# REMEDIATION AND ENABLING WORKS STRATEGY

| | |
|---|---|
| **Site:** | Buzz Bingo |
| **References:** | 18-376-R3-1 |
| **Date:** | 26 March 2026 |
| **Client:** | Kellen Homes Limited |



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## DRAWING LIST

18-376-001 - Site Location Plan

18-376-002 - Proposed Development Plan

18-376-003 - Historical Features Plan

18-376-004 - Site Features Plan

18-376-006 - Exploratory Hole Location Plan

18-376-007 - Depth of Made Ground Plan

18-376-014 – Contamination Exceedances Plan

# 1. INTRODUCTION

## 1.1. BACKGROUND

E3P has been instructed by Kellen Homes Limited to develop a remediation and enabling works strategy for the proposed residential development at the site located at the site of Buzz Bingo, Kirkmanshulme Lane, Manchester, M18 7BA.

This report is intended for submission to the regulatory bodies to outline the necessary remediation and enabling works required to render the site suitable for future residential development.

This report has additionally been prepared to highlight the contractor's requirements.

## 1.2. SITE DETAILS

| | |
|---|---|
| **Site Address** | Buzz Bingo, Kirkmanshulme Lane, Manchester, M18 7BA |
| **National Grid Reference** | E 387762, N 396230. |
| **Site Area** | 2.09 Ha. |

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

A site location plan is presented in APPENDIX III as Drawing 18-376-001.

## 1.3. REPORT OBJECTIVES

This report aims to present a remediation and enabling works strategy to discharge relevant aspects of a standard contamination planning condition.

To achieve this objective, the report presents details of the remedial objectives; presents the findings of a remedial options appraisal, describes how the remediation of the site will be undertaken and specifies how the works will be validated. In addition, the strategy explains how the works will be permitted under the current regulatory regime.

This document therefore describes the steps to be taken during the enabling works and construction phases to prepare the site for residential use.

This working document may need to be updated, in agreement with the relevant regulatory authorities, at any stage during development, depending on the conditions encountered.

## 1.4. SCOPE OF WORKS

This report has been written in general accordance with Land Contamination: Risk Management (LCRM) (Environment Agency, June 2025). The scope of this Remediation Strategy and Remedial Options Appraisal comprises:

- A summary of background information and the conceptual model.
- An overview of the results of the risk assessment undertaken at the site.

- Identification of geotechnical constraints.
- A remediation options assessment, including a selection of final remediation options; and,
- A methodology and verification requirement for remediation works.

## 1.5. REDEVELOPMENT PLAN

Kellen Homes Limited propose to construct a residential development comprising a combination of low-rise dwellings and apartment blocks, with associated gardens, estate roads, and ancillary infrastructure.

The adjacent parcel to the immediate southwest of the site boundary (referred to as the Manchester City Council [MMC] parcel) has been included in the desk top searches and the site summary; however, it was not included within the intrusive site investigation as it is understood that the proposed development only pertains to the redline boundary shown in Figure 1.1 at this stage. It is understood that the adjacent MCC parcel may be part of a future land and redevelopment purchase/option.

E3P has been provided with a drafted proposed development layout, provided as Figure 1.1 and included in APPENDIX III.

**Figure 1.1 Proposed Development Plan**



## 1.6. STAKEHOLDER PARTIES

| FUNCTION/INTEREST | NAME OF PARTY |
|---|---|
| Local Planning Authority | Manchester City Council |
| Developer | Kellen Homes Limited |
| Geoenvironmental Consultant | E3P |
| Main Contractor | Kellen Homes Limited |
| Remediation/Enabling Works Contractor | TBC |
| Human Health Regulator | Manchester City Council |
| Controlled Waters and Waste Regulator | Environment Agency |
| Highways Adoption Authority | Manchester City Council |

# 2. SITE SYNOPSIS

## 2.1. SUMMARY OF PREVIOUS WORK

Table 2.1 summarises the phases of Geoenvironmental Assessment previously carried out at the site.

Table 2.1 Summary of Previous Works

| ORGANISATION | TITLE | DATE | REFERENCE | PREPARED FOR |
|---|---|---|---|---|
| E3P | Phase I Geoenvironmental Site Assessment | November 2025 | 18-376-R1-2 | Kellen Homes Ltd |
| E3P | Phase II Geoenvironmental Site Assessment | March 2026 | 18-376-R2-2 | Kellen Homes Ltd |

The assessment of the potential risk of contaminated land within the context of the proposed residential development is included in the documents listed above. To inform the preparation of the remediation strategy, the pertinent points from the above reports are summarised within this section.

To avoid any doubt, the above reports should be read as a precursor to, and in conjunction with, this document.

## 2.2. SITE SETTING

Table 2.2 Site Description and Setting

| | | |
|---|---|---|
| Current Occupancy/Use | The subject site is an irregularly shaped parcel of land located to the east of Belle Vue, Manchester, and is currently occupied by a disused bingo hall, two hardstanding car parks, and localised areas of landscaping.<br><br>The bingo hall is located in the northwestern corner of the site. The car parks occupy the northeastern and southwestern corners of the site. The southwest car park (MCC land) is bordered by a roughly 1.5—2.0 m high metal fence, separating it from the rest of the site (land proposed for redevelopment by Kellen Homes). The south of the site is occupied by an access road from Kirkmanshulme Lane.<br><br>A row of storage containers is located along the western site boundary.<br><br>An area of landscaping consisting of grasses, low shrubs and semi-mature to mature trees is present along the northern boundary. Additionally, a grassed embankment is present between the northern boundary and the hardstand area, sloping downhill to the south.<br><br>Sporadic semi-mature and mature trees are present along the eastern, western, and southern boundaries, with a more densely vegetated area along the southwest boundary toward the MCC parcel.<br><br>Tree saplings and scrub vegetation are noted to be growing through former surface drainage grids and cracks/areas of poorly conditioned hardstanding across the central and eastern areas. | |
| Environmental Setting | **Superficial Geology** | Glacial Till – Diamicton (CLAY, SAND, SILT, GRAVEL). |
| | **Bedrock Geology** | Chester Formation – SANDSTONE. |

| | | |
|---|---|---|
| | **Hydrogeology** | The site is underlain by a secondary undifferentiated superficial aquifer and a principal bedrock aquifer.<br>The site is not located within Groundwater Source Protection Zone or a Drinking Water Safeguard Zone. In addition, there are no active groundwater, surface water, or potable abstraction points within a 2 km radius of the site. |
| | **Surface Water** | There are no watercourses within 50 m of the subject site. |
| **Site History** | Historical mapping suggests the site was formerly agricultural land, c. 1848, comprising three fields, split by tree-lined field boundaries, and two ponds. By 1893, the site had been excavated and recorded as a boating lake within the Belle Vue Zoological Gardens.<br>A clock tower was recorded within the boating lake in c. 1923 and c. 1961 a miniature railway was noted through the south and southwest of the site.<br>By c. 1978, the boating lake was infilled with a bowling alley constructed in the northwest. The site layout has remained largely unchanged since circa 1978, with only minor changes occurring with the extent of the car park in the northeast. | |

## 2.3. LANDFILL AND WASTE STATUS ON-SITE

No landfill sites (current or historic) are located on site or within 200 m of the site.

## 2.4. SUMMARY OF REPORTED GROUND CONDITIONS

E3P has prepared a detailed Site investigation report (Ref: 18-376-R2-2, dated February 2026). The summary of reported ground conditions is given in Table 2.3.

Table 2.3 Summary of Ground Conditions

| STRATA | DESCRIPTION |
|---|---|
| **Made Ground** | **0.00 m bgl to 2.00 m bgl**<br>Made Ground deposits were encountered within all of the exploratory locations, to a maximum proven depth of 2.00 m bgl (CP101).<br>Reworked Topsoil was encountered in one location (TP105), at a depth ranging from ground level to 0.40 m bgl. The stratum consisted of slightly gravelly sandy clay, with gravel constituents of mudstone, sandstone, brick and wood.<br>Where hardstand surface is present (eighteen locations), Made Ground comprised an asphalt cover underlain by a TYPE 1 MOT sub-base of light grey sandy gravel, with gravel constituents comprised of subangular to subrounded concrete and limestone. The sub-base was recorded to vary in thickness between 0.10 m and 0.40 m. |

| STRATA | DESCRIPTION |
|---|---|
| | Generally, Made Ground underlying the sub-base/reworked topsoil consisted of slightly sandy slightly gravelly clay, with gravel constituents of mudstone, sandstone, brick and ceramic. Cobbles were occasionally encountered, consisting of brick. The depths of this stratum ranged from 0.20 to 1.80 m bgl.<br><br>Locally, Made Ground comprises clayey sandy gravel with gravel constituents of mudstone, sandstone, brick, asphalt, concrete and plastic. The stratum was recorded at depths ranging from 0.30 to 2.00 m bgl. Cobbles were encountered sporadically and generally consisted of bricks and concrete fragments.<br><br>Olfactory evidence of organic contamination was noted in four locations (TP101, TP107, TP108 and TP109), with an organic odour noted at depths between 0.30 to 1.80 m bgl, generally encountered in the peripheral sections of the site, within the southeast and the southwest.<br><br>Additionally, localised brick fill was encountered in TP103 from 0.30 to 0.40 m bgl. The fill was recovered as reddish-brown gravel, with gravel consisting of brick. |
| **Superficial** | **0.40 m bgl to 7.57 m bgl**<br><br>Superficial deposits were encountered within all exploratory hole locations, with the exception of TP111, undertaken within the current embankment in the north of the site. Where encountered, superficial deposits were recorded at depths ranging between 0.40 m and in excess of 7.57 m bgl (limit of the investigation).<br><br>Superficial deposits were encountered as sandy gravelly CLAY with gravel constituents of mudstone and sandstone across the site. The soils were generally encountered in firm and stiff conditions, with isolated occurrences of very stiff soils encountered.<br><br>Soft sandy CLAY was encountered in two locations (TP109 and CP101), at depths between 1.60 m to 3.00 m bgl. |
| **Bedrock** | Bedrock remained unencountered, at the furthest depth of 7.57 m bgl. British Geological Society borehole data of the wider area records the top of bedrock at circa 30.00 m bgl. |
| **Groundwater** | Groundwater was encountered in three locations at depths ranging from 0.50 to 1.80 m bgl, recorded as slow seepages within Made Ground, with one recorded in clay (natural) at 1.80 m bgl. |

# 3. CONTAMINATION RISK ASSESSMENT

## 3.1. BACKGROUND

E3P has completed a Tier 2 Qualitative Contaminated Land Risk Assessment to determine the potential risk to human health, controlled waters, and the wider environment. 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.

## 3.2. HUMAN HEALTH RISK SUMMARY

The E3P Tier 2 Qualitative Human Health Risk Assessment identified concentrations of the following determinants at or above the screening criteria for a residential end use with plant uptake:

**Inorganics**

- Arsenic;
- Lead;

**Organics**

- Benzo(a)anthracene;
- Benzo(b)fluoranthene;
- Benzo(a)pyrene
- Dibenzo(a,h)anthracene
- TPH C21-C35 (Aromatic)

The laboratory analysis confirms the assessment within the initial conceptual site model that the main constituents of concern were likely to be PAHs, hydrocarbon compounds and inorganic heavy metals.

In relation to these exceedances, the following can be determined:

- The main exposure pathways based on the Tier 2 exceedances are:
    - Dermal contact and ingestion; and
    - Consumption of homegrown vegetables.
- The exceedances for all determinands are associated with Made Ground deposits < 1.00 m.

