcel B (football pitch area) may be suitable for re-use in garden cover system. Further chemical analysis will be required to confirm this.

Import of suitable topsoil material for use within the proposed development will most likely be required.

Topsoil will require testing in line with the schedule present within Section 3.5 and Table 3.2.

The garden and landscaped areas will require depth validation to satisfy the requirements of the CML in order to demonstrate that the appropriate thickness has been provided.

### **RE-31 – Independent Validation: Watching Brief**

Given the site history and potential contamination sources identified within the ICSM, a degree of uncertainty remains with regard to the potential for as yet unidentified contamination impact within the near-surface soils and groundwater.

It will therefore be necessary to instigate the site-wide remediation and enabling works under the supervision of a suitably qualified and independent specialist. The specialist is required to attend site as and when appropriate to monitor works, record ground conditions and fully investigate all potential sources of as yet unidentified contamination.

### **RE-32 – Waste Soils Surplus to Requirements**

In the event that a surplus of excavation material is present on-site, this, in most cases, will be deemed to be a waste in accordance with the Waste Framework Directive (Article 3(1) Waste Framework Directive 2008/98/EE). The waste producer – but ultimately, the landowner – is responsible for the compliant disposal of such materials.

A formal waste classification assessment must be undertaken, irrespective of any future options or considerations for those materials that will be removed from the site. Waste classification should only be made following the Environment Agency *Technical Guidance WM3 – Guidance on the Classification and Assessment of Waste*.



To remove the surplus material from the site it will either need to be sent to a disposal site (landfill), to a permitted treatment facility or, dependent on the waste classification assessment, it may be suitable for use on a permitted land improvement or restoration operation.

Subject to suitability, these soils can be transferred to the receiving site, subject to an approved permit or materials management plan following guidance in the CL:AIRE *Definition of Waste: Code of Practice*.

### **RE-33 – Validation of Materials for Potable Water Supply Infrastructure**

A contaminant risk assessment, completed in accordance with the UKWIR assessment framework identified elevated concentrations of potentially volatile/soluble hydrocarbon compounds that necessitate the use of protected water supply pipe-work.

All materials where organic hydrocarbon impact is identified at concentrations above the UKWIR assessment criteria for a polyurethane pipe within the proposed locality of potable water supply infrastructure should be delineated and removed by the remediation contractor under the supervision of the geoenvironmental consultant.

Validation sampling should be completed at 10 m chainage at depths of 0.75 m and 1.50 m within the locality of the potable supply pipes where impacted material is removed, with samples analysed for all pertinent volatile and semi-volatile hydrocarbons and, where necessary, chlorinated/halogenated compounds.

Upon successful remediation of all impacted materials, the post-remediation validation testing will be reviewed by a qualified person to inform an updated UKWIR assessment to be reviewed and approved by the statutory adoption authority.

If unacceptable concentrations remain following remediation, then potable water infrastructure should be constructed in accordance with a suitably robust risk assessment and design compliant with UKWIR.

Where imported material is required to construct the potable water infrastructure pipework, this material will need to comply with the requirements of UKWIR pipework thresholds for the specified pipework. For the avoidance of doubt, the PE thresholds are presented in Section 9.3. Failure to meet the required specification may necessitate further remedial works.

### **RE-34 – Production of Drill and Grout Specification**

#### **Parcel A**

The western sector will require drill and grouting by a specialist contractor in order to significantly reduce the risk of instability at the surface in the event of collapse of underlying coal workings.

The eastern sector could not be fully investigated, however there is potential for shallow unrecorded workings, therefore it is recommended that proof drilling is undertaken in this area when possible.

#### **Parcel B & C**



No evidence of coal workings have been identified. It is assumed that the coal seams within this area are below unstable deep granular deposits and the bedrock is heavily disturbed by the fault, therefore it wasn't practicable to mine coal in these areas in the 18<sup>th</sup> and 19<sup>th</sup> centuries prior to mechanisation.

No further works are required in Parcels B & C of the site unless coal workings are found within the Higher Bent within Parcel A and are traced across into Parcel B&C.

#### **Parcel D & E**

Drill and grouting is required on the western side of the site to the Cannel Coal and Higher Bent. As rock cover increases to the east the grid can widen in line with the level of risk identified.

A detailed drill and grout specification is required for the site. This should be submitted to the EA for approval.

#### **RE-35 – Landfill Treatment**

Treatment will incorporate excavation of landfill materials from each of the landfill boundary areas to the required depth'

A detailed method statement will be provided by the contractor to the EA for review and approval prior to the commencement of works. This should include as a minimum the volume of landfill material to be excavated, details of the excavation, treatment, disposal / recovery processes to be employed along with details of relevant permits / exemptions and assessments supporting that end of waste status has been achieved

#### ***Solidification and Stabilisation of Fines***

A detailed method statement will be provided by the contractor to the EA for review and approval prior to the commencement of the solidification and stabilisation works.

#### **RE-36 – Remedial Verification Report**

Collation of information relating to site clearance, chemical testing, remedial works, remedial verification, material movements and waste transfer documentation is required, where appropriate.

Complete remedial validation is to be reported in line with regulatory guidance. This will include a detailed risk assessment. The report will be submitted to the local authority for approval following completion.

### **3.5. VALIDATION SAMPLING PROTOCOL**

In accordance with the current requirements of the regulatory authorities, validation samples will be collected from all materials that are to be subject to movement under the protocols outlined within this remediation and enabling works strategy, or for materials to be imported onto the site to facilitate the proposed residential development.

Upon removal of the identified hotspots, validation samples will be collected at 2 linear metre centres from the side and base of the excavation. A minimum of two samples will be taken from any base or sidewall of the excavation.



Soil samples destined for chemical analysis will be collected at regular intervals in appropriate sampling containers. All samples will subsequently be stored in cooled boxes prior to submission to a UKAS/MCERTS accredited laboratory.

All samples will be collected using appropriate personal protective equipment (PPE) and sampling equipment, which will be cleaned at each sampling location.

A detailed copy of E3P Ltd sampling methodology, QA procedures and laboratory chain of custody forms will be documented within the site records and presented with the final validation report for the site.

Where material is found to contain concentrations of potential contaminants at levels in excess of the site-specific screening criteria (as detailed within Appendix IV), E3P will undertake further assessment and recommendations on the appropriate use for the material in question, which may involve the disposal of such materials off-site to a suitable waste management facility.

The sampling frequency for materials to be managed under the remediation strategy is presented in Table 3.4.

TABLE 3.4 SPECIFICATION OF CHEMICAL VALIDATION LABORATORY ANALYSIS

| MATERIAL USE                                       | TESTING FREQUENCY                                          | SUITE OF ANALYSIS |
|----------------------------------------------------|------------------------------------------------------------|-------------------|
| <b>Site-Generated</b>                              |                                                            |                   |
| Site-Generated 6F2                                 | 1 Sample per 1000 m <sup>3</sup>                           | A/B/C/D           |
| Site-Won MADE GROUND General Backfill              | 1 Sample per 250 m <sup>3</sup>                            | G                 |
| Site-Won MADE GROUND General Backfill              | 1 Sample per 1000 m <sup>3</sup>                           | A/B/C/D           |
| Site-Won Natural Backfill                          | 1 Sample per 2000 m <sup>3</sup>                           | A/B/C/D           |
| Site-Generated Subsoil (450 mm Garden Cover)       | 1 Sample per 250 m <sup>3</sup>                            | A/B/C/D           |
| Site-Generated Topsoil Cover (150 mm Garden Cover) | 1 Sample per 50 m <sup>3</sup>                             | A/B/C/D           |
| Hotspot Validation Samples                         | 1 Sample per 2 m of linear excavation to base and sidewall | E/G               |
| <b>Imported</b>                                    |                                                            |                   |
| 6F2                                                | 1 Sample per 1000 m <sup>3</sup>                           | A/B/C/D           |
| Subsoil Greenfield Source (450 mm Garden Cover)    | 1 Sample per 200 m <sup>3</sup>                            | A/B/C/D           |
| Subsoil Brownfield Source (450 mm Garden Cover)    | 1 Sample per 50 m <sup>3</sup>                             | A/B/C/D           |
| Topsoil Greenfield Source (150 mm Garden Cover)    | 1 Sample per 200 m <sup>3</sup>                            | A/B/C/D           |
| Topsoil Brownfield Source (150 mm Garden Cover)    | 1 Sample per 50 m <sup>3</sup>                             | A/B/C/D           |
| General Engineering Fill (Class 1 and 2 Soil)      | 1 Sample per 1000 m <sup>3</sup>                           | A/B/C/D           |

#### Notes

Suites of Analysis:

- A. Speciated PAH.
- B. Speciated TPH (C5-C35).



- C. Asbestos (ID).
- D. CLEA Inorganic Heavy Metals (As, Ba, Be, W/S Boron, Cd, Cr, Cu, Hg, Pb, Ni, Se, V & Zn + CrVI and CN)
- E. Speciated PAH, Banded TPH and VOCs.
- F. SVOC/Speciated TPH.
- G. On-Site Screening for VOC Using Calibrated PID.

All analysis prescribed above to be completed by UKAS-accredited laboratory.

### **3.6. REMEDIATION CONTRACTORS SITE MANAGEMENT AND RESPONSIBILITY**

The appointed remediation contractor will take full and overarching responsibility for all methods of work required to complete the site remediation and enabling operations to ensure the delivery of the site and the completion of the objectives in a safe, legislatively compliant manner that ensures no pollution to the subject site or the wider environs.

For individual remediation operations as set out within this performance specification, the contractor will provide site-specific methods of work for individual operations pertaining to the removal and treatment of contaminated liquids and soils. For each and every operation as set out herein, the contractor will provide a written methodology of works to be supplied to the supervising geoenvironmental engineer prior to the instigation of operations on site.

The site manager will be responsible for documentation of each day's activities with a full recorded schedule of works completed and corresponding site-specific method statements that have been utilised to ensure the completion of the task to the required standard.



## **4. MATERIALS MANAGEMENT AND LEGISLATIVE COMPLIANCE**

The processing of recycled aggregates will be completed using LAPC Part B licensed plant with the appropriate deployment notification to the local authority prior to commencement of works. All materials that are recovered as recycled aggregate will be compliant with the requirements of the WRAP protocol and the E3P validation testing requirements and as such would not be deemed to be a waste material.

A U1 Exemption will be registered for the site, which allows the reuse of up to 5000 T of prescribed material within construction, with up to 25,000 T of material permissible to be reused in the construction of roads. It should be noted that only 1000 T of material described as sand, stones or clay soil classified as waste can be reused with a U1.

A T5 Exemption, allowing for the screening and recovery of up to 5000 T of permissible material for subsequent reuse in construction will also be registered.

All materials that are recovered under the WRAP protocol, U1 or T5 exemptions must be analysed to demonstrate that they are both chemically and structurally suitable for use within the context of the development.

The relevant LAPC, U1, T5 and WRAP licences, exemptions and protocols provide the legislative framework for material compliance during the site remediation and enabling works to be completed by the specialist contractor under the supervision or E3P.

Where necessary, operations as outlined within the remediation enabling works rationale summarised in this report may be subject to regulation using the appropriate environmental permit, standard rules exemption and materials management plan, to be created in accordance with version 2 of the CL:AIRE *Definition of Waste: Code of Practice (DoW CoP)*.

It is noted that if material is to be imported utilising the CL:AIRE DoW CoP from an alternative development site, then only chemically certified, clean, naturally occurring material can be transferred.

If required, the MMP will be created with due consideration of all proposed remediation and enabling works operations prescribed within this document and will be undertaken by a qualified person with a signed declaration submitted to the EA prior to reuse of materials on the site.

The importation of material for use within the proposed construction of a development platform will be subject to compliance with the E3P protocol for the importation of materials as set out within the specification for material import included within Appendix IV of this report.

### **4.1. APPROACH & METHODOLOGY**

The following approach and methods will be undertaken in regard to the remediation and treatment of landfill excavated wastes. Reference should also be made to section 3 – Identification of Feasible Remediation Options.



## 4.2. MOBILE ENVIRONMENTAL TREATMENT PERMIT

- ✳ Landfill material identified in the site investigation reports along with its proposed excavation for remediation mean it is legally classified as a waste (Article 3 – Waste Framework Directive 2008). Any further handling of this material is waste treatment and subject to regulation by the EA in the form of an environmental permit in accordance with The Environmental Permitting (England and Wales) Regulations 2010 (as amended).
- ✳ With due consideration of the development needs and the nature of the recorded landfill material, E3P understand the applicable environmental permit will be 'SR2008 No 27: *Mobile Plant for the Treatment of Soils and Contaminated Material, Substances or Products*'. This permit allows the operator to use any of the following technology and associated plant/equipment to facilitate the treatment/remediation, including the use of technology and plant in combination. Applicable processes can include:
  - Air sparging.
  - Bioremediation – insitu and exsitu (windrows, biopiles, in-vessel bioreactors).
  - Bioventing.
  - Chemical treatment (including oxidation, dehalogenation).
  - Ex-situ treatment of pumped groundwater (chemical treatment, biological treatment, air stripping, filtration, carbon adsorption).
  - Soil Vapour Extraction (including dual phase SVE).
  - Solidification.
  - Stabilisation.
  - Thermal treatment (including thermal desorption and steam injection).
  - Treatment plant for sorting and separation; and,
  - Treatment plant for blending, mixing, bulking, screening, shredding, particle size reduction and/or particle separation in order to facilitate remedial action.

Discussions with the developer have identified a specialist remediation contractor who already hold this permit in place in readiness for deployment to the site – this will avoid the need to initially apply for the permit. Prior to works commencing, the permit holder (appointed contractor) will notify the National permitting service of the plan to use the permit through the issue of the MPP2 Permit Deployment Form.

Included in the MPP2 form, the operator will provide site-specific information to show how the project proposes to:

- ✳ Control pollution from the treatment process.
- ✳ Control and manage emissions to avoid pollution to the environment and harm to human health.

The introductory note page of this environmental permit states:

*This permit allows waste recovery activities. Please note that any processed materials will continue to be regulated as waste until they meet the end of waste test in accordance with Article 6 of Directive 2008/98/EC. You can demonstrate that you have met the end of waste tests by following either:*



- a) *meeting all the criteria set out in any relevant and applicable EU End of Waste regulations; or,*
- b) *a case by case assessment taking into account the applicable case law, which includes meeting all the requirements of a relevant and applicable Quality Protocol or Defined Industry Code of Practice (e.g. CL:AIRE Development Industry Code of Practice).*

The remediation strategy will form part of the approval process of the mobile environmental permit deployment. The remediation strategy, coupled with the MMP2 form, will provide references to the actual treatment activities and therefore we have excluded their mention in this document. The MMP2 will need to be submitted to the National Permitting Team.

#### **4.3. OPERATION NO.1 - PRIMARY 'PHYSICAL' TREATMENT**

The initial phase of treatment will incorporate the excavation of landfill materials from each of the landfill boundary areas to the required depth. Subject to confirmation in the remediation contractors 'method of works', each landfill will be treated individually with only a sufficient amount of material for processing being excavated at any time to reduce any impacts such as dust, odour and exposure to site operatives and nearby sensitive receptors.

Large, clearly identifiable waste material types will be removed from each excavation by the plant operator and segregated in readiness for removal off-site or for further on-site 'secondary' treatment. Any waste material destined to leave the site will be temporarily held in an appropriate waste container prior to collection. Examples might include large items of inert waste (brick, concrete etc.) metals, plastics etc.

As a contingency, the excavated landfill material will then be fed via a hopper onto a conveyor system where operatives manually remove clearly identifiable waste fractions into a series of containers designed to temporarily store these waste fractions (primary picking station).

The remaining waste materials will be transferred across a screening deck or trommel to remove fines from the main body of the excavated waste. Subject to confirmation with the appointed remediation contractor the screen diameter is likely to be between 25 – 50mm in size. Fine material will be stockpiled in readiness for validation inspection and testing (see section 3.4).

Removing the finer material will then allow for a more efficient 'secondary pick' of the various materials known to be landfilled at the site. As with the primary pick, each of the waste fractions will be transferred into a series of containers for temporary storage prior to further on-site processing or collection for off-site recovery or disposal.

In addition to manual separation of waste streams, magnets will also be used to supplement this process for the removal of ferrous metals for further processing off-site.

A detailed method statement will be provided by the contractor to the EA for review and approval prior to the commencement of works.

#### **4.4. OPERATION NO.2 – MANUFACTURE OF RECYCLED AGGREGATES**

The WRAP Quality Protocol for the Manufacture of Recycled Aggregates from Inert Waste is a criteria that allows defined inert waste materials to be regarded as having achieved 'end of waste' status in line with Article 6 of the Waste Framework Directive 2008.



Through the use of the techniques implemented with the mobile environmental permit, suitable inert waste materials that conform to the WRAP Protocol (e.g. concrete, bricks, glass etc.) will be segregated from the main body. These waste fractions will then be further processed to generate a recycled aggregate that meets a specific engineering standard for re-use on the site (in line with the remediation strategy).