## 3.3. CONTROLLED WATERS RISK SUMMARY

A Tier 2 Controlled Water Risk Assessment was completed by E3P as part of the E3P Geoenvironmental Site Assessment. A comparison of the data against Environmental Quality Standards (EQS) and Drinking Water Standards (DWS) recorded exceedances of the following compounds:

Table 3.1 Summary of Controlled Waters Risk Assessment

| EXCEEDANCE OF EQS | EXCEEDANCE OF DWS |
|---|---|
| **Groundwater**<br>• Chromium (III) – 6.3 µg/l – WS104<br>• Copper – 3.0 µg/l – WS104<br>• Nickel – 4.3 µg/l – CP101<br>• Anthracene – 0.7 µg/l – CP101<br>– 0.27 µg/l – WS106<br>• Benzo(b)Fluoranthene – 1.40 µg/l – WS106<br>– 1.00 µg/l – CP101<br>• Benzo(k)Fluoranthene – 0.62 µg/l – WS106<br>– 0.54 µg/l – CP101<br>• Benzo(a)Pyrene – 0.97 µg/l – WS106<br>– 1.30 µg/l – CP101<br>• Indeno(123-cd)pyrene – 0.42 µg/l – WS106<br>– 0.52 µg/l – CP101<br>• Fluoranthene – 0.48 µg/l – WS106<br>– 0.52 µg/l – CP101<br>**Leachate**<br>• Copper – 8.10 µg/l – WS106 0.30 m<br>• Zinc – 11 µg/l – WS106 0.30 m | **Groundwater**<br>• Selenium – 18 µg/l – WS104<br>• TPH C21-35 - 360 µg/l – WS106<br>**Leachate**<br>• N/A |

Shallow perched groundwater has recorded low level impact of PAH, heavy metals and long chain hydrocarbons. It is noted that the impacted groundwater records similar elevations to Made Ground soil data, and as such, low level leaching of contaminants from within the site wide Made Ground is the likely contamination source of perched groundwater. However, only minor copper and zinc exceedances were recorded within leachate samples, indicating that the leaching of contaminants has been historic with most of the mobile contamination now depleted.

It should be noted that while there have been several exceedances, they have been marginal. PAHs, copper, chromium (III), nickel and zinc have only exceeded EQS values, when the DWS values have been viewed as a priority, given the primary pollutant receptor has been identified as the principal aquifer within the underlying bedrock. Given the absence of surface water features on, or within influencing distance of the site, low level impact of the aforementioned contaminants within the perched, discontinuous groundwater are not considered to pose a risk to controlled water receptors.

Minor exceedance of DWS has been recorded within shallow perched groundwater for selenium and long chain hydrocarbons (non-volatile). The site is not located within Groundwater Source Protection Zone or a Drinking Water Safeguard Zone. In addition, there are no active groundwater, surface water, or potable abstraction points within a 2 km radius of the site. Permeability testing has shown that the overlying drift deposits have low rates of permeability, limiting vertical migration to the underlying principal bedrock aquifer.

Taking the above into account, it is considered that the risk to sensitive controlled water receptors or future end users is low.

## 3.4. HAZARDOUS CHEMICAL VAPOURS

Hazardous chemical vapours or vapour sources have not been identified on-site.

## 3.5. HAZARDOUS GROUND GAS

E3P has assessed the ground gas monitoring data and determined the following:

- Made Ground deposits were identified within each exploratory hole location advanced on the site to a maximum proven depth of 2.00 m bgl.
- Unflooded monitoring wells are generally classify as Characteristic Situation (CS)1 – Very Low Gas Risk. With all GSVs across the site remaining within CS1 classification.
- Marginal exceedance of CS1 carbon dioxide threshold (5%) recorded on one occasion within CP102 (5.4 % v/v – Visit 1). The ternary plot indicates this falls within the range typically associated with ambient air mixing and is consistent with levels generated by microbial degradation of minor organic material, as evidenced by the absence of methane and low gas flow rates. This aligns with the conceptual site model (CSM), which does not identify a significant gas source, with only occasional, limited putrescible material (e.g. wood fragments) encountered.
- Following targeted remediation and removal of any organic material, the residual risk is considered negligible.
- No evidence of a geogenic or landfill gas source has been identified.
- No radon risk has been identified on site.
- The Site Conceptual Site Model (CSM) has not identified a risk associated with volatile vapours.
- In the absence of a significant gas source, GSVs falling within CS1 classification and following remediation and enabling works removing any residual organic materials, it is considered that no future risk of hazardous ground gas is present on site and the site falls within CS1 – no gas protection measures required.

Based on the findings of the ground gas monitoring and the updated Conceptual Site Model (CSM), the site is characterised by very low gas generation potential. Measured Gas Screening Values (GSVs) are consistently within Characteristic Situation 1 (CS1), with only a marginal and isolated exceedance of carbon dioxide recorded, which is considered to be attributable to minor microbial degradation of limited organic matter rather than an active or significant gas source.

The identified Made Ground, including material associated with the infilled former shallow boating lake, will be subject to excavation and remediation as part of the proposed geotechnical earthworks. This process will involve the controlled stripping, reworking, and/or removal of unsuitable or deleterious materials to achieve the required engineering specification. Through these works, any localised pockets of organic or putrescible material will be identified during excavation and removed or appropriately treated.

Given the age of the former lake infill (circa 50 years), the limited thickness of Made Ground, the predominantly granular composition, and the absence of a viable long-term gas generation mechanism, the infill does not represent a credible ongoing source of ground gas. Furthermore, the proposed remediation strategy will effectively eliminate any residual, localised sources that could give rise to short-term gas generation.

Accordingly, upon completion of the remediation and earthworks, the site will not present a risk from hazardous ground gases. The development is therefore appropriately classified as Characteristic Situation 1 (CS1), and no specific gas protection measures are required in accordance with current guidance. Standard good construction practice should be adopted throughout.

It is recommended that the findings of this assessment and the proposed remediation approach are agreed with the Local Authority to support the discharge of planning conditions and formal acceptance of the ground gas risk classification.

## 3.6. RADON

Less than 1% of houses above the 'Action Level' – no special precautions required.

## 3.7. POTABLE WATER SUPPLY INFRASTRUCTURE

A contaminant risk assessment completed in accordance with the UKWIR assessment framework should be completed and will be addressed under separate cover.

# 4. PHASE 3 REMEDIATION OPTIONS APPRAISAL

## 4.1. OVERVIEW

A remediation options appraisal has been completed in accordance with the principles as set out within the Environment Agency publication Land Contamination: Risk Management (LC: RM) (June 2025).

LCRM requires that the following tiered assessments be followed to ensure a sufficiently detailed and robust appraisal of remediation options to inform the selection of the preferred approach and utilisation of the correct technologies to promote safe and sustainable land remediation:

- Identification of feasible remediation technologies;
- Detailed evaluation of viable options; and,
- Selection of an appropriate remediation option.

## 4.2. SUFFICIENCY OF INFORMATION

Prior to the commencement of the tiered assessment of remediation options, it is required to assess the sufficiency of available information and the validity of the risk-based assessment on which the appraisal of remediation options is based.

The intrusive ground investigation works completed to date are considered sufficient to fully understand the risks to future end users, controlled waters, and the wider environment.

## 4.3. CONTAMINANTS OF CONCERN

Following the completion of the intrusive investigation, assessment and the completion of a developed conceptual site model, Table 4.1 below summarises the contaminants of concern for which a Remediation Options Appraisal has been developed.

Table 4.1 Summary of Contaminants of Concern

| CONTAMINANT OF CONCERN | LOCATION | DEPTH (m) | MATERIAL TYPE | EXPOSURE PATHWAY |
|---|---|---|---|---|
| Heavy Metals | TP105<br>WS104<br>TP/SA109 | 0.20<br>0.90<br>1.00 | MADE GROUND | Direct contact of soil by future residents<br><br>Direct ingestion of soil by future residents |
| Non-volatile PAHs | TP105<br>WS104<br>TP/SA109 | 0.20<br>0.90<br>1.00 | MADE GROUND | |
| Long Chain TPH (C21-35) | TP107 | 0.20 | MADE GROUND | |
| Asbestos (type if known) | N/A | N/A | N/A | Inhalation of dust/fibres by future residents |
| Naphthalene and/or Volatile Mercury | N/A | N/A | N/A | Vapour inhalation by future residents<br><br>Vertical/lateral migration to controlled waters receptors |
| Volatile TPH, SVOC | N/A | N/A | N/A | |
| Chlorinated Solvents | N/A | N/A | N/A | |
| PFAS/PFOS | N/A | N/A | N/A | Direct ingestion of soil or water by future residents<br><br>Vertical/lateral migration to controlled waters receptors |
| Hazardous Ground Gases | N/A | N/A | N/A | Hazardous gas inhalation by future residents |

## 4.4. IDENTIFICATION OF REMEDIATION OPTIONS

### 4.4.1. 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 environment. 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.

### 4.4.2. SELECTION OF REMEDIATION TECHNIQUES

Several remedial technologies have been considered in addressing the contaminant linkages of concern identified at the site, as summarised in Table 4.2 overleaf.

In order to assess which of these technologies is 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 practice 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 4.2 Applicability of Remediation Technology

| REMEDIAL TECHNOLOGY | APPLICABILITY | REGULATORY APPROVAL/ PERMIT | COST | TIME FRAME | SCORE | COMMENT |
|---|---|---|---|---|---|---|
| Cover system | 5 | 5 | 5 | 5 | 20 | Essential remediation solution to remove direct exposure pathways. |
| Excavation and off-site disposal | 5 | 5 | 1 | 5 | 16 | Limited by the cost being prohibitive. Small quantities of material that cannot be treated will be removed. Likely to form one aspect of the remediation approach. |

Note for Table 4.3 – Scoring Methodology

| SCORE | APPLICABILITY | PERMISSIBILITY | COST | TIMEFRAME | ACCEPTABILITY/ SUSTAINABILITY |
|---|---|---|---|---|---|
| 0 | Not applicable, available or implementable | No chance of obtaining a permit | | | N/A |
| 1 | Not widely used and probably not applicable | Permitting will probably be difficult | Very High | Treatment time does not meet the client's requirements | N/A |
| 2 | Widely used but probably not applicable or not widely used and may not be applicable | Permitting may be difficult | High | Treatment time almost meets the client's requirements | N/A |
| 3 | Widely used but may not be applicable or not widely used but probably applicable | No permitting problems | Moderate | Treatment time meets the client's requirements | N/A |
| 4 | Widely used and probably applicable or not widely used but proven and applicable | | Low | | N/A |
| 5 | Widely used, proven and applicable | | Very Low | | N/A |
| Considerations | Contaminant type; Soil conditions; Groundwater considerations; Availability; Proven track record; Requirements for additional treatment; Whether technology is implementable at the site; Ability to attain remediation goals. | Emissions; Discharges; Noise; Planning; Mobile Treatment License; Environment Agency. | Indicative costs data from professional experience. | Site requirement for treatment within 12 months. | Client acceptance; Regulatory acceptance; Site acceptance; Other potential stakeholders' acceptance. |

## 4.5. 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 economical solutions that will ultimately result in the successful remediation of the site:

- The construction of a designed and validated clean cover system ensures no direct exposure pathway to future receptors for all plots.
- Removal of defined contaminant hotspots for off-site treatment with subsequent validation to demonstrate effective implementation.
- Off-site 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.

## 4.6. REQUIREMENT FOR REGULATORY CONTROL OF WASTE

Once full planning permission has been obtained, the relevant regulatory control measures can be implemented.

### 4.6.1. CL:AIRE DOW-COP MATERIAL MANAGEMENT PLAN

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 the 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.

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 the 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 V of this report.

# 5. REMEDIATION AND SITE-ENABLING WORKS

## 5.1. RE-1 – PRE COMMENCEMENT SUPPLEMENTARY SITE INVESTIGATION

Following the demolition of the existing structures, supplementary investigation and soil sampling are recommended. Mechanically excavated trial pits will be advanced with additional chemical analysis of the soils completed to confirm no unacceptable risk to human health and controlled waters.

If any as yet unidentified 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 by the placement of clean cover systems to break the pathway or delineation and source removal where required.

## 5.2. RE-2 – PRE COMMENCEMENT REGULATORY REQUIREMENTS

Prior to the commencement of any works on site, all reports relating to the assessment of risk to contaminated land should be submitted to the regulatory authorities to gain written approval.

All relevant Standard Rules Permits should be registered with the Environment Agency by the contractor.

The LAPC Part B Notification for the deployment of the mobile crushing plant should be implemented prior to the establishment of the equipment on site.

If the proposed volume of soils to be reused (excluding crushed materials) exceeds the parameters of the Standard Rules Permit, a CL:AIRE Materials Management Plan (MMP) qualified declaration should be made by the contractor, having obtained full written approval for the remediation strategy from the Local Planning Authority and Environment Agency.

It is not anticipated that there will be any requirement to treat any materials on-site (such as hydrocarbon-impacted soil or groundwater); however, should any previously unidentified contamination be encountered, the contractor must either notify E3P and, if appropriate, relevant regulators of their intention to complete a minor works operation or arrange for the deployment of the appropriate environmental permit for the specified operation.

## 5.3. RE-3 – INDEPENDENT VALIDATION AND SITE SUPERVISION

It will be necessary to instigate the site-wide remediation and enabling works with advice from a suitably qualified and independent specialist who is familiar with this report. The specialist is required to attend the site on a part-time basis in order to record ground conditions and to monitor progress and the quality of works completed by the contractor.

Frequencies of site attendance may need to change depending on specific operations that are being completed.

## 5.4. RE-4 – ENVIRONMENTAL AND NUISANCE CONTROL

The LC:RM requires that due consideration be given to the following key issues which will impact the appropriate selection of suitable remediation options.

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

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

## 5.5. RE-5 – RISK TO INFRASTRUCTURE

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

Survey existing infrastructure, mitigation where required to prevent, method statements, no off-site pollution risk.

## 5.6. RE-6 – SITE CLEARANCE OPERATIONS

Above and below-ground slabs/foundations are present in areas of historical development; these structures and building material 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.

For any other above-ground waste/fly tipping, the contractor should arrange for a method of disposal off-site.

## 5.7. RE-7 – MANAGEMENT OF INVASIVE PLANTS

The remediation contractor must satisfy themselves concerning the extent of all species deemed invasive before 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 before 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 the site, all waste transfer notes/duty of care certificates should be included within the validation statement.

## 5.8. RE-8 – MANAGEMENT OF IMPACTED MADE GROUND

Excavation works will be required to remove any point sources of metalloid, non-volatile PAH and long-chain TPH impact within the Made Ground across the site.

Elevated metalloid, non-volatile PAH and long-chain TPH impacted soils have been identified within the upper 1.00 m of Made Ground within TP105, TP107, TP/SA109 and WS104. Construction workers should be briefed and made aware of all contaminants present within the soils on site.

Made Ground soils are considered suitable for re-use on the site in the construction of the development platform. Where the impact cannot be attributed to a single source, all Made Ground soils should be treated as containing low-level metalloid and non-volatile PAH impact and will require placement below cover systems and hardstand.

To ensure no risk to future end users, Made Ground will require placement below cover systems in areas of proposed soft-standing or below hardstanding.

## 5.9. RE-9 – MANAGEMENT OF 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, including plot footprints, rear gardens, private driveways, adopted highway and utility 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 using the licensed plant.

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.

## 5.10. RE-10 – IMPORTATION OF MATERIALS FOR USE IN CONSTRUCTION

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.

Imported material must be certified as suitable for use in strict accordance with the E3P chemical and geotechnical performance criteria (Appendix IV and Table 5.1) 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.

## 5.11. RE-11 – MANAGEMENT OF INFILLED HISTORICAL LAKE BASE

Due to the site's former use as a boating lake, there is likely to deposits of organic / infilled unsuitable materials present below the site.

During the turnover of the site, any geotechnically unsuitable organic soils (former lake base) will require removal. The location of the known historic infilled lake is identified within the E3P historical features plan (drawing 18-376-003 in Appendix III), seen in yellow.

Unsuitable 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 geotechnical performance specification, with appropriate compaction for the intended land use.

Where organic soils are removed, in-situ hand shear vane testing of the underlying natural cohesive soils will be required to confirm the suitability of the subgrade (clay soils to confirm > 40 Cu). A suitably qualified geotechnical engineer will need to monitor the excavation of unsuitable soils, complete validation testing and confirm when all of the unsuitable material has been excavated and removed from beneath any proposed structure or infrastructure.



## 5.12. RE-12 – PREPARATION OF COVER SYSTEM

All plots will require a clean capping cover system within private gardens, additionally, and areas of proposed soft-standing will require cover systems.

Cover systems to entail a clean cover system as specified in Section 11.1, with a geotextile membrane present beneath cover systems in private front and rear gardens.

It will be the contractor's responsibility to prepare the area to 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.

Made Ground is deemed unsuitable for retention in a garden; as such, the garden area will be subject to a reduced-level dig to remove unsuitable material to a level that would allow the placement of the cover system 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 following 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 by E3P.

The DEFRA / Environment Agency guidance states *'that conflicts of interest in verification should be avoided. A contractor certifying their own work is considered to be a conflict of interest and is not good practice. If verification is carried out by the same company (or related company) that carried out the work, then the process, results and report will need to be audited by an independent consultant'* (Environment Agency, 2010).

## 5.13. RE-14 – STOCKPILE ARRANGEMENTS

Whenever it is envisaged that the use of the materials will occur in excess of one year from being stockpiled/stored, a time limit has to be agreed with the Environment Agency. The decision relating to the length of storage will be made within the context of the extant planning permission or agreed programme of works. Supporting information may be requested by the environment agency in the form of the soil resource plan.

The proposed location of any stockpiles must be pre-agreed with the developer and remediation engineer prior to stockpiling commencing.

Soil will be stripped or excavated during the construction process. In order to enable its reuse on-site at a later stage, soil needs to be stored in temporary stockpiles to minimise the surface area occupied, and to prevent damage from the weather and other enabling works/construction activities.

Stockpiled soil must not be vulnerable to compaction or erosion; must not cause pollution to surrounding watercourses; and must not increase flood risk to the surrounding area.

Stockpiles must be appropriately marked out and clearly signed to ensure that they are easily identifiable for reinstatement.

Soil should be stored in an area of the site where it can be left undisturbed and will not interfere with site operations. Ground to be used for storing the topsoil should be cleared of vegetation and any waste arising from the development.

The locations and footprints of each stockpile will be accurately recorded on a plan of appropriate scale. Marker posts will be provided in locations which have been surveyed and recorded to provide volumes for each stockpile type. Photographic records of stockpiles will be provided at the point of handover to the developer.

Stockpiling should follow the guidance set out in Defra's construction code of practice for the sustainable use of soils on construction sites with the appropriate method adopted based on the soil type for the creation of stockpiles (method 1 or 2).

Stockpiled material that may pose a risk to the environment will be required to be stored within an impermeable bunded area that is adequately sealed with a membrane sufficient to prevent rainfall from entering the bund or stockpile. Typically, sheeting is laid to lap over the extent of the bund sidewalls and sealed with soil around the periphery.

Stockpiled soils (as well as other generated and imported soils) will require chemical analysis at the frequency defined within Table 5.1, in accordance with the Manchester City Council Land Guidance, provided in Table 5.1 based on the soil type and use.

## 5.14. RE-15 – PROVISION OF TOPSOIL

Imported topsoil will require regulation under an MMP and testing, in accordance with sampling frequencies outlined within Table 5.1.

Site won topsoil should be tested in accordance with sampling frequencies outlined within Table 5.1.

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

Topsoil stockpiles should be placed in areas that will ensure no 'cross contamination' from materials with significant anthropogenic influence on-site.

## 5.15. RE-16 – PROVISION OF SUBSOIL

The shallow natural superficial deposits (predominantly cohesive soils) are deemed suitable for use within the clean cover system in 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.

Materials generated from the 'site strip' operation can be subdivided into topsoil and subsoil, with sand and clay loam soils within the lower 50% of the site strip likely to be classified as a subsoil material. These soils can be sustainably segregated, tested (in accordance to Table 5.1), and stockpiled for re-use as subsoil.

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

Sub-soil stockpiles should be placed in areas that will ensure no 'cross contamination' from materials with significant anthropogenic influence on-site.

## 5.16. RE-17 – WASTE SOIL SURPLUS

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.

## 5.17. RE-18 – GENERAL VALIDATION OF STOCKPILE MATERIAL

The site has been characterised with respect to the potential pollution risks to all known receptors defined and understood; furthermore, the appropriate remediation actions have been defined within this strategy to ensure that the site will be suitable for the intended use.

There is no requirement for further general testing of either made ground or natural soils, which will be nominally turned over, processed or subject to a direct cut / fill as part of the enabling earthworks.

Where materials are subject to specific stockpiling (made ground or natural), such materials will be subject to the geochemical validation requirements for the re-use of stockpiled materials.

## 5.18. RE-19 – VALIDATION OF MATERIAL FOR POTABLE WATER SUPPLY INFRASTRUCTURE

Based on the assessment of current site conditions, it is likely that PE pipe can be used at the proposed development.

Following remediation and enabling works, supplementary sampling at pipeline depths and routes should be undertaken with a contaminant risk assessment completed in accordance with the UKWIR assessment framework to confirm this.

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.

## 5.19. RE-20 – REMEDIATION 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.

The verification report will conclude the site remediation and enabling works, with the build phase validation to be produced separately.

## 5.20. RE-21 – REMEDIATION PROJECT UNPLANNED UPDATES

LC:RM states the following with respect to the completion of remediation works:

- Ensure remediation is done in line with the remediation strategy and regulatory controls
- React to testing results or monitoring data promptly
- Manage unexpected contamination
- Allow time to get and interpret the data without delaying progress
- Use a different solution or contingency measure if the data shows that the remediation is not working
- Ensure any method statements are correct and kept up to date

Remediation work is an iterative process, and as such, it will be managed by the specialist contractor on site, the supervising engineer, the professional project team and the client.

Where possible, regulatory authorities will be informed of ongoing changes to the project and specific remediation requirements; however, works must be allowed to proceed under professional judgment without the requirement to revise the formal remediation strategy.

All project adjustments will be fully documented and detailed within the validation report. For absolute clarity, professional judgement will be made by chartered professionals supervising the remediation works. It is considered that there is no requirement for any revision to a remediation strategy on the basis that adjustments are made due to unforeseen circumstances, which are reviewed and approved by a chartered professional within the project team. The approved remediation strategy is an iterative document that allows flexibility and changes based on specific circumstances.

# 5.21. VERIFICATION PLAN

## 5.21.1. 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.

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 or 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 to remove the risk of cross-contamination.

The sampling frequency for materials to be managed under the remediation strategy is presented in Table 5.1. The validation sampling protocol has been developed utilising guidance from the Manchester City Council Planning and Contaminated Land Technical Guidance document, dated February 2021.