To meet the requirements of a recognised engineered standard (e.g. Class 1 or 6 as defined in Street & Highway Works 600: Earthworks), further processing in the form of 'crushing' will be undertaken (the process will be included as part of the Environmental Permit deployment). Segregated inert wastes will be fed using an excavator into the feed hopper of the crusher, an operative will be stationed on the pre-crush feed conveyor to perform quality assurance checks and manually remove any non-conforming materials prior to its input into the crusher teeth. Any non-conforming materials removed will be placed into containers as per Operation No. 1. The crusher teeth will be set to meet the maximum particle size of the required product specification (e.g. 125mm for 6F5).

The resultant output from this process will be sampled and analysed to prove it meets the recognised standard/specification required. By fully conforming with the WRAP Quality Protocol the resultant aggregate can be regarded as achieving 'end of waste' status.

The key document associated with the WRAP Quality Protocol is the 'Factory Production Control' - a set of procedures (management system) focusing on the production process to ensure that product quality is consistently maintained to the required specifications. The key parts of this are:

- ✳ Standards and specifications to be used.
- ✳ Waste acceptance criteria.
- ✳ Production process & equipment.
- ✳ Records and documentation.
- ✳ Sampling and analysis.
- ✳ Testing frequencies.

Whilst there is no specific requirement to submit this for regulatory approval, these can be made available during the regulatory approvals process for this remediation strategy and mobile environmental permit deployment. The approved remediation contractor will ensure their Factory Production Control procedure is fully compiled prior to these operations commencing.

## **4.5. OPERATION NO.3 – VALIDATION OF FINES**

In the absence of any 'end of waste' protocol for the fine matrix material (post-primary treatment) for this material to meet the 'end of waste' test they must be shown to meet an agreed set of criteria from both a geochemical and geotechnical and if returned to the ground must exhibit properties that would not impact human health.

Those fines generated during the primary treatment process are likely to include the contaminants associated with the findings of the previous site investigations. In order for these to be considered as suitable for re-use in the remaining landfill void spaces, they will initially be subject to the validation testing based on those detailed in section 4.8.1.



It is anticipated that the works will be undertaken on a batch process due to the size of stockpiles that will be generated over a fixed period of time. Batch stockpiles will be clearly segregated from other ongoing site activities and stockpiles prior to the required validation testing. Each of the stockpiles will be subject to the initial validation testing as per section 4.8.1. Should the stockpile meet the agreed criteria and validation test requirements it will be clearly marked as approved in readiness for its re-use as bulk fill and re-engineered back into the void space in compliance with SHW 600: Earthworks Specification.

Any batched stockpiles that fail to meet the agreed criteria will be held in quarantine and clearly identified as such and located away from other site activities and stockpiles. At this point, a determination will be made as to what further treatment would be required in order for this batch of fine material to meet the agreed re-use criteria. Due to the nature of the material, it is assumed that the most likely form of treatment will either be ex-situ (on-site) solidification or stabilisation.

A detailed method statement will be provided by the contractor to the EA for review and approval prior to the commencement of works. This should include as a minimum the volume of landfill material to be excavated, details of the excavation, treatment, disposal / recovery processes to be employed along with details of relevant permits / exemptions and assessments supporting that end of waste status has been achieved

#### **4.6. OPERATION NO.4 – SOLIDIFICATION & STABILISATION OF FINES**

Solidification/stabilisation (S/S) transforms hazardous liquid or solid contaminants of concern (COCs) present in soil or sediment into environmentally innocuous materials of considerably reduced mobility, thus preventing the hazardous constituents from reaching sensitive receptors.

S/S treatment is designed to immobilise contaminants within the fines material, rather than removing them through chemical or physical treatment. Solidification is the process that uses a reagent to bind the contaminated media to encapsulate the COCs. Solidification adds a binder to the media in order to change the physical properties of the fines, typically resulting in a decrease in its permeability and increase in its compressive strength. Stabilisation involves a chemical reaction that reduces the leachability of the COCs by chemically immobilising them and/or reducing their solubility, which results in a reduction in mobility and hence toxicity.

S/S generally requires the addition of a binding agent. Typically, the binding agent is selected based upon the contaminant being treated as well as the material being processed. Binder materials include inorganic binders (e.g. portland cement, fly ash, lime, soluble silicates and sulphur-based binders), and organic binders (e.g., asphalt, epoxide, granulated activated carbon, organophilic clays, polyesters, and polyethylene). In many cases, the organic binders are applied to immobilise organic COCs prior to adding an inorganic binder to solidify the media.

There are many variations of S/S technology that can be applied to treat soils and sediments contaminated with various COCs and create various end products that must be disposed of or recycled. These variations fall into four categories based on the binders used, including:

- ✿ Inorganic cementation systems that incorporate portland cement, lime, and other pozzolans.
- ✿ Organic binders including asphalt, polyethylene emulsions, bitumen, and other thermoplastics.
- ✿ Thermosetting organic polymers including epoxides, phenolics, and urea.
- ✿ Vitrification, which relies on high temperature and mixing the waste with glass-forming substances to jointly melt them and then solidify the waste material as it cools. Due to its high cost, it generally is reserved for the treatment of radioactive waste.



In terms of applicability, solidification and stabilisation processes cover a broad range of COC's due to the variations and re-agents that can be used. Demonstrated effectiveness is known for the following contaminants classes:

- ✦ Inorganics (metals).
- ✦ Total Petroleum Hydrocarbons.
- ✦ Halogenated Semi Volatile Organic Compounds (SVOCs)
- ✦ Non-Halogenated SVOC's (including PAH's).

It will be the responsibility of the appointed remediation contractor to determine the specific S/S techniques to be applied for each of the quarantined fines material stockpiles. This will be referenced as part of the MPP2 deployment form.

Post-treatment (secondary) the fines material will be subject to further validation testing in line with the agreed criteria. Should the stockpile meet the agreed criteria it will be clearly marked as approved in readiness for its re-use as bulk fill and re-engineered back into the void space in compliance with SHW 600: Earthworks Specification (see section 6).

Any materials that fail to meet the approved criteria will either be re-processed or removed off-site, subject to the appropriate waste classification assessment based on the requirements of EA Technical Guidance WM3.

A detailed method statement will be provided by the contractor to the EA for review and approval prior to the commencement of the solidification and stabilisation works.

## 4.7. EXPECTED WASTE MATERIALS

As requested by the Environment Agency and as a result of the detailed review of all previous landfill site investigation reports, the following Table 4.1 has been generated which also details the waste management options and treatments to be applied to each:

TABLE 4.1 ANTICIPATED EXCAVATED WASTE TYPES

| Anticipated Excavated Waste Types |                      |                         |                               |                             |         |
|-----------------------------------|----------------------|-------------------------|-------------------------------|-----------------------------|---------|
| Type                              | Grading <sup>1</sup> | Waste Code <sup>2</sup> | Waste Management Option       | Treatment or Disposal Route |         |
| Asbestos (Cement Bonded & AIB)    | Haz                  | 17-06-05                | Removal off site <sup>3</sup> | Hazardous Landfill          | Waste   |
| Asbestos (other)                  | Haz                  | 17-06-01                | Removal off site <sup>3</sup> | Hazardous Landfill          | Waste   |
| Brick                             | Inert                | 17-01-02                | Re-use on Site <sup>4</sup>   | WRAP Protocol               | Quality |

<sup>1</sup> These gradings are generally accepted for the material type but can differ subject to further testing.

<sup>2</sup> As with footnote 3 – the waste codes vary depending on whether they are hazardous or non-hazardous.

<sup>3</sup> All waste to be removed off site will be handled in line with waste management 'Duty of Care' requirements and be subject to waste classification in line with the EA Technical Guidance for Waste Classification: WM3.

<sup>4</sup> Subject to meeting 'end of waste' criteria and validation testing.



### Anticipated Excavated Waste Types

| Type                            | Grading <sup>1</sup> | Waste Code <sup>2</sup> | Waste Management Option       | Treatment or Disposal Route                                             |
|---------------------------------|----------------------|-------------------------|-------------------------------|-------------------------------------------------------------------------|
| Cardboard                       | Non-Haz              | 19-12-01                | Removal off site <sup>3</sup> | Reprocessing <sup>3</sup> / Refuse Derived Fuel                         |
| Ceramic (inc pottery, tiles)    | Inert                | 17-01-03                | Re-use on site <sup>4</sup>   | WRAP Quality Protocol                                                   |
| Colliery Spoil (fines material) | Non-Haz / Haz        | 17-05-03 or 17-05-04    | Re-use on site <sup>4</sup>   | Solidification & Stabilisation (where applicable)                       |
| Concrete                        | Inert                | 17-01-01                | Re-use on Site <sup>4</sup>   | WRAP Quality Protocol                                                   |
| Fibreglass                      | Non-Haz              | 17-06-04                | Removal off site <sup>3</sup> | Non-hazardous Landfill                                                  |
| Electric Cable                  | Non-Haz              | 17-04-11                | Removal off site <sup>3</sup> | Metal reprocessing <sup>4</sup>                                         |
| Galligu                         | Non-Haz / Haz        | TBC                     | TBC                           | TBC                                                                     |
| Glass (inc. bottles)            | Inert                | 17-02-02                | Re-use on Site <sup>4</sup>   | WRAP Quality Protocol                                                   |
| Metal (Ferrous & Non-Ferrous)   | Non-Haz              | 17-04-07                | Removal off site <sup>3</sup> | Metal reprocessing                                                      |
| Nylon Rope                      | Non-Haz              | 17-02-03                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Paper                           | Non-Haz              | 19-12-01                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Plastic (hard-various grades)   | Non-Haz              | 17-02-03                | Removal off site <sup>3</sup> | Reprocessing <sup>4</sup> – Refuse Derived Fuel                         |
| Plastic Bottles                 | Non-Haz              | 17-02-03                | Removal off site <sup>3</sup> | Reprocessing <sup>4</sup> – Refuse Derived Fuel                         |
| Plastic (Flexible)              | Non-Haz              | 17-02-03                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Polystyrene                     | Non-Haz              | 17-02-03                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Rubber                          | Non-Haz              | 19-12-04                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Soil & Stone (fines material)   | Non-Haz / Haz        | 17-05-03 or 17-05-04    | Re-use on site <sup>4</sup>   | Solidification & Stabilisation (where applicable)                       |
| Textiles                        | Non-Haz              | 19-12-08                | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Timber                          | Non-Haz              | 17-02-01                | Removal off site <sup>3</sup> | Reprocessing <sup>4</sup> / Refuse Derived Fuel                         |
| Tyres                           | Non-Haz              | 19-12-04                | Removal off site <sup>3</sup> | Reprocessing <sup>4</sup> / Refuse Derived Fuel                         |
| Wood                            | Non-Haz              | 17-02-01                | Removal off site <sup>3</sup> | Reprocessing <sup>4</sup> / Refuse Derived Fuel                         |
| Ash (generic)                   | Non-Haz / Haz        | 19 01 11 or 19 01 12    | Removal off site <sup>3</sup> | Non-hazardous <sup>4</sup> / Hazardous Landfill                         |
| Clinker/slag                    | Non-Haz / Haz        | 19 01 11 or 19 01 12    | Removal off site <sup>3</sup> | Non-hazardous <sup>4</sup> / Hazardous Landfill                         |
| Plastic                         | Non-Haz / Haz        | 17 02 03 or 17 02 04    | Removal off site <sup>3</sup> | Refuse Derived Fuel                                                     |
| Clay                            | Non-Haz / Haz        | 17-05-03 or 17-05-04    | Re-use on site <sup>4</sup>   | Non-hazardous <sup>4</sup> Landfill or restoration site (if applicable) |



| Anticipated Excavated Waste Types |                      |                           |                                                           |                             |
|-----------------------------------|----------------------|---------------------------|-----------------------------------------------------------|-----------------------------|
| Type                              | Grading <sup>1</sup> | Waste Code <sup>2</sup>   | Waste Management Option                                   | Treatment or Disposal Route |
| Sand                              | Non-Haz              | 19 12 09 (from treatment) | Reuse onsite <sup>4</sup> or offsite removal <sup>3</sup> | WRAP Protocol Quality       |

## 4.8. VALIDATION CRITERIA

### 4.8.1. FINES MATERIAL

#### Chemical

The following information details the proposed validation testing and frequency in order to meet and 'end of waste' criteria and the subsequent test approvals as requested by EA prior to works commencing.

With regard to the planning consent validation process, post primary and/or secondary treatment fines material will be analysed in respect to the following determinands:

- ✳ US EPA16 speciated PAHs
- ✳ TPH (C5 – C35)
- ✳ Asbestos (ID)
- ✳ CLEA inorganic metals
- ✳ Semi Volatile Organic Compounds (SVOCs)
- ✳ Volatile Organic Compounds (VOCs)

Leachate analysis will also be undertaken for the following determinands:

- ✳ Arsenic
- ✳ Copper
- ✳ Total Cyanide
- ✳ Mercury
- ✳ Lead
- ✳ Zinc
- ✳ Naphthalene

These specific tests will be undertaken on a proposed frequency of one sample per 500 m<sup>3</sup>.

The approved criteria 'target' levels are shown in Appendix IV.3 – Site Specific End of Waste Criteria and IV.4 Level 3 Remedial Target Concentrations For The Former Landfill Area With Respect To Controlled Waters.

#### Geotechnical



In line with section 4.1 of this remediation strategy the post processed fines must fall within the designated material use class of SHW600: Earthworks Table 6/1:

- ✳ Class 1 – General Granular Fill
- ✳ Class 2 – General Cohesive Fill (excluding Class 2a & 2e)

Sampling, analysis and approval must be undertaken prior to any backfilling into the former landfill void spaces. These, along with the specific compaction and backfill performance criteria levels must be met, and these are defined in Table 4.3 of this remediation strategy. Material that fails to meet the required geotechnical performance criteria will not be returned to the void space and will either be subject to further processing or off-site removal in line with duty of care and waste classification requirements.

Specific to the fines materials generated from the processing of the excavated landfill material, to supplement the geotechnical validation tests shown in Table 4.4 'Classification of Constituents' testing will also be undertaken to confirm the physical make-up of the post-treated fines. In a similar nature to the WRAP Quality Protocol the validation process will look to confirm that the constituents of the fines consist of materials with the material codes (Rc, Ru, Rb, Ra, Rg) and the value of X group materials (e.g. plastic, wood, rubber, metal etc.) do not exceed 1% of the total mass of the population sampled (see Table 4.4). A visual check of the material will be undertaken 1 every 5000m<sup>3</sup>.

## 4.9. RECYCLED AGGREGATES

### Geotechnical

The following information details the required validation testing and frequency that is required to show conformity with the WRAP Quality Protocol. The information below provides a summary of the details that will be incorporated into the Factory Production Control Procedure by the approved remediation contractor. With respect to the development all recycled aggregates will be processed as a Class 6F5 – Selected Granular Material (Coarse Grading). The following Table 4.2 specifies the tests required by the EA for recycled aggregates from inert waste. Table 4.3 details the supplementary tests that are required for 6F5 material in respect of SHW600.

TABLE 4.2 WRAP QUALITY PROTOCOL: SUMMARY OF TESTING REQUIREMENTS & FREQUENCIES

| END USE CLASS                                            | STANDARD/SPECIFICATION                                                                                                          | TEST                                                               | BRITISH STANDARD TEST REFERENCE | MINIMUM TEST FREQUENCY <sup>5</sup> |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------|-------------------------------------|
| All End Use Classes (e.g. Class 1, 2, 6, 7) <sup>6</sup> | BS EN 13242 - Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction. | Particle Size Distribution <sup>7</sup>                            | EN933-1                         | 1 per week                          |
|                                                          |                                                                                                                                 | Particle Density & Water Absorption                                | EN1097-6                        | 1 per month                         |
|                                                          |                                                                                                                                 | Resistance to Fragmentation (Los Angeles Coefficient) <sup>9</sup> | EN1097-2                        | 1 every 6 months                    |
|                                                          |                                                                                                                                 | Classification of Constituents (see Table 9)                       | EN933-11                        | 1 per month                         |
|                                                          |                                                                                                                                 | Water Soluble Sulphate <sup>9</sup>                                | EN1744-1                        | 1 per month                         |

<sup>5</sup> Frequencies are defined in terms of a production week or similar and/or production day. These periods should be defined by the producer depending on the throughput of the plant/equipment. Production week can be defined as the period of even consecutive days comprising at least five production days or the period taken to complete five production days, whichever is longer.

<sup>6</sup> Excludes 6F2 as BS1377 standard does not meet WRAP Quality Protocol requirements.

<sup>7</sup> Test required for both WRAP Quality Protocol & SHW600: Earthworks.



TABLE 4.3 SHW600: EARTHWORKS - SUMMARY OF TESTING REQUIREMENTS

| END USE CLASS | STANDARD/SPECIFICATION                                                                                                          | TEST                                           | BRITISH STANDARD TEST REFERENCE | MINIMUM TEST FREQUENCY             |
|---------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------|------------------------------------|
| Class 6F5     | BS EN 13242 - Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction. | Laboratory Dry Density & Optimum Water Content | BE EN 13285                     | 1no. sample per 1000m <sup>3</sup> |
|               |                                                                                                                                 | Water Content                                  | BS EN 1097-5                    | 1no. sample per 1000m <sup>3</sup> |
|               |                                                                                                                                 | Bitumen <sup>8</sup> Content                   | BS EN 12697-1 or BS EN 12697-39 | 1 per month                        |
|               |                                                                                                                                 | Total Sulphur & Sulphide <sup>9</sup>          | EN1744-1                        | 1no. sample per 1000m <sup>3</sup> |

**Note:** Based on the descriptions of the landfill waste from previous site investigations applicable tests for 'Volume Stability of Blast Furnace Slag' & 'Volume Stability of Steel (Basic Oxygen Furnace & Electric Arc Furnace) Slag' are not considered applicable.