Table 5.1 Specification of Chemical Validation Laboratory Analysis

| MATERIAL USE | TESTING FREQUENCY | SUITE OF ANALYSIS |
|---|---|---|
| **Site Generated** | | |
| Site-Generated 6F2 | 1 Sample per 500 $m^3$ | A/B/C/D |
| Site-Won Made Ground General Backfill | 1 Sample per 250 $m^3$ where visual and/or olfactory impact is identified | F |
| Stockpiled Made Ground General Backfill | 1 Sample per 1000 $m^3$ | A/B/C/D |
| Stockpiled Made Ground General Backfill | 1 Sample per 2000 $m^3$ | G |
| Stockpiled Natural Backfill | 1 Sample per 2000 $m^3$ | A/B/C/D |
| Site-Generated Subsoil (Cover system) | 1 Sample per 100 m3 | A/B/C/D |
| Site-Generated Topsoil Cover (Cover system) | 1 Sample per 100 $m^3$ | A/B/C/D |
| Hotspot Validation Sample | 1 Sample per 10 m of linear excavation to base and sidewall | E/F |
| **Imported** | | |
| Recycled Aggregate | 1 Sample per 500 $m^3$ | A/B/C/D |
| Virgin Quarried Aggregate | 2 samples per source | D |
| Subsoil / Topsoil Greenfield Source (Residential Garden Cover system) | 1 Sample per 200 $m^3$ (minimum 3 from source) | A/B/C/D |
| Subsoil / Topsoil Brownfield Source (Residential Garden Cover system) | 1 Sample per 50 $m^3$ (minimum 6 from source) | A/B/C/D |

| MATERIAL USE | TESTING FREQUENCY | SUITE OF ANALYSIS |
|---|---|---|
| **Subsoil / Topsoil Greenfield Source (Soft Landscaping / POS Cover system)** | 1 Sample per 200 $m^3$ (minimum 3 from source) | A/B/C/D |
| **Subsoil / Topsoil Brownfield Source (Soft Landscaping / POS Cover system)** | 1 Sample per 150 $m^3$ (minimum 6 from source) | A/B/C/D |
| **General Engineering Fill (Class 1 and 2 Soil)** | 1 Sample per 1000 $m^3$ | A/B/C/D |

**Notes:**
***Suites of Analysis:***
***A. Speciated PAH.***
***B. Speciated TPH (C5-C35, BTEX, MTBE).***
***C. Asbestos (ID).***
***D. CLEA Inorganic Heavy Metals.***
***E. SVOC/VOCs***
***F. On-Site Screening for VOC Using Calibrated PID.***
***G. Leachate Analysis of Inorganic Heavy Metals, TPH, Sulphate and PAH.***
***H. Asbestos Quantification***

### 5.21.2. IMPLEMENTATION OF VERIFICATION

Implementing the verification plan is an iterative process, with the process only complete when you have ended monitoring or sampling and produced the verification report.

In accordance with LCRM, all relevant data as set out in the verification plan will be collected to ensure verification reporting accurately reflects all works carried out.

Performance against all remediation criteria will be assessed to ensure that the remediation objectives are being achieved. This may be a complex operation where criteria relate to several remediation activities, phases or timescales, and a phased approach may be taken if prior agreement has been sought from the relevant regulatory authorities.

### 5.21.3. RISK-BASED ASSESSMENT FOR NON-COMPLIANCE

Where the 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.

### 5.21.4. REMEDIAL OBJECTIVE OVERVIEW

A contingency plan is provided in Section 10 of this report to identify what action to take if results fall outside of the acceptable limits. It is possible that remediation objectives and criteria may need to be reviewed to modify the remedial process or consider other options.

- Data that may lead to a further review include:
- A change in conditions such as temperature or pH.
- A decline in contaminant concentrations not as predicted.
- A contaminant plume that does not shrink or stabilise as predicted during monitored natural attenuation (MNA) or in situ treatment.

- A diminishing return in efficiency for example, in soil vapour extraction, air sparging or pump and treat.
- A change in groundwater flow or head-up gradient of a slurry wall or permeable reactive barrier.
- A failure to prevent the migration of ground gases for example, by passive venting, containment or active abstraction.

Any changes to the original remediation objectives will be justified, recorded and agreed with the details provided in the verification report upon completion of the remediation works.

## 5.22. REMEDIATION CONTRACTOR SITE MANAGEMENT RESPONSIBILITIES

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 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.

# 6. MATERIAL MANAGEMENT AND LEGISLATIVE COMPLIANCE

The processing of recycled aggregates will be completed using LAPC Part B licenced plan with the appropriate deployment notification to the local authority prior to the commencement of works. All materials that are recovered as recycled aggregate will be compliant with the E3P validation testing requirements and, as such, would not be deemed to be a waste material where there is a certainty for their reuse on-site.

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 licenses, exemptions and protocols provide the legislative framework for material compliance during the site remediation and enabling works to be completed by the specialist contractor and validated by 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).

Under the Waste Framework Director, certain waste materials, even once processed under exemptions, continue to be classified as waste until they have fully recovered or are no longer a waste for other reasons. To facilitate the reuse or recovery of these waste materials, it is essential the correct framework is in place, including appropriate exemptions, permits or quality protocols.

It is noted that if the 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 the 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 in Appendix VI of this report.

# 7. GEOTECHNICAL ENGINEERING SPECIFICATION

## 7.1. GEOTECHNICAL ENGINEERING REQUIREMENTS

The geotechnical specification provides a set of performance specifications for the placement and engineering of materials to facilitate the construction of a development platform that will be suitable for the intended end use.

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

- Delineation and removal of historic organic material associated with the former lake base;
- Placement of fill materials to ensure compliance with the design end use for the structural foundation solution;
- 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 the proposed FFL across the complete plot;
- Preparation of plot footprint (+ 2 m on all elevations) to be suitable for ground improvement by vibro-stone column, where the depth of stiff clay/medium-dense sands exceeds 1.5 m from the proposed finished floor level (FFL);
- Preparation of plots to ensure suitability for the construction of piled foundations within the locations denoted on the geotechnical foundation key plan;
- Engineer all areas of proposed infrastructure, adopted highway and private drive to be compliant with the E3P Geotechnical Specification;
- Where deep upfill is proposed (>2.50m), surcharge settlement analysis is required to ensure that the imposed loads do not induce unacceptable long-term total or differential settlement to infrastructure.

If it is not possible to prepare the site to 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 are undertaken in accordance with this specification and to ensure that any unforeseen circumstances, such as adverse weather, do not compromise the earthwork process.

Works should be halted during periods of intermittent or prolonged rainfall to ensure the materials are not placed in a manner that would soften either the formation or the newly placed material. The contractor will be responsible for determining appropriate weather conditions and the suitability of the works.

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

Settlement analysis may be required within areas of compressible material and or significant earthworks, and this is a specialist geotechnical matter outside the scope of this report.

## 7.2. 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. The earthworks

contractor will complete pre-commencement geotechnical testing of all as-dug materials prior to engineering or any site-derived soil materials.

Due to climatic weather conditions and variance in long-term differential settlement associated with even well-compacted granular and cohesive soils and the need to ensure materials are engineered to ensure suitability for the proposed structural / infrastructure construction design, 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 that they achieve the required geotechnical specification as defined for specific areas of the site.

## 7.3. GENERAL OVERVIEW OF FILL REQUIREMENTS

**Method Compaction – Fill to Infrastructure & External Areas:** Material to be classified by Type (i.e. Class 1 or 2, etc.) using the prescribed pre-commencement testing, the correct compaction method to be selected from MCHW Series 601. Materials are to be placed in accordance with the prescribed method, with moisture content and particle size distribution to be within the defined control limits.

**End Product Compaction – Fill to Structures:** Material to be classified by Type (i.e., Class 6I or 7, etc.) using the prescribed pre-commencement testing, which will include determination of the laboratory-defined Maximum Dry Density and Optimum Moisture Content (DD/OMC). Material will be placed and engineered with in-situ validation testing to demonstrate that the performance requirements for the fill material have been achieved to the satisfaction of the supervising engineer.

E3P has provided a generalised synopsis of typical engineering requirements for differing residential development sectors and the likely geotechnical engineering performance requirements.

## 7.4. CLASSIFICATION OF FILL MATERIAL

This specification should be read in conjunction with the following:

- UK Manual of Contract Documents for Highway Works (MCHW) CC 601; and,
- BS 1377-1:2016 Methods of test for soils for civil engineering purposes. General requirements and sample preparation

### 7.4.1. 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;
- Selected granular fill (Class 6); and,
- Selected cohesive fill (Class 7).

Other materials, as defined within MCHW, may be suitable for use; however, their selection, testing and use must be approved by the supervising engineer before the commencement of any works on-site.

### 7.4.2. PRE-COMMENCEMENT EARTHWORKS TESTING FREQUENCY

To determine the geotechnical classifications of any material to be placed and compacted in layers, representative samples will be taken at a frequency as defined herein to ensure that the geotechnical properties and method for placement and engineering can be determined prior to the commencement of works on-site.

The Main Contractor will instigate, arrange and manage the completion of the requisite pre-commencement testing prior to the start of any earthworks.

Table 7.1 E3P Earthworks Generalised Pre-Commencement and Performance Specifications

| CONSTRUCTION DETAIL | MATERIAL | TEST TYPE | FREQUENCY | PERFORMANCE REQUIREMENT |
|---|---|---|---|---|
| **Method Compaction**<br><br>**Fill to Infrastructure & External Areas**<br><br>**Engineered Up-Fill**<br>**(To be completed prior to upfilling)** | All bulk fill - Class 1 and Class 2 – Site-generated screened natural sand and gravel or clay materials. | Particle Size Distribution (PSD) and Natural Moisture Content | 1 per 1000 $m^3$ | Grading to Class 1 or 2 |
| | | Compaction Tests using 4.5 kg rammer for granular (Class 1) and 2.5 kg for cohesive (Class 2) – Optimum Moisture Content and Maximum Dry Density | 1 per 2000 $m^3$ | Moisture content to be within 2% (+/-) of the laboratory-determined optimum. |
| **End Product Compaction**<br><br>**Fill To Structures**<br><br>**Engineered Up-Fill**<br>**(To be completed prior to upfilling)** | Class 6 (selected Granular) or Class 7 (selected Cohesive) | Particle Size Distribution (PSD) and Natural Moisture Content | 1 per 1000 $m^3$ | Grading to Class 6 or 7 |
| | | Compaction Tests using 4.5 kg rammer for granular (Class 1) and 2.5 kg for cohesive (Class 2) – Optimum Moisture Content and Maximum Dry Density | 1 per 1500 $m^3$ | Moisture content to be within 2% (+/-) of the laboratory-determined optimum.<br>Materials to be engineered to ensure the in-situ density exceeds 95% of the laboratory-defined maximum. |

Table7.2 E3P Generalised Earthworks Geotechnical Compaction Specification

| SOIL/MATERIAL TYPE | CLASS | DESCRIPTION | COMPACTION EQUIPMENT | LAYER THICKNESS | ROLLER PASSES |
|---|---|---|---|---|---|
| Granular Fill (Sand and Gravel) | 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 gravel with many cobbles | > 5000 kg vibrating roller | 400 mm | 5 |
| Cohesive Fill (Clay with minor sand and gravel component) | 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 |

| SOIL/MATERIAL TYPE | CLASS | DESCRIPTION | COMPACTION EQUIPMENT | LAYER THICKNESS | ROLLER PASSES |
|---|---|---|---|---|---|
| **Recycled Aggregate (< 125 mm well graded)** | 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 |

### 7.4.3. USE OF FILL MATERIAL

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.