The above Table 4.3 does not include references to any post placement, in-situ compaction tests such as California Bearing Ratio (BS1377-4). Refer to section 6 for further details on the compaction testing requirements.

TABLE 4.4 – CLASSIFICATION OF CONSTITUENTS – CLASSIFICATION GROUPS (BS EN 933-11)

| MATERIAL CODE | CONSTITUENTS                                                                                               |
|---------------|------------------------------------------------------------------------------------------------------------|
| Rc            | Concrete, concrete products, mortar, concrete masonry units                                                |
| Ru            | Unbound aggregate, natural stone, hydraulically bound aggregate                                            |
| Rb            | Clay masonry units (i.e. bricks and tiles), calcium silicate masonry units, aerated non-floating concrete. |
| Ra            | Bituminous materials                                                                                       |
| Rg            | Glass                                                                                                      |
| FL            | Floating material in volume                                                                                |
| X             | Cohesive (e.g. clay and soil), metals, wood, plastic, rubber, gypsum plaster.                              |

**Notes:** Maximum permitted for constituents X: 1% by mass. Maximum permitted for constituent FL: <10cm<sup>3</sup>/kg unbound.

## Chemical

In addition to the testing specifications and frequencies stipulated in the WRAP Quality Protocol (see Table 4.3, 4.4, 4.5) Table 3.2 also requires chemical validation testing of site generated recycled aggregates. The chemical testing covers US EPA16 PAHs, TPH (C5 – C35), asbestos identification and CLEA inorganic metals. This supplementary chemical testing is a requirement of the planning consent validation process and is supplementary to the requirements of the WRAP Quality Protocol. The testing frequency is based upon volumes generated rather than production timescales. The testing frequency to be undertaken is set at one sample per 500 m<sup>3</sup>.

<sup>8</sup> Does not apply if the Class Ra (asphalt) content of the recycled aggregate is 20% or less.

<sup>9</sup> Only required where processed materials are placed within 500mm of concrete/cement bound/other cementitious material or permanent metallic structures.



## 5. ENVIRONMENTAL MONITORING AND VALIDATION

### 5.1. SITE MANAGEMENT

The tracking of materials will be based on the following hierarchy:

- ✚ The principal contractor will have the responsibility for setting out areas of the site on the basis of the contract specification.
- ✚ Operatives will have instructions only to excavate and to emplace materials in specified areas as assigned by the site manager/foreman.
- ✚ The site manager (employed by the principal contractor) will issue daily instructions to drivers regarding the placement of materials sourced from specific stockpiles or areas, ensuring that appropriate documentary evidence is collected that details which materials are going where and why.
- ✚ An E3P consultant, who will be in attendance as required, will:
  - Inspect the excavation areas and certify that the correct materials are being excavated;
  - Conduct spot checks on loaded vehicles to ensure compliance with this remediation strategy; and
  - Ensure that any loads that fail visual, olfactory or spot checks either remain on the vehicle or, if unloaded, are excavated and set aside. This material will be treated according to the recommendations of the E3P site engineer.
- ✚ E3P will conduct an audit of waste consignment notes. All material imported and removed from site will have duty of care/consignment notes, copies of which will be retained on-site by the site manager.
- ✚ Materials directly reusable will be incorporated into the earthworks, subject to operational conditions and phasing of excavations, in which case they will be stockpiled prior to final placement.

### 5.2. COMPLETION

Following the completion of the remediation works, a report will be compiled by the environmental consultant detailing all site enabling works undertaken, waste consignment notes, and all site investigations, laboratory test certificates and validation testing undertaken.

A certificate of completion of earthworks should be included within the report which should then be issued to the local authority for their approval.

E3P considers that with the adoption of the above best practices the site can be safely redeveloped. The site enabling works process and presence of any residual contamination (if this is the case) should be recorded for future reference by landowners/occupiers. Future development at the site where this may result in penetration of new areas of hardstanding should be subject to no-less-stringent measures with respect to assessment and, where appropriate, monitoring, than those set out herein.



## **5.3. MITIGATION OF RISK FROM SOILS WITH ASBESTOS FIBRES**

### **5.3.1. PRE-COMMENCEMENT WORKS**

Prior to the commencement of works the following requirements must be satisfied:

-  Induction of all people that will be involved with the proposed site works; and
-  All methodologies must be agreed upon by all parties involved.

### **5.3.2. CONTROL, MONITORING AND REPORTING OF GENERAL AERIAL EMISSIONS FROM DUSTS AND PARTICULATES**

#### **DAMPING DOWN OF SOILS – MITIGATE PARTICULATE (DUST) EMISSION**

During excavation, as outlined within the detailed working methodologies, soils will be regularly damped down using water to control the generation of dust (this may also comprise precipitation). The contractor will determine the best form of dust suppression to be used when a detailed programme has been issued.

If any previously unidentified asbestos-containing materials are identified, these should be dealt with in strict accordance with the *Control of Asbestos Regulations* (2012) and industry best practice as detailed in CIRIA 733.

#### **GENERAL CONTROL OF DUST**

The following control measures should be utilised to ensure that dust levels are kept to a minimum at all times:

-  Where necessary, haul road, work areas and stockpiles will be damped down with water spray.
-  The application of water to haul roads, work areas and stockpiles should be closely monitored by the resident engineer to ensure that soils are not saturated and, therefore, that the potential for water run-off is appropriately mitigated.
-  Once completed, any stockpiles will be sealed by compacting at the surface.
-  Vehicle speeds and movements on site will be kept to a minimum (< 5 mph) during civil excavation works to reduce the potential to generate dust.



## PERSONAL PROTECTIVE EQUIPMENT (PPE)

In accordance with the HSE *Guidance Note em6: Asbestos Essentials, Personal protective equipment (including RPE)*, E3P recommend that all site operatives present within the work area where potential asbestos-impacted soils are being excavated are supplied with the following personal protective equipment:

Overalls:

- ✳ Disposable overalls.
  - Type 5 (BS EN ISO 13982-1) are suitable.
  - Cotton overalls hold dust and need specialist laundering.
- ✳ Waterproof overalls for outdoor work.
- ✳ Use oversized overalls - this will help to prevent ripping at the seams.
- ✳ If the cuffs are loose, seal them with tape.
- ✳ Avoid wearing a long-sleeved shirt as these are difficult to cover properly.
- ✳ Wear the overall legs over footwear as tucking them in lets dust into footwear.
- ✳ Wear the hood over the RPE straps.

Failure to utilise and correctly employ PPE will result in immediate cessation of works. Works will not be permitted to recommence until the individual has undergone further training in the use of PPE or the individual is removed from the works area.

**At this current time, with the levels of ACM identified within the soils, the above-listed PPE is not considered to be required for all site personnel during the entire management of these soils.**

When handling asbestos-impacted soils during the enabling works, asbestos monitoring works should be conducted in accordance with, but not limited to, the following HSE legislation and guidance:

- ✳ Health & Safety at Work Act 1974;
- ✳ The Control of Asbestos Regulations 2012;
- ✳ CL:AIRE, 2016. Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance;
- ✳ Approved Code of Practice L143 Work with materials containing asbestos;
- ✳ Management of Health and Safety at Work Regulations 1999;
- ✳ HSE Guidance Note HSG248 Asbestos, the analysts guide to sampling and analysis;
- ✳ HSE Guidance Note HSG247 Asbestos: The licensed contractors' guide; and
- ✳ CIRIA 733 Asbestos in soil and made ground: a guide to understanding and managing risks.



If required, air monitoring in accordance with HSG248 will be undertaken intermittently throughout the duration of the works at a frequency to be determined by the contractor, entirely dependent on whether asbestos-impacted soils are being handled at any given time. In general terms, during any one monitoring period, ten standard monitoring pumps will be run throughout the day, for the appropriate time period to achieve the required limit of detection. These slides will be analysed immediately by the on-site UKAS-accredited laboratory.

Once any monitoring has been analysed by the on-site UKAS-accredited laboratory, the results will be delivered to the resident engineer who will then follow the correct site procedure. The results will then be included within the verification report.



## **6. GEOTECHNICAL ENGINEERING SPECIFICATION**

### **6.1. E3P GEOTECHNICAL ENGINEERING SPECIFICATION**

The overarching philosophy of the site enabling works will be the delivery of the following:

- ✚ Preparation of plot footprint (+ 2 m on all elevations) to be suitable for ground improvement by vibro-stone column, where depth of stiff clay/medium-dense sands exceeds 1.5 m from proposed finished floor level (FFL).
- ✚ Preparation of plots to be suitable for construction with shallow spread foundation where firm to stiff clay and medium-dense sands are present at a depth < 1.5 m from proposed FFL across the complete plot.
- ✚ Engineer all areas of the proposed adopted road and private drive to be compliant with the E3P Geotechnical Specification with CBR and elevation defined by the client.

In the event that it is not possible to prepare the site in a manner that will achieve the required foundation solution, the supervising engineer and client should be contacted at the first available opportunity.

The contractor should employ a suitably experienced engineer to be present on-site during these earthwork operations to ensure soil suitability, placement, compaction and testing is undertaken in accordance with this specification and to ensure that any unforeseen circumstances, such as adverse weather, do not compromise the earthworks process.

Works should be halted during periods of intermittent or prolonged rainfall to ensure the materials are not placed in a manner that would result in softening of either the formation or the newly placed material. It will be the contractor's responsibility to determine appropriate weather conditions and determine the suitability of works.

Particular attention must be given to variable weather conditions when re-engineering clay soils as a moisture content fluctuation ( $\pm 2\%$ ) of the tolerable limit will result in an unacceptable degree of compaction loss.

### **6.2. LOCALLY-WON FILL MATERIAL**

It is proposed to upfill and level the site with material won from the development area. From the site-specific investigations undertaken to date, it is expected that the majority of the soils won from the processing of demolition material will be granular and cohesive soil matrices.

Due to climatic weather conditions and variance in long-term differential settlement associated with even well-compacted granular soils, and the need to facilitate future re-engineering using vibro-replacement stone columns to support a shallow reinforced strip foundation, it is essential that the cut-and-fill process is well controlled and materials are placed/compacted in accordance with this specification.

Where site-won materials are to be used as fill to achieve the required development platform, they must be compacted to ensure in-situ densities that are in excess of 95% of the maximum dry density, as determined using a 4.5 kg laboratory Proctor test.

Materials should only be compacted when the actual moisture content is within 2% ( $\pm$ ) of the optimum for the soil matrices as determined by laboratory bench testing.



### **6.3. CLASSIFICATION OF FILL MATERIAL**

This specification should be read in conjunction with the following:

- ✦ The Manual of Contract Documents for Highway Works, Volume 1, Specification for Highway Works, Series 600, Earthworks as amended in February 2016; and
- ✦ BS 1377-1:2016 Methods of test for soils for civil engineering purposes. General requirements and sample preparation

#### **6.3.1. GENERAL CLASSIFICATION**

The contractor should ensure that all earthworks materials comply with Clause 601 of the *Specification for Highway Works* and shall fall into one of the following general classifications as defined in Table 6.1 of the *Specification for Highway Works*.

- ✦ General granular fill (Class 1);
- ✦ General cohesive fill (Class 2), excluding Class 2A and 2E; or
- ✦ Selected granular fill (Class 6).



TABLE 6.1 E3P EARTHWORKS GEOTECHNICAL COMPACTION SPECIFICATION

| SOIL/MATERIAL TYPE                                                         | CLASS | DESCRIPTION                                                                                                            | COMPACTION EQUIPMENT                                                | LAYER THICKNESS        | ROLLER PASSES |
|----------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------|---------------|
| <b>Granular Fill</b><br><b>(Sand and Gravel Matrices)</b>                  | 1 A   | Sandy Gravel with some cobbles                                                                                         | > 5000 kg vibrating roller                                          | 225 mm                 | 4             |
|                                                                            | 1 B   | Sand or Gravel of same grading size                                                                                    | > 5000 kg vibrating roller                                          | 250 mm                 | 10            |
|                                                                            | 1 C   | Coarse gravels with many cobbles                                                                                       | > 5000 kg vibrating roller                                          | 400 mm                 | 5             |
| <b>Cohesive Fill</b><br><b>(Clay with Minor Sand and Gravel Component)</b> | 2 A   | Wet Clay                                                                                                               | > 1000 kg vibrating tamping roller (sheep foot only)                | 100–225 mm             | 3             |
|                                                                            | 2 B   | Dry Clay                                                                                                               | > 5000 kg vibrating roller<br>or<br>1400 kg tamping (trench roller) | 225 mm<br>or<br>125 mm | 4<br>or<br>12 |
|                                                                            | 2 C   | Gravelly Clay                                                                                                          | > 5000 kg vibrating roller<br>or<br>1400 kg tamping (trench roller) | 225 mm<br>or<br>125 mm | 4<br>or<br>12 |
|                                                                            | 2 D   | Silty/Sandy Clay                                                                                                       | > 5000 kg vibrating roller<br>or<br>1400 kg tamping (trench roller) | 225 mm<br>or<br>125 mm | 4<br>or<br>12 |
| <b>Recycled Aggregate Crush</b><br><b>(&lt; 125 mm Well Graded)</b>        | 6F2   | Any combination of inert hard materials, other colliery spoil, or rock with substantial amounts of clay-like component | > 5000 kg vibrating roller                                          | 250 mm                 | 6             |



### **6.3.2. USE OF FILL MATERIALS**

In addition to any grading requirement, the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150 mm shall not be deposited within the restored surface level unless directed otherwise by the engineer. Un-burnt colliery spoil, pulverised fuel ash or furnace bottom ash shall not be used as a fill material.

### **6.4. GENERAL REQUIREMENTS**

The contractor shall employ only plant and working methods that are suited to the materials to be handled and traversed. The contractor shall be responsible for maintaining the nature of the acceptable material so that when it is placed and compacted it remains acceptable in accordance with the contract.

For the purposes of this contract, the proposed earthworks requirements have been split into distinct end-use categories, with the corresponding requirements for the earthworks specification assigned to individual areas.



TABLE 6.2 COMPACTION/BACKFILL REQUIREMENTS

| LAND USE REQUIREMENT                                                       | COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERIA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Traditional Spread Foundation</b>                                       | Ensure no disturbance of natural soil at shallow depth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Re-Engineering of Soils Using Vibro-Replacement Stone Column (VRSC)</b> | <p>Materials to be placed in a controlled manner to facilitate the construction of vibro-replacement stone columns (VRSC). to limit differential settlement and increase net Allowable Bearing Pressure (ABP)</p> <p><b>These works are to be completed within the building structure footprint and +2 m of all elevations.</b></p> <p>Material must be 90% granular in composition with less than 10% fines (which are classified as materials &lt; 0.6 microns in size).</p> <p>No material greater than 125 mm in size is permitted, with 90% of the soils placed conforming to grading &lt; 90 mm.</p> <p>Material is to be placed when actual moisture content is within tolerable limits of the optimum, with specific attention to soils that are notably wetter than the optimum.</p> <p>Material to be placed in a manner so as to ensure a minimum CBR of 5% at formation to facilitate machine movement and piling mat construction.</p> <p>Where site-won materials are used to upfill, levels must be compacted to an “end product” performance specification where the in-situ density exceeds 95% of the maximum (determined by laboratory conditions).</p> <p>Where rock is present at a shallow depth, the remediation contractor will ensure the substratum is prepared to ensure that a minimum of 1000 mm of appropriately graded granular material is present to the underside of the proposed doubly reinforced concrete strip foundation.</p> <p>The substratum must be prepared to ensure a vibro-stone column treatment depth is not less than 80% of the immediate adjacent profile.</p> |
| <b>Piled Foundation</b>                                                    | <p>All plot footprint (+ 2 m) must be free of any deleterious elements, tree roots and obstructions &gt; 150 mm.</p> <p>Where upfill is proposed, material is to be placed using method compaction specification to achieve a CBR as required by the developer for piling mat construction.</p> <p>Piling mat is to be placed and constructed in accordance with the approved geotechnical engineer’s temporary works design.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



| LAND USE REQUIREMENT                                  | COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERIA                                                                                                                                                                                                        |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adopted Highways (+ 2 m from Back of Footpath)</b> | <i>Method Compaction – MCHW Specification For Highway Works Series 600</i> is to be followed, with in-situ validation testing to meet requirement of adoptions authority.<br><br>A CBR > 5% is required at subgrade formation (prior to placement of capping). |
| <b>Estate Roads</b>                                   | <i>Method Compaction – MCHW Specification For Highway Works Series 600</i> is to be followed to achieve a CBR > 5%.                                                                                                                                            |
| <b>Gardens, POS and Other External Areas</b>          | Material is to be placed in layers not exceeding 300 mm and must be rolled using dedicated plant (no earth moving equipment) and in general compliance with the requirements of <i>MCHW Specification For Highway Works Series 600</i> .                       |

Acceptability shall be determined in accordance with Table 6/1 of the *Specification for Highway Works*.

Laboratory testing for the purposes of determining acceptability and compaction requirements will be conducted by the engineer.

Haulage of material to embankments or other areas of fill shall proceed only with sufficient spreading and compaction. Plant is operating at the place of deposition to ensure compliance with Clause 612 of the *Specification for Highway Works*.

No excavated acceptable material or unacceptable material required to be processed, other than surplus to the requirements of the contract, shall be removed from the site.

Where the excavation reveals a combination of acceptable and unacceptable materials, the contractor shall carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. Unless otherwise described in the contract, classes of fill material required to be deposited separately shall be excavated separately without contamination by other classes of material.

The contractor shall make their own arrangements for the stockpiling of acceptable material, and unacceptable material to be processed, and for the provision of site for this purpose.

The contractor shall ensure that they do not adversely affect the stability of excavations or fills by their methods of stockpiling materials, use of plant or siting of temporary buildings or structures.

Topsoil shall, wherever practicable, be used immediately after its stripping and, if not, shall be stored in stockpiles of heights not exceeding 2 m. Topsoil shall not be stockpiled for more than two years. Topsoil shall not be unnecessarily trafficked, either before stripping or when in a stockpile. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

Excavations requiring backfilling shall remain open only for the minimum period necessary.



The contractor shall keep earthworks free of water, including:

- ✳ Arranging the rapid removal of water:
  - shed on to the earthworks; and
  - entering the earthworks from any source;
- ✳ Provide, where necessary, temporary watercourses, drains, pumping and the like;
- ✳ Discharge accumulated water and groundwater into the permanent outfalls of the drainage system where practicable; and
- ✳ Provide adequate means for trapping silt on temporary systems discharging into permanent drainage systems.

The contractor shall carry out and maintain groundwater lowering or other treatment as required.

Where materials are designated either Class U1B or Class U2 (according to the *Specification for Highway Works*), the contractor shall carry out any special requirements for their handling. Where such materials are encountered during the progress of the works, the contractor shall make all necessary arrangements for their safe handling and disposal after consultation with the appropriate environmental authority.

#### **6.4.1. CONSTRUCTION OF FILLS – HIGHWAYS**

All fills shall be constructed:

- ✳ In the locations as shown in the contract drawings to the lines and levels stated therein;
- ✳ Of classes of material complying with this specification;
- ✳ By deposition, as soon as practicable after excavation, in layers to meet the compaction requirements as required for each class of material as specified; and
- ✳ To the requirements of this clause and any other requirements for fill in this specification.

Before commencing work on any area of fill, the contractor shall ensure that:

- ✳ The base is sound and stable by excavating and removing any topsoil as soft subsoil;
- ✳ Base layers are not exposed until the fill layer is ready for placement; and
- ✳ Uncompacted material on the side slopes of previously backfilled zones shall be removed and benches of between 1.0 m and 1.5 m height cut in compacted fill immediately prior to deposition of the new fill to ensure that the new backfill placed against the slope is properly integrated.

Whenever fill is to be placed on surfaces inclined at 1 vertical to 7 horizontal or steeper, the surface shall be benched immediately prior to deposition of the fill in order to achieve horizontal basal surfaces. The benches shall be between 1.0 m and 1.5 m in height.



Areas of fill shall, unless otherwise permitted by the engineer, be constructed evenly over their fullest possible extent and the contractor shall carefully control and direct construction plant and other vehicular traffic uniformly over the area of compacted fill. The minimum plan dimensions of any one panel of backfilling shall be properly integrated with areas of previous backfilling. Damage by construction plant and other vehicular traffic shall be made good by the contractor with material having the same characteristics and strength as the material had before it was damaged.

Temporary slopes within compacted and uncompacted backfill shall be formed at gradients that ensure stability.

#### **6.4.2. CONSTRUCTION OF FILLS – ADOPTED HIGHWAYS, ESTATE ROADS AND CAR PARK**

The contractor shall carry out compaction upon the materials that require to be compacted, as soon as practicable after deposition.

Compaction shall be either method as required for the classes of fill in Table 6/1 that require to be compacted.

The contractor shall obtain permission from the overseeing organisation before carrying out compaction requirements as listed in Table 6/1 for the class of material being compacted.

Method compaction shall be undertaken using the plant and methods appropriate to the compaction requirements as listed in Table 6/1 for the class of material being compacted.

Earth moving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account when assessing the amount of compaction required for any layer.

If more than one class of material is being used in such a way that it is not practicable to define the areas in which each class occurs, the contractor shall compact with plant operating as if only the material which required the greater compaction effort is being compacted.

If the results of field tests show densities that indicate the state of the compaction to be inadequate, then if this is due to failure of the contractor to comply with requirements of the contract, the contractor shall carry out such further work as is required to comply with the contract.

Refer to Clause 612/10 of the *MCHW Specification for Highway Works* for definition of plant to be used in accordance with these specified works.

The contractor will be responsible for assessing the class of fill in accordance with Table 6/1 of the *Specification for Highway Works*. Table 6/4 of the *Specification for Highway Works* should then be employed to assess the method of compaction to be employed. The test results and method statements shall be submitted to the consulting engineers for approval.



### **6.4.3. UNACCEPTABLE MATERIAL**

The contractor is solely responsible for ensuring full and detailed analysis of all reported ground conditions and areas of risk in terms of the potential for unacceptable material to be present within the proposed earthworks. Limitations in the available information should be highlighted to the supervising engineer prior to the commencement of earthworks. The contractor is to make full and unequivocal arrangements to investigate the potential presence of unsuitable materials within the earthworks and construction of highway fill. All unsuitable materials are to be identified for removal in accordance with this specification.

#### **Unacceptable material Class U1A shall be:**

Material which does not comply with the permitted constituents and material properties of MCHW Table 6/1 and contract specific Appendix 6/1 for acceptable material; and;

Material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

-  Peat, materials from swamps, marshes and bogs;
-  Logs, stumps and perishable material;
-  Materials in a frozen condition;
-  Clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65; and,
-  Material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;(ii)unacceptable material

#### **Unacceptable material Class U1B shall be:**

Contaminated materials, including controlled wastes (as defined in the Environmental Protection Act 1990 Part IIA) whose level of contamination is above that given either in contract specific Appendix 6/14 or in contract specific Appendix 6/15, but excluding all hazardous wastes (as Volume 1 Series 600 Specification for Highway Works Earthworks W2 Amendment – February 2016 defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive wastes (as defined in the Radioactive Substances Act 1993).3(02/16).

Unacceptable material Class U2 shall be:(i) hazardous waste (as defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive waste (as defined in the Radioactive Substances Act 1993).4(02/16).

Where required in contract, unacceptable material (other than Class U2) shall be processed by mechanical, chemical or other means to render the material acceptable for use in the permanent works in accordance with the requirements of Table 6/1 and contract specific MCHW Appendix 6/1.



## 6.5. EARTHWORKS MATERIAL TESTS

Prior testing of the potential sources of fill shall be undertaken by the contractor and submitted to the consulting engineers for approval. This testing shall include, but not necessarily be limited to, the compaction and backfill requirements detailed in Table 6.3.

TABLE 6.3 COMPACTION/BACKFILL REQUIREMENTS

| TABLE 6.6<br>COMPACTION/BACKFILL REQUIREMENTS                                                                                                                                                                                                                  |                 | COMPACTION METHODOLOGY and<br>GENERAL PERFORMANCE CRITERIA |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------|
| LAND USE                                                                                                                                                                                                                                                       |                 |                                                            |
| Liquid and Plastic Limits                                                                                                                                                                                                                                      |                 | BS 1377: Part 2                                            |
| Grading                                                                                                                                                                                                                                                        |                 | BS 1377: Part 2                                            |
| Uniformity Coefficient                                                                                                                                                                                                                                         |                 | Calculated from grading curve                              |
| Moisture Content<br>Multi-point moisture condition value (MCV) (to assess optimum moisture content).                                                                                                                                                           |                 | BS 1377: Part 2                                            |
| Organic Matter (Maximum 2.5% Total Organic Content)                                                                                                                                                                                                            |                 | BS 1377: Part 3                                            |
| Water Soluble Sulphate                                                                                                                                                                                                                                         |                 | TRL Report 447 Test No 1                                   |
| Total Sulphate Content                                                                                                                                                                                                                                         |                 | TRL Report 447 Test No 4                                   |
| Earthwork In-situ Tests<br>Subsequent to the filling and compaction of the material, a series of in-situ tests shall be undertaken to confirm the success of the compaction process. This testing shall include, but necessarily be limited to, the following: |                 | Clause 632 (BS 1377: Part 4)                               |
| Test                                                                                                                                                                                                                                                           | Test Method     |                                                            |
| Plate Load Tests (Equivalent CBR of 5%)                                                                                                                                                                                                                        | BS 1377: Part 9 |                                                            |
| Disposal of Materials<br>The contractor shall be responsible for the safe disposal of any excess of unsuitable material found on the site.                                                                                                                     |                 |                                                            |
| Proctor Compaction Testing                                                                                                                                                                                                                                     |                 | BS 1377: Part 4                                            |

## 6.6. SPECIFICATION FOR GROUND IMPROVEMENT BY VIBRO-STONE COLUMN

The over-arching method and specification for the placement and compaction of non-compliant material where the fine constituent (< 0.63 micron) exceeds the standard requirements for ground improvement by VSC is given in Table 6.4 & 6.5.



TABLE 6.4 OVERVIEW OF WORKS OPERATIONS

|        |                                                                                                                                                                                                                                                                                                                                                                               |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <p>Carefully segregate materials excavated during civil engineering works (on site and import) into the following soil types:</p> <ul style="list-style-type: none"> <li>✿ Sand/granular soils;</li> <li>✿ Dry sandy clay;</li> <li>✿ Wet clay soil; and</li> <li>✿ Silt.</li> </ul> <p>Ensure all stockpiles are sealed to minimise water ingress in approved locations.</p> |
| Step 2 | <p>Analyse bulk sample from each (site-won or imported) soil matrix as per the requirements of the E3P specification for:</p> <ul style="list-style-type: none"> <li>✿ Dry density/optimum moisture content (Procter); and</li> <li>✿ Particle size grading coefficient.</li> </ul>                                                                                           |
| Step 3 | <p>On-site observations in conjunction with particle size distribution (PSD) grading will confirm the classification of material and thus the corresponding method for compaction.</p>                                                                                                                                                                                        |
| Step 4 | <p>The dry density/moisture content testing should be used to ensure that the material is within <math>\pm 3\%</math> of the optimum to ensure compaction can be achieved.</p>                                                                                                                                                                                                |
| Step 5 | <p>The classified material should be placed and compacted in accordance with the corresponding method for the material under conditions where the moisture content is within the tolerable limits.</p>                                                                                                                                                                        |
| Step 6 | <p>Once placed and compacted, the required validation testing should be completed at formation to demonstrate compliance.</p> <p>The testing will include:</p> <ul style="list-style-type: none"> <li>✿ In-situ density and air void ratio;</li> <li>✿ Moisture condition value; and</li> <li>✿ Undrained shear strength.</li> </ul>                                          |



TABLE 6.5 COMPACTION AND VALIDATION OF NON-STANDARD MATERIAL BACKFILL TO VSC

| REQUIRED PARAMETERS             |                                                                                                                                                                                                                                                                                                                                                              | THE COMPACTION MUST ACHIEVE THE FOLLOWING MATERIAL PARAMETERS:                                            |  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--|
| Verification Testing and Report | Bulk Density ( $\rho$ )                                                                                                                                                                                                                                                                                                                                      | 95% of the maximum dry density and must be within 3% of the optimum moisture content.                     |  |
|                                 | All materials used for upfilling must be durable and inert.                                                                                                                                                                                                                                                                                                  |                                                                                                           |  |
|                                 | In order to verify that the aforementioned material parameters have been attained, representative sampling and testing must be undertaken. All testing will be in accordance with BS EN ISO 17892-1:2014 and BS EN ISO 17892-2:2014. All testing is to be undertaken by a laboratory with the relevant UKAS accreditation. The following tests are required: |                                                                                                           |  |
|                                 | In-situ Density ( $\rho$ )                                                                                                                                                                                                                                                                                                                                   | Approved methods of in-situ testing (i.e. calibrated nuclear density probe (NDP), sand replacement test). |  |
|                                 | Moisture Content                                                                                                                                                                                                                                                                                                                                             | Moisture content test.                                                                                    |  |
|                                 | In-situ density testing on every 500 m <sup>3</sup> and in each layer of upfill well-spread over site within and around the proposed structures' footprint.                                                                                                                                                                                                  |                                                                                                           |  |
|                                 | Testing must be from a range of depths throughout the treated fill. A minimum of six samples must be taken and tested.                                                                                                                                                                                                                                       |                                                                                                           |  |
|                                 | A drawing depicting the location of each sample and test point must be provided along with a list of each point and the relevant test/sample depth. A list of all geotechnical testing results for each sample and test must be provided along with the relevant test certificates.                                                                          |                                                                                                           |  |
|                                 | If the soils are not suitable, due to the moisture content being higher than the optimum moisture content, then lime modification may also be required.                                                                                                                                                                                                      |                                                                                                           |  |
|                                 | The above is given strictly on the basis that it does not conflict with other elements of the project-specific requirements.                                                                                                                                                                                                                                 |                                                                                                           |  |

## 6.7. CURRENT AND PROPOSED SITE TOPOGRAPHY AND SLOPE INTERACTION

The current and proposed site topography, changes in elevation and any existing or new slopes are beyond the scope of this specification. Where any earth slopes exceed a design gradient of 1(v) in 3(h) either on-site or within the conjectured zone of structural influence, extreme care should be taken with a full and detailed geotechnical slope analysis to inform the retained design solution.



## 7. RECORD-KEEPING AND VERIFICATION

### 7.1. RECORD-KEEPING

During the course of the remediation and site enabling works, the on-site E3P consultant will undertake the following record-keeping protocols:

- ✚ Detailed daily site diary including material movements;
- ✚ Sampling register, testing results, photographs, details of locations of hydrocarbon-impacted soils (drawings), details of hotspot removals, details of consignment notes of any hydrocarbon-impacted material that is required to be disposed of off-site; and
- ✚ Detailed surveys (volumes).

Record-keeping on-site, in particular movements and analysis of specific material types, will be in the form of site diaries and a remediation excavation record. This record will remain on-site and will be completed by the E3P on-site engineer during the course of the remediation and site enabling works.

### 7.2. VERIFICATION

The records listed above will then be compiled into a validation report produced by E3P on completion of the remediation and site enabling works, clearly referencing the origin of the materials used and testing carried out to confirm its suitability for use, where required. E3P will also prepare an as-built development drawing clearly detailing the materials present on-site to be cross referenced with the supporting validation documentation.

The validation report will include the following:

- ✚ Remediation strategy (including copies of confirmation from regulatory authorities agreeing criteria);
- ✚ Detailed surveys of all excavations and production of as-built drawings for the earthworks;
- ✚ Copy of consignment notes relating to the movement of wastes to a licensed waste management facility;
- ✚ Detailed drawings showing all sampling locations for both chemical and geotechnical testing;
- ✚ Chemical test results;
- ✚ Geotechnical test results;
- ✚ Details of qualified persons signed declaration; and
- ✚ Monitoring results if undertaken (e.g. asbestos in air, gas water).



## **8. CONTINGENCY PLAN**

### **8.1. PREVIOUSLY UNIDENTIFIED CONTAMINANTS**

Should significantly impacted material be encountered during the development, then it will be excavated and stockpiled on an impermeable material and sampled and tested for an appropriate range of determinants.

Once the laboratory analysis of the material is available, an assessment will be undertaken to determine whether it can be retained on-site as part of the material management plan or whether it should be disposed of off-site.

Depending on the nature of any such impact, it may be necessary to undertake validation testing of the excavation faces in order to demonstrate that no such materials are left in situ.

Any impacted materials will be stored within a bunded area and any run-off appropriately dealt with and disposed of from site if required.



## 9. SECOND PHASE MITIGATION AND MANAGEMENT – BUILD PHASE

This document details the construction works that are required to ensure full compliance with the remediation Strategy, Regulatory Authorities, Building Control & Warranty Providers;

- ✚ The following should be implemented during the build phase of the development:
- ✚ Laboratory testing of the imported topsoil;
- ✚ Chemical validation of any additional subsoil imported for use within gardens;
- ✚ Placement and validation of sub-soil (clean material) in a 450mm layer within any plots where the material was not placed during the Remediation & Enabling works;
- ✚ Placement and chemical validation of imported topsoil within all gardens; and,
- ✚ Installation and validation of ground gas protection measures.

The validation protocols are presented within the E3P Remediation and Enabling Works Strategy and are presented below.

### 9.1. PLACEMENT OF COVER SYSTEM

The Remediation and Enabling Works Strategy for the site, with respect to human health of the future site users includes the provision of a chemically suitable clean material to be installed in all garden and landscaped areas; the construction of the clean cover / placement of clean material shall consist of:

- ✚ 450 mm subsoil; and,
- ✚ 150 mm topsoil.