## 7.5. GENERAL PERFORMANCE 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 7.3 Compaction/Backfill Requirements

| LAND USE | COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERA |
|---|---|
| **Traditional Spread Foundation** | Ensure no disturbance of natural soil at shallow depths. |
| **Re-Engineering of Soils Using Vibro-Replacement Stone Column (VRSC)** | Materials to be placed in a controlled manner to facilitate the construction of vibro-replacement stone columns (VRSC). to limit differential settlement and increase Allowable Bearing Capacity (ABC)<br>These works are to be completed within the building structure footprint and +2 m of all elevations.<br>The material grading must be >90% granular in composition with less than 10% fines (which are classified as materials < 63 microns in size).<br>No material greater than 125 mm in size is permitted, with 90% of the soils placed conforming to grading < 90 mm.<br>In addition, there shall be less than 20% material finer than 2mm.<br>Material is to be placed when the actual moisture content is within tolerable limits of the optimum, with specific attention to soils that are notably wetter than the optimum.<br>Material to be placed in a manner so as to ensure a minimum CBR of 3% at formation to facilitate machine movement and piling mat construction.<br>Where materials that do not conform to the standard backfill requirements for VSC (i.e. >10% <63 microns), materials 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).<br>Materials are to be engineered to ensure a maximum CBR of 7% to mitigate the requirement for pre-boring of locations. |

| LAND USE | COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERA |
|---|---|
| | 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.<br>The substratum must be prepared to ensure a vibro-stone column treatment depth is not less than 80% of the immediate adjacent profile. |
| **Piled Foundation** | All plot footprint (+ 2 m) must be free of any deleterious elements, tree roots and obstructions > 150 mm.<br>Where upfill is proposed, the material is to be placed using Method Compaction specification to achieve a CBR as required by the developer for piling mat construction.<br>The piling mat is to be placed and constructed in accordance with the approved geotechnical engineer's temporary works design. |
| **Adopted Highways (+ 2 m from the Back of Footpath** | Method Compaction – MCHW Specification For Highway Works Series 601 is to be followed, with in-situ validation testing to meet the requirement of the adoption authority.<br>A CBR > 3% is required at subgrade formation (prior to placement of capping). |
| **Estate Road** | Method Compaction – MCHW Specification For Highway Works Series 601 is to be followed to achieve a CBR > 5%. |
| **Garden, POS and Other External Areas** | 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 a Method Compaction MCHW Specification For Highway Works Series 601. |

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 onto 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 and will be responsible for ensuring that all relevant permits and consents are in place if 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.

### 7.5.1. CONSTRUCTION OF FILL – HIGHWAYS AND INFRASTRUCTURE

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.

Where fill material is placed on a soil matrix, the contractor and client shall ensure the future settlement associated by the consolidation of compressible materials is considered by a geotechnical engineer.

For soils with the potential to consolidate by surcharge, live and dynamic loadings, ground improvement works may be required.

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.

### 7.5.2. CONSTRUCTION OF FILL – ADOPTED HIGHWAYS, ESTATE ROADS AND CAR PARKS

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.

Earthmoving 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 the failure of the contractor to comply with the 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.

### 7.5.3. 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 for 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 the 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 (UK Manual of Contract Documents for Highway Works (MCHW) CC 601 defined 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.

## 7.6. 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 7.4.

7.4 Compaction/Backfill Requirements

| LAND USE | COMPACTION METHOD AND GENERAL PERFORMANCE CRITERIA |
|---|---|
| **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>After 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:<br>**Test** / **Test method**<br>Plate load tests (equivalent CBR of 5%) / Bs 1377: part 9<br>**Disposal of materials**<br>The contractor shall be responsible for the safe disposal of any excess of unsuitable material found on the site. | CLAUSE 632 (BS 1377: PART 4) |
| **Compaction testing** | BS 1377: PART 4 |

## 7.7. SPECIFICATION OF EARTHWORKS – VIBRO STONE COLUMNS (VSC)

The over-arching method and specification for the placement and compaction of non-compliant material where the fine constituent (<63 microns) exceeds the 10% by volume generally considered as the standard requirements for ground improvement by VSC is given in Table 7.5 and Table 7.6.

Table 7.5 Overview of Works Operations

| | |
|---|---|
| **Step 1** | Carefully segregate materials excavated during civil engineering works (on-site and import) into the following soil types:<br>- Sand/granular soils;<br>- Dry sandy clay;<br>- Wet clay soil<br>- Silt.<br>Ensure all stockpiles are sealed to minimise water ingress in approved locations. |

| | |
|---|---|
| **Step 2** | Analyse bulk samples from each (site-won or imported) soil matrix as per the requirements of the E3P specification for:<br>• Dry density/optimum moisture content (4.5 kg Class 2 or 2.5 kg Class 1); and,<br>• Particle size grading coefficient. |
| **Step 3** | On-site observations in conjunction with particle size distribution (PSD) grading will confirm the classification of material and thus the corresponding method for compaction. |
| **Step 4** | The dry density/moisture content testing should be used to ensure that the material is within ± 2% of the optimum to ensure compaction can be achieved. |
| **Step 5** | 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. |
| **Step 6** | Once placed and compacted, the required validation testing should be completed at formation to demonstrate compliance.<br>The testing will include:<br>• In-situ density and air void ratio;<br>• Moisture condition value; and<br>• Undrained shear strength. |

Table 7.6 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 (ρ)** | 95% of the maximum dry density and must be within 2% 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 (ρ)** | 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 m3 and in each layer of upfill well spread over site within and around the proposed structures' footprint.<br>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.

## 7.8. PREPARATION OF VSC UNDER TREE INFLUENCE

Where trees are present or are to remain within their total zone of influence, the contractor must ensure that all cohesive soils are removed to the required depth with the subsequent replacement utilising 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.

Where trees are fully removed, potentially desiccated material will be removed to its full extent, as defined within NHBC Chapter 4.2.

Where the tree influence depth exceeds 2.5 m, specialist assessment and desiccation assessment will be required to determine the full depth of removal of cohesive materials within the conjectured zone of tree influence.

The depth of the granular blanket required will be determined prior to the commencement of the works in accordance with the parameters specified by the NHBC and LABC.

The supervising engineer will supervise and validate the removal of all potentially desiccated material.

## 7.9. CURRENT AND PROPOSED SITE TOPOGRAPHY AND SLOPE INTERACTIONS

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.

# 8. DEFINED GEOTECHNICAL ENGINEERING WORKS AND VALIDATION

In accordance with the geotechnical specification and requirements as documented herein, the following schedule of Ground Engineering (GE) works will be implemented and validated by the specialist contractor with validation by a suitably qualified geotechnical engineer.

## 8.1. GE1 – PRE COMMENCEMENT REMEDIATION CONTRACTOR REQUIREMENTS

Complete all materials testing in accordance with the required frequencies prior to the commencement of earthworks.

The contractor is to prepare an Implementation Testing Plan (ITP) for submission to the supervising engineer for approval prior to the commencement of earthworks.

## 8.2. GE2 – PROCESSING 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, including 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 7 using licensed plant.

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.

## 8.3. GE3 – CUT AND FILL TO DEVELOPMENT LEVELS

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 capacity (ABC) in the order of 125 kN/m$^2$.

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 before 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 before the commencement of filling and compaction works. In-situ density testing is required to demonstrate compliance with the E3P Geotechnical Performance Specification.

## 8.4. GE4 – PLACEMENT AND COMPACTION OF FILL FOR VSC

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

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

Non-compliant material requiring engineering to geotechnical design: material is to be placed and engineered in accordance with the correct method for the Series 601 classification (1, 2 or 6) with moisture contents to be controlled within acceptable design limits. In-situ density is to be confirmed to be > 95% of the laboratory-determined maximum (2.5 kg) with a < 5% air void ratio.

## 8.5. GE5 – CONSTRUCTION OF TEMPORARY WORK PLATFORMS

Where plots are to be prepared in a manner that will facilitate ground improvement by vibro-stone column, 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 > 5%.

## 8.6. GE6 – GEOTECHNICAL REQUIREMENT FOR REPLACEMENT MATERIALS

Material is to be backfilled in strict compliance with the E3P Geotechnical Engineering Specification as presented in detail within Section 7 of this report, which generally requires the reinstatement and compaction criteria presented in Table 7.2.

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's remediation elevations.

## 8.7. GE7 – PREPARATION OF GROUND FOR VSC UNDER 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 before the commencement of the works and in full agreement of the client but will nominally be equal to or in excess of 2.5 × foundation width.

## 8.8. GE8 – DEEP FILL ASSESSMENT

Where material upfill is proposed on compressible materials, predictive settlement modelling is required to determine the long-term potential for surcharge to induce consolidation within the underlying stratum.

Where settlement exceeds the prescribed limits, ground engineering works are required to be designed by a specialist to ensure no long-term risk of subsidence to structures and infrastructure.

# 9. RECORD KEEPING AND VERIFICATION

## 9.1. RECORD KEEPING

During the remediation and site enabling works, the contractor will undertake the following record-keeping protocols:

- Detailed site diary including material movements;
- Sampling register, testing results, photographs, details of locations of contaminated 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 remediation and site enabling works.

## 9.2. VERIFICATION REPORT

Following the completion of the remediation works and the provision of site records from the contractor, to demonstrate that all of the remediation works have been undertaken in accordance with the Remediation and Enabling Works Strategy, E3P will provide a Verification Report.

The report will provide a summary of the key elements of work and will be referenced to the agreed redevelopment strategy and planning requirements with supporting information presented within appendices.

The Verification Report will be based upon LCRM (June 2025) and will incorporate a summary and commentary of, where applicable:

- Background information on the site;
- Statutory and regulatory requirements;
- Details of the remediation required;
- Decision records covering agreements with regulators;
- Records of works undertaken and associated validation and monitoring records obtained from the contractor (chemical and geotechnical testing data, import sources, consignment notes etc);
- E3P's supervision records;
- Detailed drawings showing all sampling locations for chemical and geotechnical validation sampling;
- Specialist contractor's validation reports for particular elements of work;
- Detailed surveys of all excavations and production of as-built drawings;
- Final status of remediation and achievement of remedial objectives to satisfy planning conditions; and,
- Additional risk assessments/non-scheduled reactive works undertaken or details of any unexpected contamination.

On completion of the verification works, the appropriate documentation will be forwarded to the client and the regulatory authorities.

In most cases, a Verification Report will be produced once the remediation works have been completed; however, there may be instances where the remediation is phased and separate Verification Reports may be required.

E3P considers that with the adoption of the above best practices, the site can be safely redeveloped. The site enabling works process and the 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.

# 10. CONTINGENCY PLAN

## 10.1. PREVIOUSLY UNIDENTIFIED CONTAMINATION

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 amendments to the original remediation objectives will be justified, recorded and included in the Verification Report.

# 11. SECOND PHASE MITIGATION AND MANAGEMENT

This document details the construction works that are required to ensure full compliance with the remediation Strategy, Regulatory Authorities, Building Control and 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 soft landscaping;
- Placement and chemical validation of sub-soil within soft landscaping.
- Placement and chemical validation of imported topsoil within soft landscaping.

This section covers the build phase requirements with regard to cover systems for soft landscaping however, in relation to any further build phase validation items, such as ground gas mitigation, this is available in a separate Build Phase Development Strategy.