In accordance with the current requirements of the regulatory authorities, validation samples will be collected from all materials that are to be imported or re-used on-site to confirm the proposed development will pose no unacceptable risk to human health or the wider environ.

Subsoil and topsoil shall be free of any deleterious materials, such as buildings materials, timber, plastics etc and conform to the requirements of BS 3882:2007.

Initial testing of site won sub-soil to classify its re-use on site has been completed as part of the remediation works undertaken. Therefore, further analysis of sub-soil will be required to achieve the testing frequencies outlined within the remediation strategy and in the event of importation of additional material during construction.

Testing requirements for top-soil and sub-soil are presented in Table 9.1.



TABLE 9.1 SPECIFICATION FOR SOIL TESTING

| MATERIAL USE                                    | TESTING FREQUENCY                | SUITE OF ANALYSIS |
|-------------------------------------------------|----------------------------------|-------------------|
| Subsoil Greenfield Source (450 mm Garden Cover) | 1 Sample per 200 m <sup>3</sup>  | A/B/C/D           |
| Subsoil Brownfield Source (450 mm Garden Cover) | 1 Sample per 50 m <sup>3</sup>   | A/B/C/D           |
| Topsoil Greenfield Source (150 mm Garden Cover) | 1 Sample per 200 m <sup>3</sup>  | A/B/C/D           |
| Topsoil Brownfield Source (150 mm Garden Cover) | 1 Sample per 50 m <sup>3</sup>   | A/B/C/D           |
| General Engineering Fill (Class 1 and 2 Soil)   | 1 Sample per 1000 m <sup>3</sup> | A/B/C/D           |

**Notes**

Suites of Analysis:

- A. Speciated PAH.
- B. Speciated TPH (C5-C35).
- C. Asbestos (ID).
- D. CLEA Inorganic Heavy Metals.

**9.1.1. PROCEDURE FOR PLACEMENT OF CHEMICALLY SUITABLE COVER SYSTEM**

Garden and landscaped areas need to be backfilled with 450mm chemically validated subsoil, with 150mm topsoil overlaying this. Topsoil is required to be confirmed as chemically suitable prior to placement. Where sub-soil is not placed during Remediation & Enabling works, E3P will be required to return to site and undertake independent validation of the correct placement of sub-soil.

The placement of 600 mm of clean material will be undertaken during the build phase works of the project.

The placement of subsoil and corresponding validation will be documented within the Garden Validation Letters (to be issued on completion of the contractor's works).

If proposed utilities are to be placed within the cover system, the clean cover should be placed prior to installation of these utilities.

If natural drift deposits are encountered, excavation can cease here.

E3P will collect photographic evidence of the placement of 150mm of certified topsoil and 450mm of subsoil on completion of construction works. This element will also be checked by the Building Control Officer as part of the site completion prior to issuing of a CML certificate.

The garden validation procedure is detailed in Table 9.2.



TABLE 9.2 GARDEN VALIDATION PROCEEDURE

| PROCEDURE                     | METHOD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Chemical Validation</b>    | <p>Imported sub-soils and topsoil will need to be chemically analysed to confirm suitability for use with the proposed cover system prior to installation and completion of the garden systems.</p> <p>E3P will issue an email to the appropriate party with an assessment of the chemical suitability of both sub soils and top soils.</p> <p>If acceptable the materials can be installed to the required depth at which time the plot will be deemed complete following a validation procedure by a suitability qualified E3P engineer.</p> |
| <b>Trial Holes</b>            | <p>Trial holes are deemed necessary for all plots given that the 600 mm cover system will need to be placed on each plot during the build phase.</p>                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Validation</b>             | <p>Photographic evidence will be taken by E3P of the topsoil placement demonstrating the depth of topsoil and practical completion of works are required for each and every plot.</p> <p>For plots where sub-soil depths require validation by E3P during the build phase, photographs will be taken and collated by E3P.</p>                                                                                                                                                                                                                  |
| <b>Validation Certificate</b> | <p>Once the photographs of the placement of topsoil (over the clean material) have been provided, E3P will issue a plot specific validation certificate to demonstrate that the required subsoil and topsoil has been placed in the required garden plots along with the chemical analysis.</p>                                                                                                                                                                                                                                                |
| <b>Completion Report</b>      | <p>Upon completion of all garden and landscaped areas within the development, a Completion Report will be issued providing the confirmation that all remediation requirements have been achieved.</p>                                                                                                                                                                                                                                                                                                                                          |

Plate 1 provides an example of a garden validation photographs that will be required for each plot.



**PLATE 1**      **EXAMPLE PLOT COVER SYSTEM VALIDATION**

|                                                                                     |           |                                                                                      |
|-------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------|
| <b>Plot No: 70</b>                                                                  |           |                                                                                      |
|                                                                                     | 0.00-0.15 | Validated TOPSOIL                                                                    |
| <b>Depth of Strata (m bgl)</b>                                                      | 0.15-0.60 | Validated SUBSOIL                                                                    |
| <b>Depth of Cover System Materials</b>                                              |           | <b>Depth of Cover System Materials</b>                                               |
|   |           |   |
| <b>Depth of Cover System at Ground Level</b>                                        |           | <b>Depth of Cover System in Relation to Plot</b>                                     |
|  |           |  |



## 9.2. GROUND GAS PROTECTION MEASURES

Ground gas monitoring to date suggests that some areas of the site will fall into the bracket for Characteristic Situation 2 / Amber ½ which will require specialist mitigation measures to be constructed in accordance with BS8485 (2015)+A1(2019). However, the full ground gas regime is yet to be decided as the assessment is ongoing. The complete assessment will be detailed under a ground gas assessment addendum report.

The validation inspection is to include the items that are detailed within Table 9.3.

TABLE 9.3 GROUND GAS MITIGATION MEASURES VALIDATION ITEMS

| INSPECTION                     | METHOD                                                                                                                                                                                                              |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product Verification</b>    | Confirmation that suitable products have been installed to consist of photographs of product types, labels on packaging and delivery tickets.                                                                       |
| <b>Wall Cavity Inspection</b>  | Confirmation that gas membrane spans the external wall cavity above the periscopic vents.                                                                                                                           |
| <b>General Condition</b>       | The membrane is to be inspected to ensure there are no tears, punctures or rips.                                                                                                                                    |
| <b>Jointing</b>                | The engineer is to check the overlaps between membranes are correctly sealed with sufficient overlaps.                                                                                                              |
| <b>Service Entry Points</b>    | Verification of the presence of preformed tophats sealed to the pipe and membrane as per the construction detail.                                                                                                   |
| <b>Passive Venting Systems</b> | The engineer should verify the presence of vents at 2m centres on at least 3 of the external walls. Verification of the stone venting layer and presence of pipes to be supplied by photographic records from site. |

Examples of gas membrane verification photographs provided in Plate 2.

**It should be noted that these are for illustrative purposes only as each site will have a site-specific gas membrane specification.**



PLATE 2 EXAMPLE GAS MEMBRANE VERIFICATION

Plot – 236

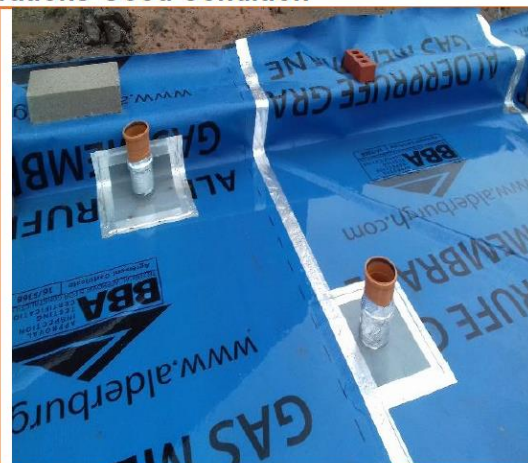
General Condition of Membrane-Good Condition



Verification of Joints and Seals-Good Condition



Verification of Service Penetrations-Good Condition



### 9.3. POTABLE WATER SUPPLY – CONTAMINANT ASSESSMENT CRITERIA

Table 9.4 provides a summary of the threshold concentrations that must not be exceeded within remediated ground at pipeline depth in order to PE pipe works to be acceptable for the proposed development.

TABLE 9.4 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

| Contaminant Group                                                 | PE-threshold |
|-------------------------------------------------------------------|--------------|
| Total VOC                                                         | 0.5          |
| Total BTEX And MTBE                                               | 0.1          |
| Total SVOCs (Excluding PAH and those substances marked with an *) | 2            |
| EC5-EC10 Aliphatic and Aromatic Hydrocarbons                      | 2            |
| EC10-EC16- Aliphatic and Aromatic Hydrocarbons                    | 10           |
| EC16-EC40 Aliphatic and Aromatic Hydrocarbons                     | 500          |
| Phenols (From SVOC Analysis)*                                     | 2            |
| Cresols and Chlorinated Phenols (From SVOC Analysis)              | 2            |
| Ethers*                                                           | 0.5          |
| Nitrobenzene*                                                     | 0.5          |
| Ketones*                                                          | 0.5          |
| Aldehydes*                                                        | 0.5          |
| Amines                                                            | Fail         |

Upon completion of the remedial works a full UKWIR Risk Assessment should be undertaken.

**END OF REPORT**



# APPENDIX I

# LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



# **APPENDIX II**

## **GLOSSARY**

## TERMS

|              |                                                            |                |                                                      |
|--------------|------------------------------------------------------------|----------------|------------------------------------------------------|
| <b>ACM</b>   | Asbestos-containing material                               | <b>MMP</b>     | Materials management plan                            |
| <b>ADS</b>   | Acoustic design statement                                  | <b>ND</b>      | Not detected                                         |
| <b>AST</b>   | Above-ground storage tank                                  | <b>NDP</b>     | Nuclear density probe                                |
| <b>BGS</b>   | British Geological Survey                                  | <b>NMP</b>     | Noise management plan                                |
| <b>BSI</b>   | British Standards Institute                                | <b>NPSE</b>    | Noise policy statement for England                   |
| <b>BTEX</b>  | Benzene, toluene, ethylbenzene, xylenes                    | <b>NR</b>      | Not recorded                                         |
| <b>CA</b>    | Coal Authority                                             | <b>PAH</b>     | Polycyclic aromatic hydrocarbon                      |
| <b>CBR</b>   | California bearing ratio                                   | <b>PCB</b>     | Polychlorinated biphenyl                             |
| <b>CIEH</b>  | Chartered Institute of Environmental Health                | <b>PI</b>      | Plasticity index                                     |
| <b>CIRIA</b> | Construction Industry Research Association                 | <b>PID</b>     | Photo ionisation detector                            |
| <b>CLEA</b>  | Contaminated land exposure assessment                      | <b>POS</b>     | Public open space                                    |
| <b>CML</b>   | Council of Mortgage Lenders                                | <b>PPE</b>     | Personnel protective equipment                       |
| <b>CoC</b>   | Contaminants of concern                                    | <b>ProPG</b>   | Professional practice guidance                       |
| <b>CSM</b>   | Conceptual site model                                      | <b>QA</b>      | Quality assurance                                    |
| <b>DNAPL</b> | Dense non-aqueous phase liquid (chlorinated solvents, PCB) | <b>SGV</b>     | Soil guideline value                                 |
| <b>DWS</b>   | Drinking water standard                                    | <b>SPH</b>     | Separate-phase hydrocarbon                           |
| <b>EA</b>    | Environment Agency                                         | <b>SPT</b>     | Standard penetration test                            |
| <b>EQS</b>   | Environmental quality standard                             | <b>SVOC</b>    | Semi-volatile organic compound                       |
| <b>FFL</b>   | Finished floor level                                       | <b>TPH</b>     | Total and speciated petroleum hydrocarbon            |
| <b>GAC</b>   | General assessment criteria                                | <b>TPH CWG</b> | Total Petroleum Hydrocarbon (Criteria Working Group) |
| <b>GL</b>    | Ground level                                               | <b>UKWIR</b>   | United Kingdom Water Infrastructure Risk             |
| <b>GSV</b>   | Gas screening value                                        | <b>UST</b>     | Underground storage tank                             |
| <b>HCV</b>   | Health criteria value                                      | <b>VCC</b>     | Vibro-concrete column                                |
| <b>ICSM</b>  | Initial conceptual site model                              | <b>VOC</b>     | Volatile organic compound                            |
| <b>LEL</b>   | Lower explosive limit                                      | <b>VRSC</b>    | Vibro-replacement stone columns                      |
| <b>LMRL</b>  | Lower method reporting limit                               | <b>VSC</b>     | Vibro-stone columns                                  |
| <b>LNAPL</b> | Light non-aqueous phase liquid (petrol, diesel, kerosene)  | <b>WHO</b>     | World Health Organisation                            |
| <b>MCV</b>   | Moisture condition value                                   | <b>WRAP</b>    | Waste and Resources Action Programme                 |
| <b>MIBK</b>  | Methyl isobutyl ketone                                     | <b>WTE</b>     | Water table elevation                                |



**Don Street**

Remediation and Enabling Works Strategy

November 2022

|                |                                                            |                         |                                         |
|----------------|------------------------------------------------------------|-------------------------|-----------------------------------------|
| <b>m</b>       | Metres                                                     | <b>ppm</b>              | Parts per million                       |
| <b>km</b>      | Kilometres                                                 | <b>mg/m<sup>3</sup></b> | Milligram per metre cubed               |
| <b>% v/v</b>   | Percent volume in air                                      | <b>m bgl</b>            | Metres below ground level               |
| <b>mb</b>      | Millibars (atmospheric pressure)                           | <b>m bcl</b>            | Metre below cover level                 |
| <b>l/hr</b>    | Litres per hour                                            | <b>mAOD</b>             | Metres above ordnance datum (sea level) |
| <b>µg/l</b>    | Micrograms per litre (parts per billion)                   | <b>kN/m<sup>2</sup></b> | Kilonewtons per metre squared           |
| <b>ppb</b>     | Parts per billion                                          | <b>µm</b>               | Micrometre                              |
| <b>mg/kg</b>   | Milligrams per kilogram (parts per million)                | <b>SSRT</b>             | Site Specific Remediation Target        |
| <b>PSD</b>     | Particle Size Distribution                                 | <b>DD</b>               | Dry Density                             |
| <b>CL:AIRE</b> | Contaminated Land: Applications in Real Environments       | <b>Mc</b>               | Moisture Content                        |
| <b>ρ</b>       | Bulk Density                                               | <b>GPR</b>              | Ground Penetrating Radar                |
| <b>NDP</b>     | Nuclear Density Probe                                      | <b>FFL</b>              | Finished Floor Level                    |
| <b>LEL</b>     | Lower Explosive Limit                                      | <b>UKWIR</b>            | UK Water Industry Research              |
| <b>CIRIA</b>   | Construction Industry Research and Information Association | <b>LOD</b>              | Limit of Detection                      |