## 11.1. COVER SYSTEM REQUIREMENTS

The Remediation Strategy for the site, with respect to the 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:

- 600 mm clean cover system within garden areas;
- 450 mm clean cover system within front gardens deemed to be functional landscaping;
- Geotextile break layer in all private front and rear garden areas, and,
- 450 mm clean cover system within areas of landscaping and POS.

The above depths are in line with Section 6 of the Manchester City Council Planning & Contaminated Land Technical Guidance, dated February 2021. Where trees are proposed, a deeper growing medium comprising 900 mm may be required.

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

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

The sampling frequency for these materials is presented in Table 5.1.

## 11.2. PROCEDURE FOR PLACEMENT AND VALIDATION OF CHEMICALLY SUITABLE COVER SYSTEM

Rear Garden areas need to be backfilled with 450 mm chemically validated subsoil, with 150 mm topsoil overlaying this. Topsoil and subsoil are required to be confirmed as chemically suitable prior to placement.

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

Landscaped areas and POS need to be backfilled with 300 mm chemically validated subsoil, with 150 mm topsoil overlaying this. Topsoil and subsoil are required to be confirmed as chemically suitable prior to placement.

The placement of 450 mm of clean material will be undertaken during the build phase works of the project.

A geotextile break layer is required beneath all cover systems in front and rear garden areas.

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 150 mm of certified topsoil, 450 mm of subsoil and placement of geotextile membrane 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 a CML certificate.

The garden validation procedure is detailed in Table 11.1.

TABLE 11.1 Garden Validation Procedure

| PROCEDURE | METHOD |
|---|---|
| **Chemical Validation** | Imported subsoils and topsoil will need to be chemically analysed to confirm suitability for use with the proposed cover system before installation and completion of the garden systems.<br><br>E3P will issue an email to the appropriate party with an assessment of the chemical suitability of both subsoils and topsoils.<br><br>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 suitably qualified E3P engineer. |
| **Trial Holes** | Trial holes are deemed necessary for all plots and must be advanced at random. |
| **Validation** | 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.<br><br>For plots where sub-soil depths require validation by E3P during the build phase, photographs will be taken and collated by E3P. It should be noted that cover systems should be installed as late as possible in the build programme to reduce the risk of cross-contamination. |
| **Validation Certificate** | 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 have been placed in the required garden plots along with the chemical analysis. |
| **Completion Report** | Upon completion of all garden and landscaped areas within the development, a Completion Report will be issued providing confirmation that all remediation requirements have been achieved. |

Figure 11.1 provides an example of garden validation photographs required for each plot.

Figure 11.1 Example Plot Cover System Validation

| Plot No: 70 | | |
|---|---|---|
| Depth of Strata (m bgl) | 0.00-0.15 | Validated TOPSOIL |
| | 0.15-0.60 | Validated SUBSOIL |

***Depth of Cover System Materials***



***Depth of Cover System Materials***



***Depth of Cover System at Ground Level***



***Depth of Cover System in Relation to Plot***



**END OF REPORT**

# Appendix I: Limitations



## GENERAL

This report and any associated works (together comprising the "Services") were compiled and carried out by E3P for the client (as present in Section 1) under the E3P “Terms of Business” or with those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.

Unless explicitly agreed otherwise, in writing, this report has been prepared under E3P Standard Terms and Business as included within our proposal to the Client.

Project-specific appointment documents may be agreed upon at our discretion and a charge may be levied for both the time to review and finalise appointment documents and also for associated changes to the appointment terms. E3P reserves the right to amend the fee should any changes to the appointment terms create an increased risk to E3P.

The report needs to be considered in light of the proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

## PHASE 1 GEOENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

Coverage: This section covers reports with the following titles or combination of titles: Phase 1; Desktop Study; Geoenvironmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Baseline Environmental Assessment; Project Scope Summary Report (PSSR), Program Environmental Impact Report (PEIR), Geotechnical Development Risk Register; Agricultural Land Assessment; Mineral Safeguarding Assessment; Desk Top Coal Mining Risk Assessment; Hydrogeological Appraisal; Construction Environmental Management Plan; and Site Water Management Plan.

The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walkover inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects’ responses may not have been received from all parties. E3P cannot be held responsible for any disclosures that are provided post-production of our report and will not automatically update our report.

The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, E3P reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.

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 does not constitute or replace full and proper surveys completed by suitably qualified and experienced specialists in these fields.

E3P does not warrant work/data undertaken/provided by others.

## INTRUSIVE INVESTIGATION REPORTS

Coverage: The following report titles (or combination) may cover this category of work: Geoenvironmental Site Investigation; Geotechnical Assessment; GIR (Ground Investigation Reports); Preliminary Environmental And Geotechnical Risk Assessment; Preliminary Summary; Coal Mining Risk Assessment, Ground Gas Addendum; and, Geotechnical Risk Register.

The investigation has been undertaken to provide information concerning either:

- The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
- Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.

The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.

Unless otherwise specified in the scope of works, any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.

For geotechnical investigations, the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.

The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.

The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report

The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, E3P has used reasonable skill and care to extrapolate conditions between these points based on assumptions to develop our interpretation and conclusions.

The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation and at the time of the investigation.

Conditions can change between investigation points both spatially and over time and these interpretations should therefore be considered indicative. The assessment of extreme weather events and their impact on ground conditions is not within the scope of E3P's work

The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of

any future changes or amendments to these values. Specific assumptions associated with the risk assessment process have been outlined within the body or associated appendix of the report.

Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.

Where soil contamination concentrations recorded as part of this investigation are used for commentary on the potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed and the waste classification and any subsequent disposal option agreed upon with licenced subcontractors and/or the relevant regulators.

The results of the asbestos testing are factually reported and interpretation is given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.

If costs have been included in relation to additional site works, and/or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

## EUROCODE 7: GEOTECHNICAL DESIGN

On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.

In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

## DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIATION AND ENABLING WORK STRATEGY REPORTS

These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected based on the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.

The outputs of the Detailed Quantitative Risk Assessments are based upon the manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.

Before adoption on-site, assessment criteria will need to be discussed and agreed upon with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales

associated with the Regulatoy Authority engagement are not within the control of E3P. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

E3P does not accept liability for any subcontract work that has not been completed in strict accordance with an approved E3P Remediation and Enabling Works Strategy.

## GEOTECHNICAL DESIGN REPORT (GDR)

The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.

## MONITORING (INCLUDING REMEDIATION MONITORING REPORTS AND BUILD PHASE MITIGATION)

These reports are factual and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of earthworks or remedial works.

The data is presented and will be compared with assessment criteria.

# Appendix II: Glossary



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

| | | | |
|---|---|---|---|
| **MCV** | Moisture condition value | **WRAP** | Waste and Resources Action Programme |
| **MIBK** | Methyl isobutyl ketone | **WTE** | Water table elevation |
| **m** | Metres | **ppm** | Parts per million |
| **km** | Kilometres | **mg/m$^3$** | Milligram per metre cubed |
| **% v/v** | Percent volume in air | **m bgl bgl** | Metres below ground level |
| **mb** | Millibars (atmospheric pressure) | **m bcl** | Metre below cover level |
| **l/hr** | Litres per hour | **mAOD** | Metres above ordnance datum (sea level) |
| **µg/l** | Micrograms per litre (parts per billion) | **kN/m$^2$** | Kilonewtons per metre squared |
| **ppb** | Parts per billion | **µm** | Micrometre |
| **mg/kg** | Milligrams per kilogram (parts per million) | **SSRT** | Site Specific Remediation Target |
| **PSD** | Particle Size Distribution | **DD** | Dry Density |
| **CL:AIRE** | Contaminated Land: Applications in Real Environments | **Mc** | Moisture Content |
| **ρ** | Bulk Density | **GPR** | Ground Penetrating Radar |
| **NDP** | Nuclear Density Probe | **FFL** | Finished Floor Level |
| **LEL** | Lower Explosive Limit | **UKWIR** | UK Water Industry Research |
| **CIRIA** | Construction Industry Research and Information Association | **LOD** | Limit of Detection |
| **PFAS** | Per- and Poly-Fluorinated Substances | **PFOA** | Perfluorooctanoic Acid |

# Appendix III: Drawings






Notes:

Client: Kellen Homes

Job No: 18-376

Date: 24.10.2025

Drawing No: 001

Scale: NTS

| Phase | Issue | Date | Drawn | Checked | PM |
|---|---|---|---|---|---|
| P1 | REVA | 24.10.2025 | TG | EP | MD |

Job Title: Buzz Bingo

Drawing Title: Site Location Plan

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| | | | | | | |
|---|---|---|---|---|---|---|
| P1 | REVA | 23.03.2026 | TG | MD | MD | |
| Phase | Issue | Date | Drawn | Checked | PM | |

*Notes:*

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 23.03.2026

*Drawing No:* 002

*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Proposed Development Plan

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*Historical Features*

- Boating Lake
- Clock Tower
- Bowling Alley / Bingo Hall / Disused Bingo Hall
- Footpath
- Field Boundary

*Notes:*

| P1 | REVA | 27.10.2025 | TG | EP | MD |
|---|---|---|---|---|---|
| Phase | Issue | Date | Drawn | Checked | PM |

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 27.10.2025

*Drawing No:* 003

*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Historical Features Plan

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*Site Features*

- Area Of Vegetation
- Footpath
- Access Road
- Hardstanding Car Park
- Cable Box
- Storage Container
- Diused Bingo Hall
- Air Conditioning Unit
- Skip / Bin
- Manhole
- Surface Water Drain
- Stairs
- Electrical Pylon
- Trees
- Lamppost
- Sign Post
- MCC Land Boundary
- Vehicle Access Gate

*Notes:*

| P1 | REVA | 27.10.2025 | TG | EP | MD |
|---|---|---|---|---|---|
| Phase | Issue | Date | Drawn | Checked | PM |

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 27.10.2025

*Drawing No:* 004

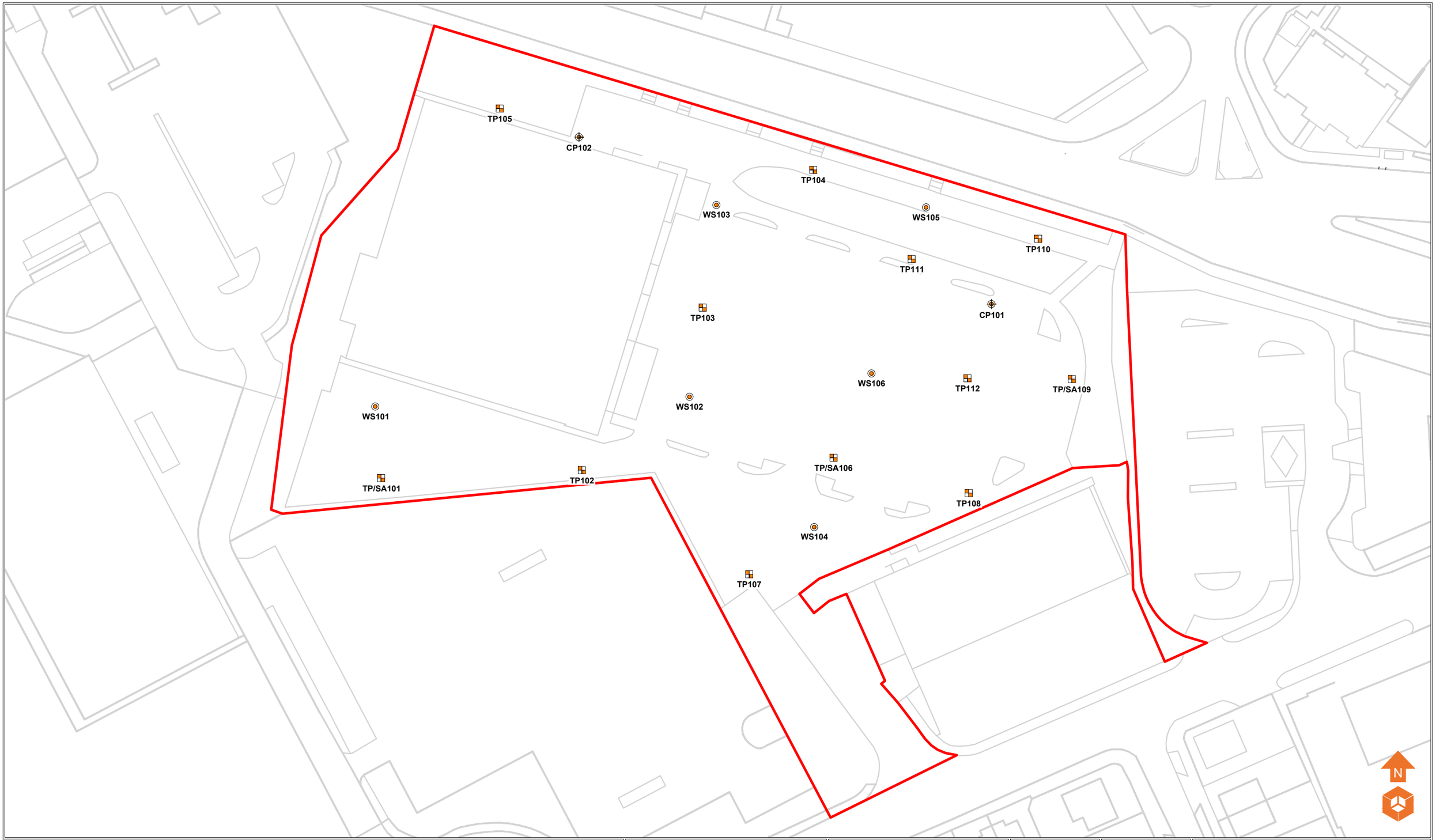
*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Site Features Plan

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*Location Symbols*

- Approximate Window Sample Probehole Location
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location
- Approximate Trial Pit / Soakaway Location

*Notes:*

| P1 | REVA | 15.12.2025 | TG | CA | GC |
|---|---|---|---|---|---|
| Phase | Issue | Date | Drawn | Checked | PM |

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 15.12.2025

*Drawing No:* 006

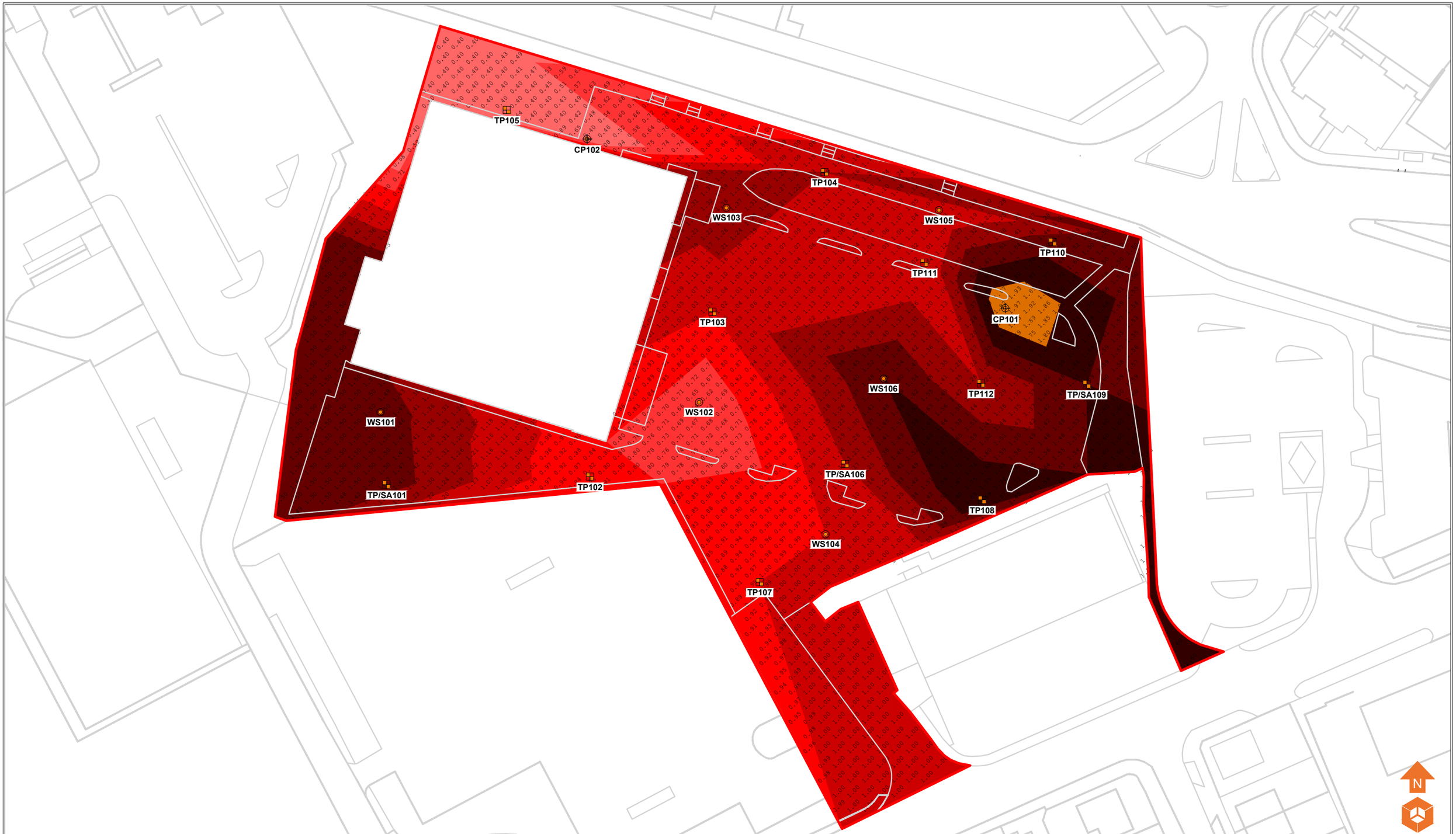
*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Exploratory Hole Location Plan

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*Location Symbols*

- WS101 — Approximate Window Sample Probehole Location
- TP101 — Approximate Trial Pit Location
- CP101 — Approximate Cable Percussive Borehole Location
- TP/SA101 — Approximate Trial Pit / Soakaway Location

*Made Ground Depth (m)*

- Depth of Made Ground 0.40 - 0.59m
- Depth of Made Ground 0.60 - 0.79m
- Depth of Made Ground 0.80 - 0.99m
- Depth of Made Ground 1.00 - 1.19m
- Depth of Made Ground 1.20 - 1.39m
- Depth of Made Ground 1.40 - 1.59m
- Depth of Made Ground 1.60 - 1.79m
- Depth of Made Ground >1.80m

*Notes:*

| Phase | Issue | Date | Drawn | Checked | PM |
|---|---|---|---|---|---|
| P1 | REVA | 06.02.2026 | TG | MD | MD |

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 06.02.2026

*Drawing No:* 007

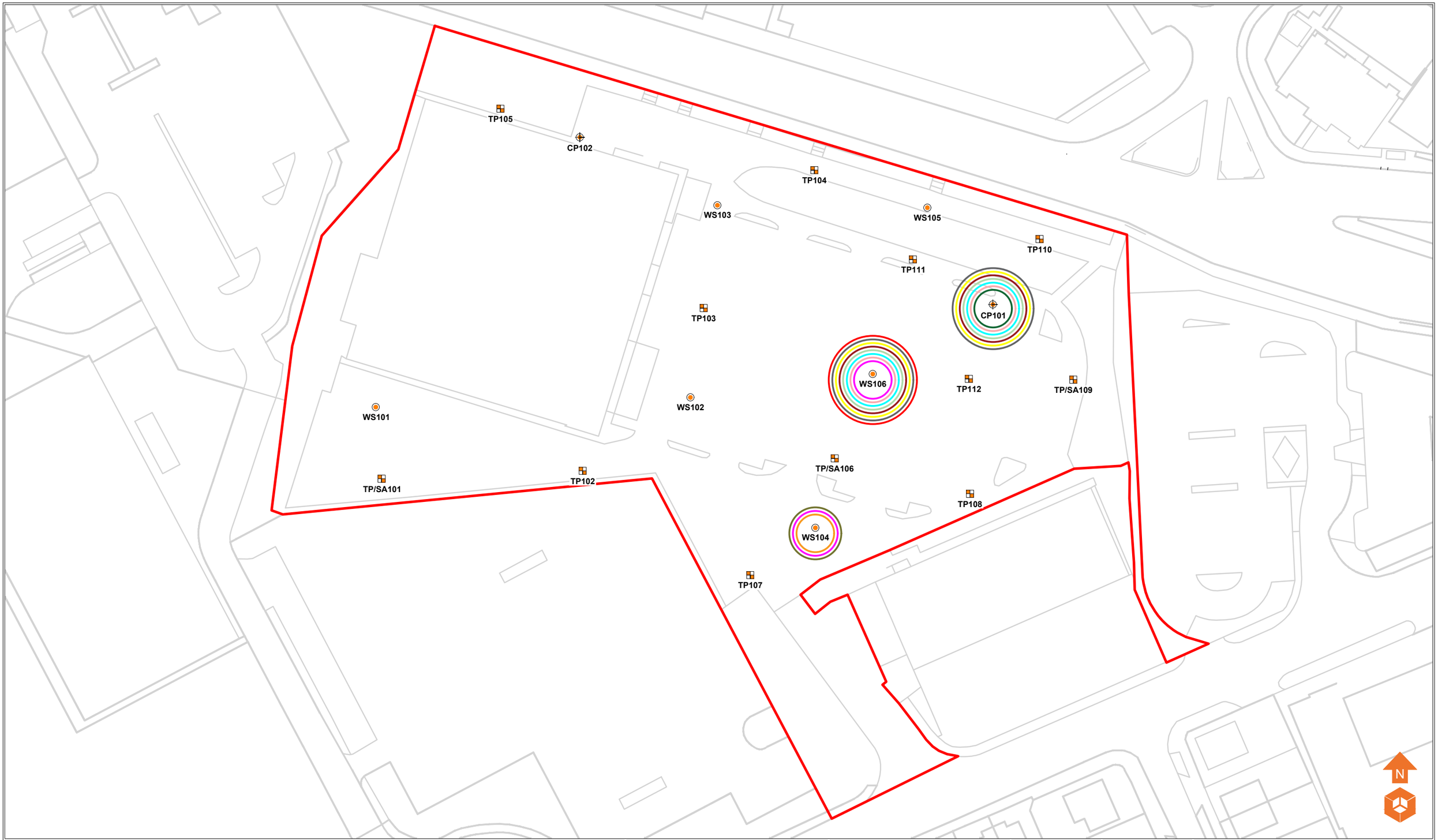
*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Depth Of Made Ground Plan

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*Location Symbols*

- Approximate Window Sample Probehole Location
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location
- Approximate Trial Pit / Soakaway Location

*Contamination Exceedances*

- Chromium III
- Copper
- Nickel
- Selenium
- TPH C21–C35
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo (a) Pyrene
- Indeno(123-cd)pyrene
- Fluoranthene
- Anthracene