# **APPENDIX III**

## **DRAWINGS**

# **APPENDIX IV E3P REMEDIATION/ VALIDATION CRITERIA**

## IV.1 HUMAN HEALTH REMEDIATION TARGETS – LOW-RISE RESIDENTIAL END USE

| DETERMINAND                                      | UNITS | WITHIN AN ALLOTMENT | WITHIN 600 mm COVER SYSTEM (GARDEN) | HARD STANDING AND >600 mm OF COVER | PUBLIC OPEN SPACE 300 mm COVER | PUBLIC OPEN SPACE > 300 mm  | PATH -WAY |
|--------------------------------------------------|-------|---------------------|-------------------------------------|------------------------------------|--------------------------------|-----------------------------|-----------|
| Arsenic                                          | mg/kg | 43                  | 37 <sup>(i)</sup>                   | 40 <sup>(ii)</sup>                 | 79 <sup>(iii)</sup>            | 640 <sup>(iv)</sup>         | 1         |
| Cadmium                                          | mg/kg | 1.9                 | 11 <sup>(i)</sup>                   | 85 <sup>(ii)</sup>                 | 120 <sup>(iii)</sup>           | 532 <sup>(iv)</sup>         | 1         |
| Chromium (Hexavalent)                            | mg/kg | 1.8                 | 6 <sup>(i)</sup>                    | 6 <sup>(ii)</sup>                  | 7.7 <sup>(iii)</sup>           | 220 <sup>(iv)</sup>         | 1         |
| Lead                                             | mg/kg | 200                 | 210 <sup>(vi)</sup>                 | 330 <sup>(vii)</sup>               | 760 <sup>(viii)</sup>          | 760 <sup>(viii)</sup>       | 1         |
| Elemental Mercury                                | mg/kg | 21                  | 1.2 <sup>(i)</sup>                  | 1.2 <sup>(ii)</sup>                | 16 <sup>(iii)</sup>            | 30 <sup>(iv)</sup>          | 2         |
| Nickel                                           | mg/kg | 53                  | 180 <sup>(i)</sup>                  | 180 <sup>(ii)</sup>                | 230 <sup>(iii)</sup>           | 3400 <sup>(iv)</sup>        | 1         |
| Selenium                                         | mg/kg | 88                  | 250 <sup>(i)</sup>                  | 430 <sup>(ii)</sup>                | 1100 <sup>(iii)</sup>          | 1800 <sup>(iv)</sup>        | 1         |
| Copper                                           | mg/kg | 520                 | 2400 <sup>(i)</sup>                 | 7100 <sup>(ii)</sup>               | 12,000 <sup>(iii)</sup>        | 44,000 <sup>(iv)</sup>      | 1         |
| Zinc                                             | mg/kg | 620                 | 3700 <sup>(i)</sup>                 | 40,000 <sup>(ii)</sup>             | 81,000 <sup>(iii)</sup>        | 170,000 <sup>(iv)</sup>     | 1         |
| Phenol                                           | mg/kg | 210                 | 280 <sup>(i)(xi)</sup>              | 280 <sup>(xiv)(xi)</sup>           | 760 <sup>(iii)(xi)</sup>       | 760 <sup>(iv)(xi)</sup>     | 2         |
| Naphthalene                                      | mg/kg | 4.1                 | 2.3 <sup>(i)(xi)</sup>              | 2.3 <sup>(xiv)(xi)</sup>           | 1200 <sup>(iv)(xi)</sup>       | 1200 <sup>(iv)(xi)</sup>    | 2         |
| Acenaphthylene                                   | mg/kg | 28                  | 170 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 15,000 <sup>(iii)(xi)</sup>    | 29,000 <sup>(iv)(xi)</sup>  | 3         |
| Acenaphthene                                     | mg/kg | 34                  | 210 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 15,000 <sup>(iii)(xi)</sup>    | 29,000 <sup>(iv)(xi)</sup>  | 1         |
| Fluorene                                         | mg/kg | 27                  | 170 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 9900 <sup>(iii)(xi)</sup>      | 20,000 <sup>(iv)(xi)</sup>  | 1         |
| Phenanthrene                                     | mg/kg | 15                  | 95 <sup>(i)(xi)</sup>               | 500 <sup>(v)</sup>                 | 3100 <sup>(iii)(xi)</sup>      | 6200 <sup>(iv)(xi)</sup>    | 3         |
| Anthracene                                       | mg/kg | 380                 | 500 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 74,000 <sup>(iii)(xi)</sup>    | 150,000 <sup>(iv)(xi)</sup> | 3         |
| Fluoranthene                                     | mg/kg | 52                  | 280 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 3100 <sup>(iii)(xi)</sup>      | 6300 <sup>(iv)(xi)</sup>    | 3         |
| Pyrene                                           | mg/kg | 110                 | 500 <sup>(i)(xi)</sup>              | 500 <sup>(v)</sup>                 | 7400 <sup>(iii)(xi)</sup>      | 15,000 <sup>(iv)(xi)</sup>  | 3         |
| Benzo(a)Anthracene                               | mg/kg | 2.9                 | 7.2 <sup>(i)(xi)</sup>              | 11 <sup>(ii)(xi)</sup>             | 29 <sup>(iii)(xi)</sup>        | 49 <sup>(iv)(xi)</sup>      | 3         |
| Chrysene                                         | mg/kg | 4.1                 | 15 <sup>(i)(xi)</sup>               | 30 <sup>(ii)(xi)</sup>             | 57 <sup>(iii)(xi)</sup>        | 93 <sup>(iv)(xi)</sup>      | 3         |
| Benzo(b)Fluoranthene                             | mg/kg | 0.99                | 2.6 <sup>(i)(xi)</sup>              | 3.9 <sup>(ii)(xi)</sup>            | 7.1 <sup>(iii)(xi)</sup>       | 13 <sup>(iv)(xi)</sup>      | 3         |
| Benzo(k)Fluoranthene                             | mg/kg | 37                  | 77 <sup>(i)(xi)</sup>               | 110 <sup>(ii)(xi)</sup>            | 190 <sup>(iii)(xi)</sup>       | 370 <sup>(iv)(xi)</sup>     | 3         |
| Benzo(a)Pyrene                                   | mg/kg | 0.97                | 2.2 <sup>(i)(xi)</sup>              | 3.2 <sup>(ii)(xi)</sup>            | 5.7 <sup>(iii)(xi)</sup>       | 11 <sup>(iv)(xi)</sup>      | 3         |
| Indeno(123-cd)Pyrene                             | mg/kg | 9.5                 | 27 <sup>(i)(xi)</sup>               | 45 <sup>(ii)(xi)</sup>             | 82 <sup>(iii)(xi)</sup>        | 150 <sup>(iv)(xi)</sup>     | 3         |
| Dibenzo(a,h)Anthracene                           | mg/kg | 0.14                | 0.24 <sup>(i)(xi)</sup>             | 0.31 <sup>(ii)(xi)</sup>           | 0.57 <sup>(iii)(xi)</sup>      | 1.1 <sup>(iv)(xi)</sup>     | 3         |
| Benzo(ghi)Perylene                               | mg/kg | 290                 | 320 <sup>(i)(xi)</sup>              | 360 <sup>(ii)(xi)</sup>            | 640 <sup>(iii)(xi)</sup>       | 1400 <sup>(iv)(xi)</sup>    | 3         |
| TPH C <sub>5</sub> -C <sub>6</sub> (aliphatic)   | mg/kg | 730                 | 42 <sup>(i)(xi)</sup>               | 42 <sup>(ii)(xi)</sup>             | 42 <sup>(iii)(xi)</sup>        | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>6</sub> -C <sub>8</sub> (aliphatic)   | mg/kg | 2300                | 100 <sup>(i)(xi)</sup>              | 100 <sup>(ii)(xi)</sup>            | 100 <sup>(iii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>8</sub> -C <sub>10</sub> (aliphatic)  | mg/kg | 320                 | 27 <sup>(i)(xi)</sup>               | 27 <sup>(ii)(xi)</sup>             | 27 <sup>(iii)(xi)</sup>        | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>10</sub> -C <sub>12</sub> (aliphatic) | mg/kg | 2200                | 130 <sup>(i)(xi)</sup>              | 130 <sup>(ii)(xi)</sup>            | 130 <sup>(iii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>12</sub> -C <sub>16</sub> (aliphatic) | mg/kg | 11000               | 1000 <sup>(xiv)(xi)</sup>           | 1000 <sup>(xiv)(xi)</sup>          | 1000 <sup>(xiv)(xi)</sup>      | 10,000 <sup>(xiv)(xi)</sup> | 1         |
| TPH C <sub>16</sub> -C <sub>21</sub> (aliphatic) | mg/kg | 260000              | 1000 <sup>(xiv)(xi)</sup>           | 1000 <sup>(xiv)(xi)</sup>          | 1000 <sup>(xiv)(xi)</sup>      | 10,000 <sup>(xiv)(xi)</sup> | 1         |
| TPH C <sub>21</sub> -C <sub>35</sub> (aliphatic) | mg/kg |                     |                                     |                                    |                                |                             | 1         |
| TPH C <sub>5</sub> -C <sub>7</sub> (aromatic)    | mg/kg | 13                  | 70 <sup>(i)(xi)</sup>               | 370 <sup>(ii)(xi)</sup>            | 370 <sup>(iii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>7</sub> -C <sub>8</sub> (aromatic)    | mg/kg | 22                  | 130 <sup>(i)(xi)</sup>              | 860 <sup>(ii)(xi)</sup>            | 860 <sup>(iii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>8</sub> -C <sub>10</sub> (aromatic)   | mg/kg | 8.6                 | 34 <sup>(i)(xi)</sup>               | 47 <sup>(ii)(xi)</sup>             | 47 <sup>(iii)(xi)</sup>        | 10,000 <sup>(xiv)(xi)</sup> | 2         |
| TPH C <sub>10</sub> -C <sub>12</sub> (aromatic)  | mg/kg | 13                  | 74 <sup>(i)(xi)</sup>               | 250 <sup>(ii)(xi)</sup>            | 250 <sup>(iii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 2         |



## Don Street

### Remediation and Enabling Works Strategy

November 2022

| DETERMINAND                                     | UNITS                    | WITHIN AN ALLOTMENT | WITHIN 600 mm COVER SYSTEM (GARDEN) | HARD STANDING AND >600 mm OF COVER | PUBLIC OPEN SPACE 300 mm COVER | PUBLIC OPEN SPACE > 300 mm  | PATH -WAY |
|-------------------------------------------------|--------------------------|---------------------|-------------------------------------|------------------------------------|--------------------------------|-----------------------------|-----------|
| TPH C <sub>12</sub> -C <sub>16</sub> (aromatic) | mg/kg                    | 23                  | 140 <sup>(i)(xi)</sup>              | 1000 <sup>(ii)(xi)</sup>           | 1800 <sup>(ii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 1         |
| TPH C <sub>16</sub> -C <sub>21</sub> (aromatic) | mg/kg                    | 46                  | 260 <sup>(i)(xi)</sup>              | 1000 <sup>(ii)(xi)</sup>           | 1900 <sup>(ii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 1         |
| TPH C <sub>21</sub> -C <sub>35</sub> (aromatic) | mg/kg                    | 370                 | 1000 <sup>(xiv)(xi)</sup>           | 1000 <sup>(ii)(xi)</sup>           | 1900 <sup>(ii)(xi)</sup>       | 10,000 <sup>(xiv)(xi)</sup> | 1         |
| Asbestos                                        | Fibres Volume Weight (%) | NFD                 | NFD                                 | 0.001%                             | NFD                            | 0.001                       | 4         |

#### Notes 1

NFD = No Fibres Detected

Asbestos will be screened visually on site by a qualified environmental consultant and where potential ACM is identified, representative samples will be subject to quantitative analysis of % volume by weight.

Should any ACM be identified within the soil matrices, further detailed % assessment would be required when the reported laboratory result exceeds the limit of detection for the analytical method at 0.01% by volume (weight).

#### Notes 2

Excludes matrices where free product is observed.

No viable exposure pathway beneath hardstanding and cover system.

#### Notes 3

Main exposure pathways: 1 = soil ingestion, 2 = vapour inhalation (indoor), 3 = dermal contact and ingestion, 4 = dust inhalation.

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration, N/A = Not Applicable (no exceedance of assessment criteria), Loc of MC = location of exceedances.

- i. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use with plant uptake.
- ii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use without plant uptake – these levels used below 600 mm cover system within residential gardens as soils will be present within a residential setting yet soils will not be disturbed and garden plants will not reach these soils.
- iii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for public open space (POS) residential.
- iv. Value derived from LQM Sutable 4 Use Levels (S4ULs) for public open space (POS) park – these levels used below 300 mm POS cover system as soils will not be disturbed by any future site users and exposure to these soils will be similar to a park end use.
- v. Value derived from LQM Sutable 4 Use Levels (S4ULs) alongside assessment with WM3 to ensure that materials remaining on site do not exceed the WM3 toxicity criteria for hazardous waste.
- vi. Value derived from Category 4 Screening Levels (C4SL) for residential land use with homegrown produce.
- vii. Value derived from Category 4 Screening Levels (C4SL) for residential land use without homegrown produce.
- viii. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) residential.
- ix. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) park.
- x. Mercury – based on elemental mercury.
- xi. PAH and TPH levels used are for 1% SOM.
- xii. Xylenes based on p-xylene (o-xylene 2600 mg/kg, m-xylene 3500 mg/kg) and is capped by its solubility.
- xiii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use with plant uptake due to the volatilisation risk.
- xiv. BTEX is not SOM-related due to inhalation pathway.



## IV.2 REMEDIATION TARGETS – SURFACE WATER ANALYSIS

| DETERMINAND               | UNIT | EQS<br>SCREENING<br>VALUE <sup>1, 2, 3, 4</sup> | DWS<br><sup>4, 5, 6</sup> |
|---------------------------|------|-------------------------------------------------|---------------------------|
|                           |      | AA                                              |                           |
| Arsenic                   | µg/l | 50                                              | 10                        |
| Cadmium                   | µg/l | 0.08-0.25                                       | 5                         |
| Chromium (VI)             | µg/l | 3.4                                             | –                         |
| Chromium (III)            | µg/l | 4.7                                             | 50                        |
| Copper                    | µg/l | 1                                               | 2000                      |
| Total Cyanide             | µg/l | 1                                               | 50                        |
| Lead                      | µg/l | 1.2                                             | 10                        |
| Mercury                   | µg/l | –                                               | 1.0                       |
| Nickel                    | µg/l | 4                                               | 20                        |
| Selenium                  | µg/l | –                                               | 10                        |
| Zinc                      | µg/l | 10.9                                            | –                         |
| pH                        |      | 6–9                                             |                           |
| Naphthalene               | µg/l | 2                                               | 10*                       |
| Anthracene                | µg/l | 0.1                                             |                           |
| Benzo[b]fluoranthene      | µg/l | 0.00017*                                        |                           |
| Benzo[k]fluoranthene      | µg/l | 0.00017*                                        |                           |
| Benzo(a)pyrene            | µg/l | 0.00017*                                        |                           |
| Indeno(123-cd)pyrene      | µg/l | 0.00017*                                        |                           |
| Benzo(ghi)pyrene          | µg/l | 0.00017*                                        |                           |
| Fluoranthene              | µg/l | 0.0063                                          |                           |
| Benzo(ghi)perylene        | µg/l | 1.7–4                                           |                           |
| TPH C5-C7 (benzene)       | µg/l | 10                                              | 1                         |
| TPH C7-C8 (toluene)       | µg/l | 74                                              | 700                       |
| TPH C8-C10 (xylene)       | µg/l | 30                                              | 300                       |
| TPH C10-C12 (naphthalene) | µg/l | 2                                               | 90 <sup>5</sup>           |
| TPH C12-C16               | µg/l | –                                               | 90 <sup>5</sup>           |
| TPH C16-C35               | µg/l | –                                               | 90 <sup>5</sup>           |
| TPH C5-C6                 | µg/l | –                                               | 1000 <sup>6</sup>         |
| TPH C6-C8                 | µg/l | –                                               | 1000 <sup>6</sup>         |
| TPH C8-C10                | µg/l | –                                               | 300                       |
| TPH C10-C12               | µg/l | –                                               | 300                       |
| TPH C12-C16               | µg/l | –                                               | 300                       |



| DETERMINAND          | UNIT | EQS<br>SCREENING<br>VALUE <sup>1, 2, 3, 4</sup> | DWS <sup>4, 5, 6</sup> |
|----------------------|------|-------------------------------------------------|------------------------|
|                      |      | AA                                              |                        |
| TPH C16 – C21        | µg/l | –                                               | 300**                  |
| TPH C21-C35          | µg/l | –                                               | 300**                  |
| Tetrachloroethylene  | µg/l | 0.4                                             | 10                     |
| Trichloroethylene    | µg/l | 10                                              | 10                     |
| Trichlorobenzene     | µg/l | 0.4                                             | –                      |
| Trichloromethane     | µg/l | 2.5                                             | –                      |
| Dichloromethane      | µg/l | 20                                              | 200                    |
| Carbon Tetrachloride | µg/l | 12                                              | 3                      |
| Vinyl Chloride       | µg/l | –                                               | 0.3                    |

#### Notes

# Solubility <0.01µg/l

AA – Annual Average

\* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

\*\* There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. The Water Supply (Water Quality) Regulations 2018
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. CL:AIRE Petroleum Hydrocarbons in Groundwater 2017
5. WHO Guidelines for Drinking Water Quality. Fourth edition
6. A total TPH criteria of 1000 mg/kg will act as a surrogate criteria for remaining aliphatic and aromatic TPH fractions.



## IV.3 SITE SPECIFIC END OF WASTE CRITERIA

| DETERMINAND                                      | UNITS  | GAC     | PATHWAY |
|--------------------------------------------------|--------|---------|---------|
| Arsenic                                          | mg/kg  | 640     | 1       |
| Cadmium                                          | mg/kg  | 190     | 1       |
| Chromium (VI)                                    | mg/kg  | 6       | 1       |
| Lead                                             | mg/kg  | 1100    | 1       |
| Mercury                                          | mg/kg  | 58      | 2       |
| Nickel                                           | mg/kg  | 980     | 1       |
| Selenium                                         | mg/kg  | 12000   | 1       |
| Copper                                           | mg/kg  | 68000   | 1       |
| Zinc                                             | mg/kg  | 730000  | 1       |
| Cyanide - Total                                  | mg/kg  | 791     | 1       |
| Phenols - Total.                                 | mg/kg  | 210     | 1       |
| Asbestos                                         | Fibres | <0.001% | 4       |
| Naphthalene                                      | mg/kg  | 2.3     | 3       |
| Acenaphthylene                                   | mg/kg  | 83000   | 2       |
| Acenaphthene                                     | mg/kg  | 84000   | 1       |
| Fluorene                                         | mg/kg  | 63000   | 1       |
| Phenanthrene                                     | mg/kg  | 22000   | 2       |
| Anthracene                                       | mg/kg  | 520000  | 2       |
| Fluoranthene                                     | mg/kg  | 23000   | 2       |
| Pyrene                                           | mg/kg  | 54000   | 2       |
| Benzo(a)Anthracene                               | mg/kg  | 170     | 2       |
| Chrysene                                         | mg/kg  | 350     | 2       |
| Benzo(b)Fluoranthene                             | mg/kg  | 44      | 2       |
| Benzo(k)Fluoranthene                             | mg/kg  | 1200    | 2       |
| Benzo(a)Pyrene                                   | mg/kg  | 35      | 2       |
| Indeno(123-cd)Pyrene                             | mg/kg  | 500     | 2       |
| Dibenzo(a,h)Anthracene                           | mg/kg  | 3.5     | 2       |
| Benzo(ghi)Perylene                               | mg/kg  | 3900    | 2       |
| TPH C <sub>5</sub> -C <sub>6</sub> (aliphatic)   | mg/kg  | 42      | 3       |
| TPH C <sub>6</sub> -C <sub>8</sub> (aliphatic)   | mg/kg  | 100     | 3       |
| TPH C <sub>8</sub> -C <sub>10</sub> (aliphatic)  | mg/kg  | 27      | 3       |
| TPH C <sub>10</sub> -C <sub>12</sub> (aliphatic) | mg/kg  | 13      | 3       |
| TPH C <sub>12</sub> -C <sub>16</sub> (aliphatic) | mg/kg  | 1000    | 1       |
| TPH C <sub>16</sub> -C <sub>21</sub> (aliphatic) | mg/kg  | 1000    | 1       |
| TPH C <sub>21</sub> -C <sub>35</sub> (aliphatic) | mg/kg  |         | 1       |
| TPH C <sub>5</sub> -C <sub>7</sub> (aromatic)    | mg/kg  | 370     | 3       |
| TPH C <sub>7</sub> -C <sub>8</sub> (aromatic)    | mg/kg  | 860     | 3       |
| TPH C <sub>8</sub> -C <sub>10</sub> (aromatic)   | mg/kg  | 47      | 3       |
| TPH C <sub>10</sub> -C <sub>12</sub> (aromatic)  | mg/kg  | 250     | 3       |
| TPH C <sub>12</sub> -C <sub>16</sub> (aromatic)  | mg/kg  | 1000    | 1       |
| TPH C <sub>16</sub> -C <sub>21</sub> (aromatic)  | mg/kg  | 1000    | 1       |
| TPH C <sub>21</sub> -C <sub>35</sub> (aromatic)  | mg/kg  | 1000    | 3       |
| TPH C <sub>5</sub> -C <sub>6</sub> (aliphatic)   | mg/kg  | 42      | 3       |
| TPH C <sub>6</sub> -C <sub>8</sub> (aliphatic)   | mg/kg  | 100     | 3       |
| TPH C <sub>8</sub> -C <sub>10</sub> (aliphatic)  | mg/kg  | 27      | 3       |
| TPH C <sub>10</sub> -C <sub>12</sub> (aliphatic) | mg/kg  | 130     | 3       |
| TPH C <sub>12</sub> -C <sub>16</sub> (aliphatic) | mg/kg  | 1000    | 1       |
| TPH C <sub>16</sub> -C <sub>21</sub> (aliphatic) | mg/kg  | 1000    | 1       |



## Don Street

### Remediation and Enabling Works Strategy

November 2022

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#### . Notes

Main Exposure Pathways: 1 = Soil Ingestion, 2 = Dermal Contact & Ingestion, 3 = Vapour Inhalation (indoor), 4 = Dust Inhalation.  
Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance; NFD = No Fibres Detected

\* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi volatile fractions (C<sub>5</sub>-C<sub>12</sub>) and the Tier 1 values for aromatic compound for the non-volatile fractions (C<sub>12</sub>-C<sub>35</sub>). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.



#### IV.4 LEVEL 3 REMEDIAL TARGET CONCENTRATIONS FOR THE FORMER LANDFILL AREA WITH RESPECT TO CONTROLLED WATERS

| Contaminant   | Level 3 Remedial Target Concentration |                   |
|---------------|---------------------------------------|-------------------|
|               | Soils (mg/kg)                         | Leachate (mg/l)   |
| Arsenic       | 9460                                  | 18.9 (18900 ug/l) |
| Copper        | 189                                   | 0.378 (378 ug/l)  |
| Total Cyanide | 189                                   | 0.378 (378 ug/l)  |
| Mercury       | 189                                   | 0.378 (378 ug/l)  |
| Lead          | 227                                   | 0.454 (454 ug/l)  |
| Zinc          | 2060                                  | 4.12 (4120 ug/l)  |
| Naphthalene   | 36.3                                  | 0.883 (883 ug/l)  |



# **APPENDIX V**

## **E3P MATERIAL IMPORT CRITERIA**

|                                                                                          |                                                                                                               |                                                                                                                                                                              |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SITE OF IMPORTATION ADDRESS</b>                                                       |                                                                                                               | <b>E3P</b><br>+44 (0) 161 707 9612<br><a href="mailto:info@e3p.co.uk">info@e3p.co.uk</a>  |
| <b>Client</b>                                                                            |                                                                                                               |                                                                                                                                                                              |
| <b>Main Contractor</b>                                                                   |                                                                                                               |                                                                                                                                                                              |
| <b>Earthworks Contractor</b>                                                             |                                                                                                               |                                                                                                                                                                              |
| <b>Haulier</b>                                                                           |                                                                                                               |                                                                                                                                                                              |
| <b>Date of Planned Import</b>                                                            |                                                                                                               |                                                                                                                                                                              |
| <b>Overview of Planned Material Import</b>                                               |                                                                                                               |                                                                                                                                                                              |
| <b>Material Source (Site of Origin) and Postcode</b>                                     |                                                                                                               |                                                                                                                                                                              |
| <b>Site Investigation Report</b>                                                         | <b>Report Title and Reference:</b><br><b>Date:</b><br><b>Information Supplied By:</b>                         |                                                                                                                                                                              |
| <b>Reason for Generation of Excess Material at Site of Origin</b>                        |                                                                                                               |                                                                                                                                                                              |
| <b>Chemical Test Results for Stockpile at Site of Origin</b>                             | <b>Date:</b><br><b>Laboratory Certificate Ref:</b><br><b>Organisation Responsible for Stockpile Sampling:</b> |                                                                                                                                                                              |
| <b>Geotechnical Material Classification and Testing</b>                                  | <b>Delete as Appropriate:</b> Class 1 / Class 2 / Class 6 / Topsoil                                           |                                                                                                                                                                              |
| <b>Pictures of Material Stockpile Pending Transportation</b>                             | <b>Delete as Appropriate:</b> Yes / No                                                                        |                                                                                                                                                                              |
| <b>Person or Organisation Responsible for Ensuring Quality Control at Site of Origin</b> |                                                                                                               |                                                                                                                                                                              |
| <b>Quantity of Material to Be Imported (m<sup>3</sup>)</b>                               |                                                                                                               |                                                                                                                                                                              |
| <b>Proposed Area of Deposition (Site of Reuse)</b>                                       |                                                                                                               |                                                                                                                                                                              |
| <b>Waste Exemption/Permit or CL:AIRE MMP</b>                                             |                                                                                                               | <b>Delete as Appropriate:</b> U1 Standard Rules / CL:AIRE MMP (Direct Transfer) / Bespoke                                                                                    |



# **APPENDIX VI CONTRACTOR PRE- COMMENCEMENT CHECK SHEET**

## GEOTECHNICAL ENABLING WORKS PRE-START FORM

Prior to the commencement of any site remediation or enabling works, this form will be completed by E3P, in the presence of the appointed contractor, to ensure that all pertinent remediation and enabling works activities are fully discussed and understood.

| Activity                                                                                                                   | Testing Responsibility | Contractors Method Statement Required (Y/N) | Comment/Action                                  |
|----------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------|-------------------------------------------------|
| Deployment of Environmental Permit                                                                                         |                        |                                             | Ref No:                                         |
| Deployment of LAPC Part B – Mobile Plant Permit                                                                            |                        |                                             | Ref No:                                         |
| CL:AIRE MMP and Qualified Person Declaration                                                                               |                        |                                             | Ref No:                                         |
| Identification of All Invasive Plant Species and Production of Eradication Plan with Appropriate Supervision by Specialist |                        |                                             | Appointed specialist:                           |
| Removal of All Vegetation                                                                                                  |                        |                                             | Note disposal location:                         |
| Removal of All Root Bulbs and Root Networks                                                                                |                        |                                             | Note disposal location:                         |
| Identification of Contamination Hotspots, Removal of Material and Stockpile                                                |                        |                                             | Rationale:                                      |
| Legislatively Compliant Procedure to Deal with Contamination Excavated from Hotspot                                        |                        |                                             | Rationale:                                      |
| Processing and Recycling of Aggregate with Geotechnical and Chemical Validation Testing                                    |                        |                                             | Note stockpile location and anticipated volume: |
| Stockpiling of Subsoil and Certification of Suitability for Reuse                                                          |                        |                                             | Stockpile location:                             |
| Decommission of All Redundant Drainage Infrastructure                                                                      |                        |                                             |                                                 |
| Decommission of All Former Interceptors                                                                                    |                        |                                             |                                                 |
| Decommission of All Former Above- and Below-Ground Tanks                                                                   |                        |                                             |                                                 |
| Removal of All Asbestos to a Licensed Facility                                                                             |                        |                                             |                                                 |
| Engineering of Plots for Shallow Spread Foundation in Accordance with E3P Geotechnical Specification                       |                        |                                             | Plot Numbers                                    |



**Don Street**

Remediation and Enabling Works Strategy

October 2022

| Activity                                                                                                   | Testing Responsibility | Contractors Method Statement Required (Y/N) | Comment/Action                |
|------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------|-------------------------------|
| Engineering of Plots for VSC in Accordance with E3P Geotechnical Specification                             |                        |                                             | Plot Numbers.                 |
| Engineering of Plots for Pile Foundation in Accordance with E3P Geotechnical Specification                 |                        |                                             | Plot Numbers                  |
| Engineering of Plots for Raft Foundation in Accordance with E3P Geotechnical Specification                 |                        |                                             | Plot Numbers                  |
| Stockpiling of Topsoil and Certification of Suitability for Reuse                                          |                        |                                             | Stockpile location            |
| Engineering of Highways Bulk Upfill in Accordance with E3P Specification with Compliant Validation Testing |                        |                                             | Upfill specification          |
| Engineering of Highways Subgrade in Accordance with E3P Specification with Compliant Validation Testing    |                        |                                             | Upfill specification          |
| Engineering of Highways Capping in Accordance with E3P Specification with Compliant Validation Testing     |                        |                                             | Upfill specification          |
| Cut-and-Fill the Development Site to Clients' Required Elevation with As-Built Survey                      |                        |                                             | Required formation elevations |



# **APPENDIX VII CONTRACTOR COMPLETION CHECK SHEET**

## GEOTECHNICAL ENABLING WORKS COMPLETION FORM

Upon completion of all site remediation and enabling works, this form will be completed by E3P, in the presence of the appointed contractor, to ensure that all pertinent geotechnical enabling works activities are complete or, where a deviation from the specification has occurred, all future limitations and issues are documented for the client's records.

| Activity                                                                                                   | Complete |    |     | Signature |
|------------------------------------------------------------------------------------------------------------|----------|----|-----|-----------|
|                                                                                                            | Yes      | No | N/A | (initial) |
| Eradication of all invasive plant species                                                                  |          |    |     |           |
| Removal of all vegetation                                                                                  |          |    |     |           |
| Removal of all root bulbs and root networks                                                                |          |    |     |           |
| Stockpiling of topsoil and certification of suitability for reuse                                          |          |    |     |           |
| Stockpiling of subsoil and certification of suitability for reuse                                          |          |    |     |           |
| Stockpile all recycled aggregate with geotechnical and chemical validation testing                         |          |    |     |           |
| Removal of all relict foundations and infrastructure in their entirety                                     |          |    |     |           |
| Decommission of all redundant drainage infrastructure                                                      |          |    |     |           |
| Decommission of all former interceptors                                                                    |          |    |     |           |
| Decommission of all former above- and below-ground tanks                                                   |          |    |     |           |
| Removal of all waste materials to a licensed facility                                                      |          |    |     |           |
| Removal of all asbestos to a licensed facility                                                             |          |    |     |           |
| Engineering of all plots for shallow spread foundation in accordance with E3P Geotechnical Specification   |          |    |     |           |
| Engineering of all plots for VSC in accordance with E3P Geotechnical Specification                         |          |    |     |           |
| Engineering of all plots for pile foundation in accordance with E3P Geotechnical Specification             |          |    |     |           |
| Engineering of all plots for raft foundation in accordance with E3P Geotechnical Specification             |          |    |     |           |
| Engineering of highways bulk upfill in accordance with E3P Specification with compliant validation testing |          |    |     |           |
| Engineering of highways subgrade in accordance with E3P Specification with compliant validation testing    |          |    |     |           |
| Engineering of highways capping in accordance with E3P Specification with compliant validation testing     |          |    |     |           |
| Cut-and-fill the development site to client's required elevation with as-built survey                      |          |    |     |           |



## **POST-REMEDIATION AND ENABLING LIMITATIONS**

All and every deviation from the approved specification for works should be documented by the remediation and enabling works contractor below.



# **APPENDIX VIII**

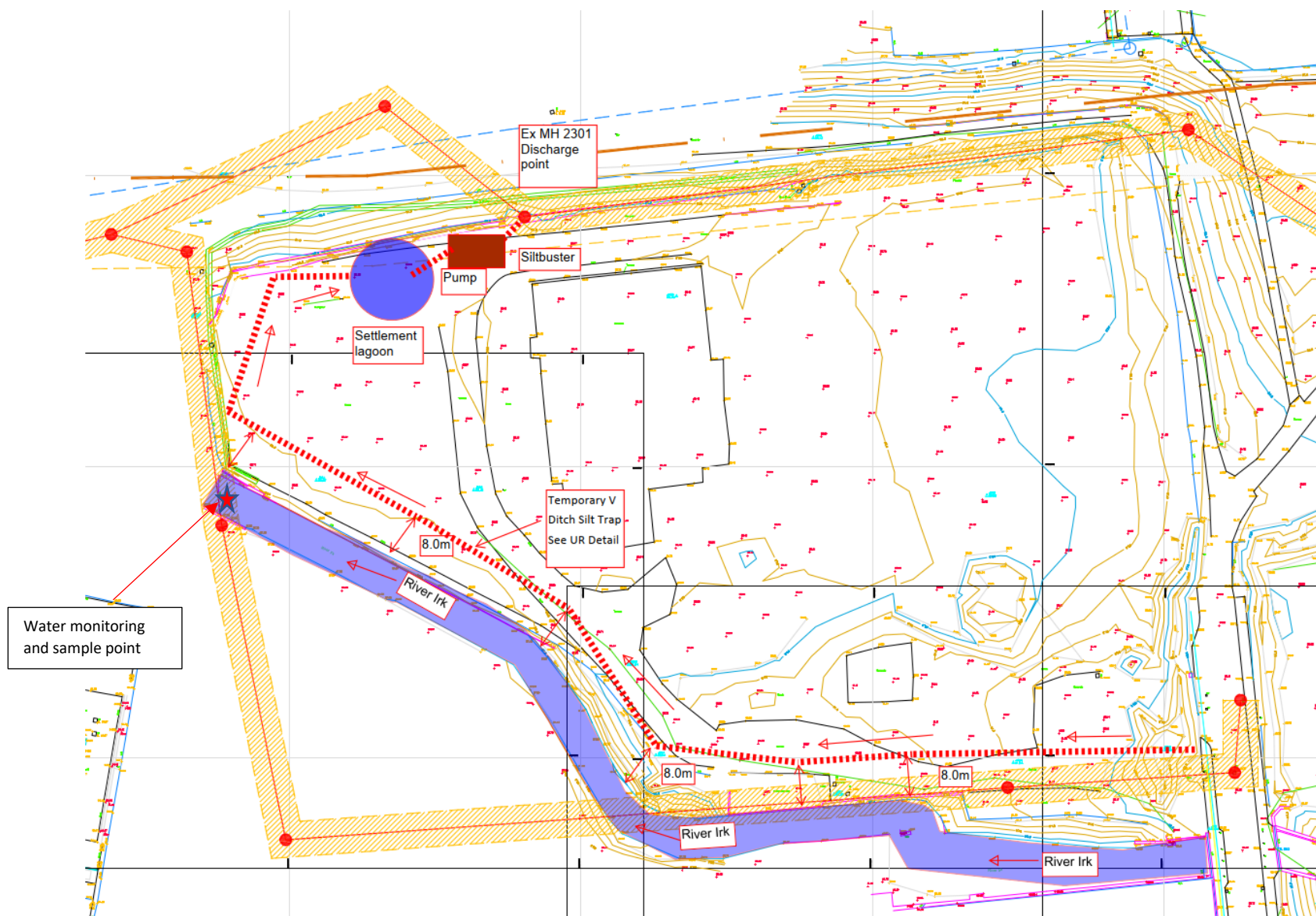
# **DEWATERING PLAN**

## Notes

Any redundant outfalls identified during V ditch excavation shall be stoppered up to prevent discharge to River Irk.

Discharge points subject to UU formal discharge consent

River Irk watercourse will be subject to daily visual inspection recorded on record sheet ENV-08-UR Watercourse Inspection sheet, supplemented with record photos, for retention on site for inspection. sampling known outfalls tbc by E3P / Kellen Homes



367 Don Street

Dewatering Sketch

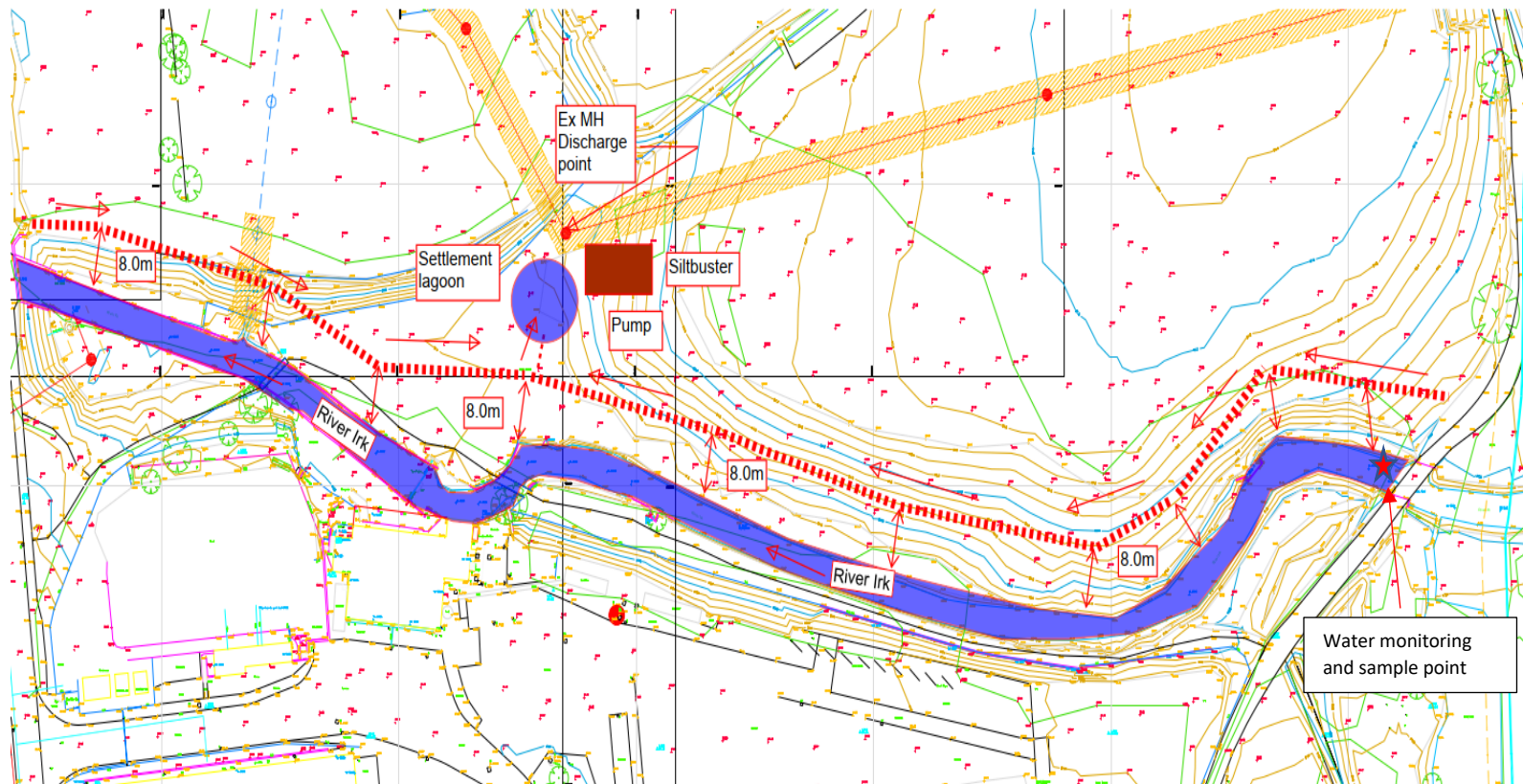
Area 1

#### Notes

Any redundant outfalls identified during V ditch excavation shall be stoppered up to prevent discharge to River Irk

Discharge points subject to UU formal discharge consent

River Irk watercourse will be subject to daily visual inspection recorded on record sheet ENV-08-UR Watercourse Inspection sheet, supplemented with record photos, for retention on site for inspection. sampling known outfalls tbc by E3P / Kellen Homes



367 Don Street

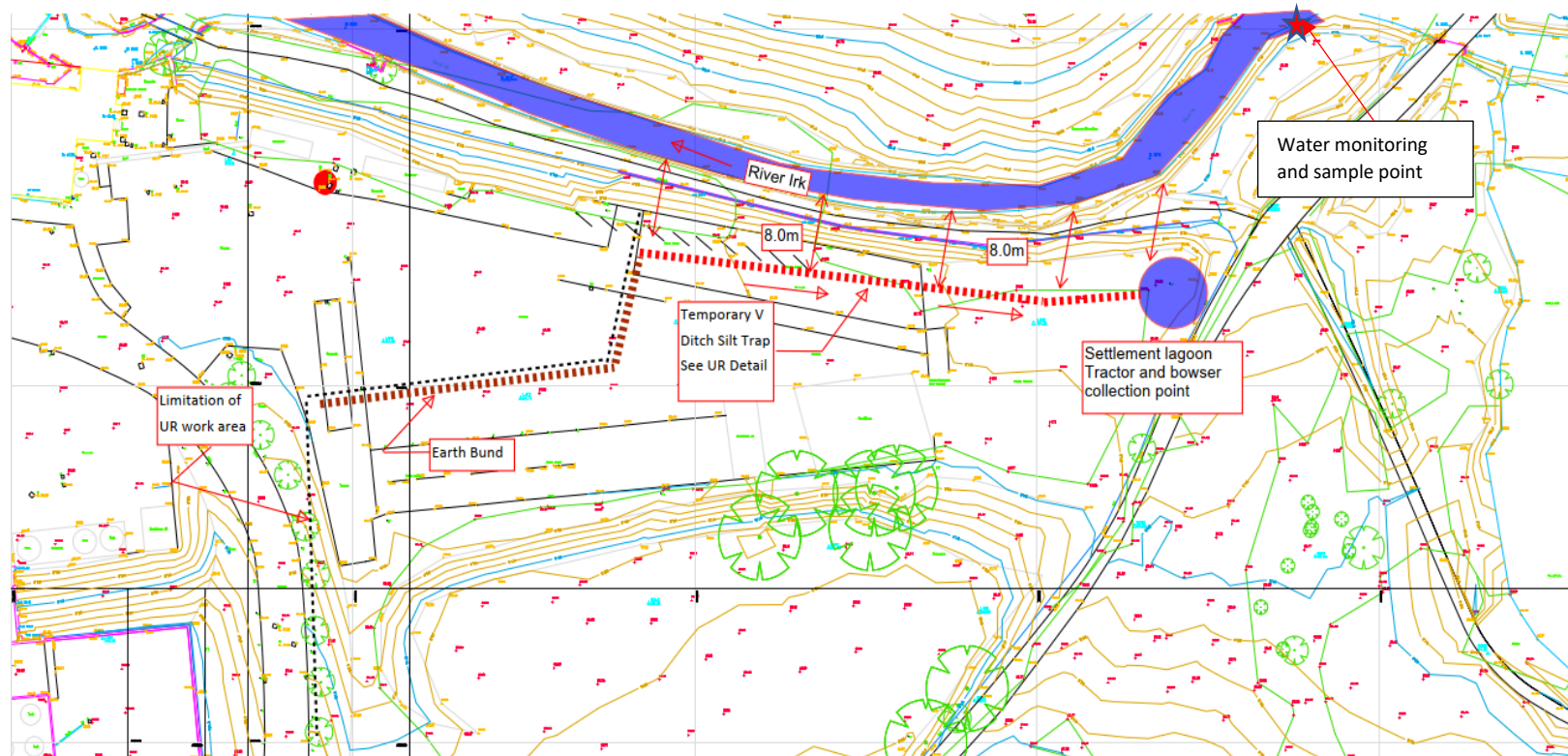
Dewatering Sketch

Area 2/4

#### Notes

Any redundant outfalls identified during V ditch excavation shall be stoppered up to prevent discharge to River Irk

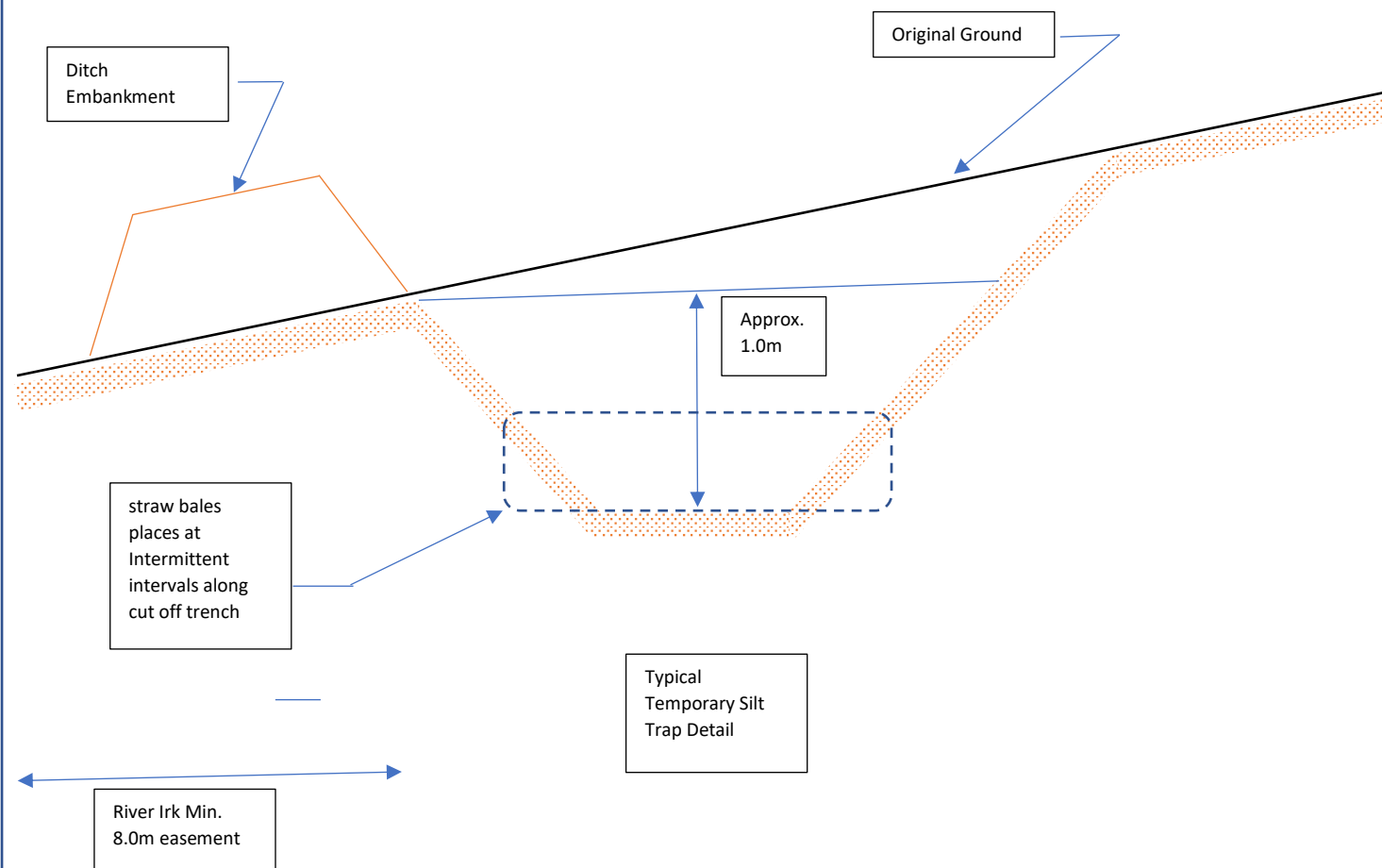
River Irk watercourse will be subject to daily visual inspection recorded on record sheet ENV-08-UR Watercourse Inspection sheet, supplemented with record photos, for retention on site for inspection. sampling known outfalls tbc by E3P / Kellen Homes



367 Don Street

Dewatering Sketch

Area 5



#### Notes

Any redundant outfalls identified during V ditch excavation shall be stoppered up to prevent discharge to River Irk

367 Don Street

Typical Temporary V  
Ditch Silt Trap Detail

## Don Street Dewatering Plan Summary

It has been identified that silty water may arise from dewatering the excavations on the project. Water containing silt shall not be allowed to flow directly into or be discharged into the River Irk.

The Don Street Dewatering Plan shows the proposed Urban Regen system for the capture and discharge of surface water and groundwater via silt traps, sumps/lagoons, pumps, settlement tanks, discharge lines. It also shows intended water monitoring locations at the Don Street Middleton project. Please see attached sketches in Appendix A. It is to be read in conjunction with the Environment Agency RPS in relation to the discharge of clean water from dewatering to the main river as discussed with Kellen Homes.

It is proposed that a series of V ditch silt Cut-off ditches and earth berms will be provided to prevent surface water from entering the River Irk. It is planned that the groundwater/ silty water shall then be disposed of by discharge to the existing combined sewer which runs from East to West across the site with the prior agreement and consent of the sewerage undertaker. Urban Regen will obtain this agreement through the submission of a temporary discharge consent form to United Utilities

The dewatering plan for the site will have two stages of treatment. The stages of treatment considered are as follows;

- Filtration of water through filter media e.g. check dams / straw bales situated intermittently along a series V ditch silt traps.
- Detention / settlement in settlement lagoons and discharge via a pump and Siltbuster Plant.
- Testing to confirm suitability to discharge.

Discharge to the sewer will be via a Silt buster type settlement tank with 4" outlet pipework which will be fitted with a turbine meter cold water super dry dial class B PN16 flanged 4 " nominal water meter. Meter readings will be inspected and monitored daily for adherence for applicable flow rates by Urban Regen Site Engineer and recordings logged.

All check dams/straw bales, settlement lagoons and silt buster settlement tanks will be checked at least once weekly via a walkover survey during the full period of the project. All excess silts will be removed and disposed of appropriately. Where check dams have become full blocked with silt, they will be replaced.

The River Irk watercourse will be subject to daily visual inspections by Urban Regen site management recorded on record sheet ENV-08-UR Watercourse Inspection sheet, supplemented with record photos, for retention on site for inspection.

Weather forecast and flood/high wind warnings are monitored daily. Should the site experience adverse weather conditions which require the site to cease operations, the site is to be made safe, and all Plant/Equipment shall be stored/parked in the designated areas indicated on the site TM plan. Until instructed to return to the work area. Sand bags/bunds/grips may need to be installed prior to a potential flood. Advice will be found by contacting Floodline, Telephone: 0345 988 1188 (24-hour service).

Water sampling upstream and downstream at the projects limitations will be conducted by E3P. There will also be sampling conducted at unknown outfalls along the watercourse by E3P / Kellen Homes at frequencies set out by the approved remediation strategy.

Further measures will be implemented to minimise potential impacts during earthworks which include:

- prior to pumping from excavations permits to operate pumps will be issued to the pump operator, indicating the point of discharge and all other necessary arrangements
- topsoil/vegetation along watercourses would be retained for as long as possible to aid attenuation and sediment infiltration;
- subsoil would be exposed for a minimum length of time after topsoil strip.
- Temporary Cut-off trenches may be excavated to connect V ditches together to prevent localized surface water run-off into the River Irk.
- Any redundant outfalls identified during V ditch excavation shall be stoppered up to prevent discharge to River Irk.

An incident plan will be put in place and recorded within a Project Environmental Emergency Action Plan.

The plan will identify the following;

- Emergency contacts such as the emergency services, environment agency, waste management and spill management contractors and water companies.
- Site contact names and numbers.
- Site specific restrictions such as working hours, noise restrictions, protected and restricted areas.
- Site plan indicating main features of the site including the location of foul and surface water drainage, waste skips, any sensitive receptors such as watercourse, protected or restricted areas and adjacent properties and also the location of the spill response equipment.
- Record of oils and chemicals stored on site including size, quantity, location, hazard and means of dealing with them.
- A pollution incident flow diagram indicating all the steps to be taken should an incident occur.

All staff and operatives will be briefed on the procedures for dealing with an environmental incident.

Staff will be trained to deal with incidents should an incident occur it will be reported to the appropriate member of staff and will action the Environmental Emergency Action Plan.

All appropriate steps will be taken to contain the incident and deal with the aftermath including notification of all affected parties and preparation of records.

Incidents will be recorded on form Environmental Incident Record, and all incidents will be discussed and recorded in the projects HSEQ meetings.

The following Urban Regen Records will be completed for the Project

UR\_HS\_Environmental Risk Assessment  
UR\_ENV\_12 Daily water Dust Odour Monitoring records  
E05- Project Environmental Emergency Action Plan.  
UR\_ENV\_01 Impacts and Control Measures Schedule Nov 2016



**Urban Regen**

ESTABLISHED 2001



**Urban Soil**

SOLUTIONS

UR\_ENV\_02 Environmental Monitoring Site inspection Nov 2016

UR\_HS\_36 Environmental toolbox talks