*Notes:*

| Phase | Issue | Date | Drawn | Checked | PM |
|---|---|---|---|---|---|
| P1 | REVA | 23.03.2026 | TG | TM | MD |

*Client:* Kellen Homes

*Job No:* 18-376

*Date:* 23.03.2026

*Drawing No:* 014

*Scale:* NTS

*Job Title:* Buzz Bingo

*Drawing Title:* Contamination Exceedances Plan - Groundwater

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# Appendix IV: Remediation/Validation Criteria



## Human Health Remediation Targets – Residential End Use

| DETERMINAND | UNIT | WITHIN 600 mm COVER SYSTEM | HARDSTANDING AND > 600 mm COVER SYSTEM | POS AND 300 mm COVERSYSTEM | POS AND > 300 mm COVER SYSTEM | PATHWAY |
|---|---|---|---|---|---|---|
| Arsenic | mg/kg | 37(i) | 40(ii) | 79(iii) | 170(iv) | 1 |
| Cadmium | mg/kg | 11(i) | 85(ii) | 120(iii) | 532(iv) | 1 |
| Chromium (Hexavalent) | mg/kg | 6(i) | 6(ii) | 7.7(iii) | 220(iv) | 1 |
| Lead | mg/kg | 200(vi) | 310(vii) | 630(viii) | 1300(viii) | 1 |
| Elemental Mercury | mg/kg | 1.2(i) | 1.2(ii) | 16(iii) | 30(iv) | 4 |
| Nickel | mg/kg | 130(i) | 180(ii) | 230(iii) | 800(iv) | 1 |
| Selenium | mg/kg | 250(i) | 430(ii) | 1100(iii) | 1800(iv) | 1 |
| Copper | mg/kg | 2400(i) | 7100(ii) | 12000(iii) | 44000(iv) | 1 |
| Zinc | mg/kg | 3700(i) | 40000(ii) | 81000(iii) | 170000(iv) | 1 |
| Phenol | mg/kg | 120(i)(xi) | 440(xiv)(xi) | 440(iii)(xi) | 440(iv)(xi) | 1 |
| Naphthalene | mg/kg | 2.3(i)(xi) | 2.3(xiv)(xi) | 1200(iv)(xi) | 1200(iv)(xi) | 4 |
| Acenaphthylene | mg/kg | 170(i)(xi) | 500(v) | 15000(iii)(xi) | 29000(iv)(xi) | 2 |
| Acenaphthene | mg/kg | 210(i)(xi) | 500(v) | 15000(iii)(xi) | 29000(iv)(xi) | 1 |
| Fluorene | mg/kg | 170(i)(xi) | 500(v) | 9900(iii)(xi) | 20000(iv)(xi) | 1 |
| Phenanthrene | mg/kg | 95(i)(xi) | 500(v) | 3100(iii)(xi) | 6200(iv)(xi) | 2 |
| Anthracene | mg/kg | 500(i)(xi) | 500(v) | 74000(iii)(xi) | 150000(iv)(xi) | 2 |
| Fluoranthene | mg/kg | 280(i)(xi) | 500(v) | 3100(iii)(xi) | 6300(iv)(xi) | 2 |
| Pyrene | mg/kg | 500(i)(xi) | 500(v) | 7400(iii)(xi) | 15000(iv)(xi) | 2 |
| Benzo(a)Anthracene( | mg/kg | 7.2(i)(xi) | 11(ii)(xi) | 29(iii)(xi) | 49(iv)(xi) | 2 |
| Chrysene | mg/kg | 15(i)(xi) | 30(ii)(xi) | 57(iii)(xi) | 93(iv)(xi) | 2 |
| Benzo(b)Fluoranthene (iii) | mg/kg | 2.6(i)(xi) | 3.9(ii)(xi) | 7.1(iii)(xi) | 13(iv)(xi) | 2 |
| Benzo(k)Fluoranthene (iii) | mg/kg | 77(i)(xi) | 110(ii)(xi) | 190(iii)(xi) | 370(iv)(xi) | 2 |
| Benzo(a)Pyrene (vii) | mg/kg | 2.2(i)(xi) | 3.2(ii)(xi) | 5.7(iii)(xi) | 11(iv)(xi) | 2 |
| Indeno(123-cd)Pyrene | mg/kg | 27(i)(xi) | 45(ii)(xi) | 82(iii)(xi) | 150(iv)(xi) | 2 |
| Dibenzo(a,h)Anthracene | mg/kg | 0.24(i)(xi) | 0.31(ii)(xi) | 0.57(iii)(xi) | 1.1(iv)(xi) | 2 |
| Benzo(ghi)Perylene | mg/kg | 320(i)(xi) | 360(ii)(xi) | 640(iii)(xi) | 1400(iv)(xi) | 2 |
| TPH C5-C6 (aliphatic) | mg/kg | 42(i)(xi) | 42(ii)(xi) | 42(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C6-C8 (aliphatic) | mg/kg | 100(i)(xi) | 100(ii)(xi) | 100(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C8-C10 (aliphatic) | mg/kg | 27(i)(xi) | 27(ii)(xi) | 27(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C10-C12 (aliphatic) | mg/kg | 130(i)(xi) | 130(ii)(xi) | 130(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C12-C16 (aliphatic) | mg/kg | 1000(xiv)(xi) | 1000(xiv)(xi) | 1000(xiv)(xi) | 10000(xiv)(xi) | 4 |
| TPH C16-C35 (aliphatic) | mg/kg | 1000(xiv)(xi) | 1000(xiv)(xi) | 1000(xiv)(xi) | 10000(xiv)(xi) | 1 |
| TPH C5-C7 (aromatic) | mg/kg | 70(i)(xi) | 370(ii)(xi) | 370(ii)(xi) | 10000(xiv)(xi) | 4 |

| DETERMINAND | UNIT | WITHIN 600 mm COVER SYSTEM | HARDSTANDING AND > 600 mm COVER SYSTEM | POS AND 300 mm COVERSYSTEM | POS AND > 300 mm COVER SYSTEM | PATHWAY |
|---|---|---|---|---|---|---|
| TPH C7-C8 (aromatic) | mg/kg | 130(i)(xi) | 860(ii)(xi) | 860(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C8-C10 (aromatic) | mg/kg | 34(i)(xi) | 47(ii)(xi) | 47(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C10-C12 (aromatic) | mg/kg | 74(i)(xi) | 250(ii)(xi) | 250(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C12-C16 (aromatic) | mg/kg | 140(i)(xi) | 1800(ii)(xi) | 1800(ii)(xi) | 10000(xiv)(xi) | 4 |
| TPH C16-C21 (aromatic) | mg/kg | 260(i)(xi) | 1900(ii)(xi) | 1900(ii)(xi) | 10000(xiv)(xi) | 1 |
| TPH C21-C35 (aromatic) | mg/kg | 1000(xiv)(xi) | 1900(ii)(xi) | 1900(ii)(xi) | 10000(xiv)(xi) | 1 |
| Asbestos | Fibres Volume Weight | NFD | 0.001% | NFD | 0.001 | 3 |

**Notes 1**

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 5&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 0.001% by volume (weight).

**Notes 2**

Excludes matrices where free product is observed;

Commercial Tier 2 GAC modelled to assume no exposure pathway; and,

No viable exposure pathway beneath hard standing and cover system.

**Notes 3**

Main Exposure Pathways: 1 = Soil Ingestion, 2 = Dermal Contact & Ingestion 3 = Dust Inhalation 4 = Vapour Inhalation (indoor)

Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; NA – Not Applicable (no exceedance of assessment criteria); Loc of MC = Location of Exceedances

(i)Value derived from LQM Suitable 4 Use Levels (S4ULs) for residential end use with plant uptake.

(ii)Value derived from LQM Suitable 4 Use Levels (S4ULs) for residential end use without plant uptake – these levels used below 600mm 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 Suitable 4 Use Levels (S4ULs) for Public open Space (POS) residential.

(iv)Value derived from LQM Suitable 4 Use Levels (S4ULs) for Public Open Space (POS) park – these levels used below 300mm 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 Suitable 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 2600mg/kg, m-xylene 3500mg/kg) and is capped by its solubility.

(xiii)Value derived from LQM Suitable 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.

## Human Health Remediation Targets – Commercial End Use

| DETERMINAND | UNIT | WITHIN 300 mm COVER SYSTEM (POS) | UNDER HARD STANDING AND >300 mm TO 1.0 m BELOW COVER SYSTEM ** | PATHWAY |
|---|---|---|---|---|
| Arsenic (vii) | mg/kg | 79 | 640 | 1 |
| Cadmium (vii) | mg/kg | 120 | 190 | 1 |
| Chromium (Hexavalent) | mg/kg | 7.7 | 33 | 1 |
| Lead (vii) | mg/kg | 630 | 2300 | 1 |
| Elemental Mercury | mg/kg | 16 | 58 | 4 |
| Nickel | mg/kg | 230 | 980 | 1 |
| Selenium | mg/kg | 1100 | 12000 | 1 |
| Copper | mg/kg | 12000 | 68000 | 1 |
| Zinc | mg/kg | 81000 | 730000 | 1 |
| Cyanide | mg/kg | 791 | 791 | 1 |
| Phenol | mg/kg | 440 | 440 | 1 |
| Asbestos | Fibres | NFD | ≤0.001 | 3 |
| Naphthalene | mg/kg | 4900 | 190 | 4 |
| Acenaphthylene | mg/kg | 15000 | 83000 | 2 |
| Acenaphthene | mg/kg | 15000 | 84000 | 1 |
| Fluorene | mg/kg | 9900 | 63000 | 1 |
| Phenanthrene | mg/kg | 3100 | 22000 | 2 |
| Anthracene | mg/kg | 74000 | 520000 | 2 |
| Fluoranthene | mg/kg | 3100 | 23000 | 2 |
| Pyrene | mg/kg | 7400 | 54000 | 2 |
| Benzo(a)Anthracene | mg/kg | 29 | 170 | 2 |
| Chrysene | mg/kg | 57 | 350 | 2 |
| Benzo(b)Fluoranthene | mg/kg | 7.1 | 44 | 2 |
| Benzo(k)Fluoranthene | mg/kg | 190 | 1200 | 2 |
| Benzo(a)Pyrene | mg/kg | 5.7 | 35 | 2 |
| Indeno(123-cd)Pyrene | mg/kg | 82 | 500 | 2 |
| Dibenzo(a,h)Anthracene | mg/kg | 0.57 | 3.5 | 2 |
| Benzo(ghi)Perylene | mg/kg | 640 | 3900 | 2 |
| TPH C5-C6 (aliphatic) | mg/kg | 570000 | 3200 | 4 |
| TPH C6-C8 (aliphatic) | mg/kg | 600000 | 7800 | 4 |
| TPH C8-C10 (aliphatic) | mg/kg | 13000 | 2000 | 4 |
| TPH C10-C12 (aliphatic) | mg/kg | 13000 | 9700 | 4 |
| TPH C12-C16 (aliphatic) | mg/kg | 13000 | 59000 | 4 |
| TPH C16-C35 (aliphatic) | mg/kg | 250000 | 1600000 | 1 |
| TPH C5-C7 (aromatic) | mg/kg | 56000 | 26000 | 4 |

| DETERMINAND | UNIT | WITHIN 300 mm COVER SYSTEM (POS) | UNDER HARD STANDING AND >300 mm TO 1.0 m BELOW COVER SYSTEM ** | PATHWAY |
|---|---|---|---|---|
| TPH C7-C8 (aromatic) | mg/kg | 56000 | 56000 | 4 |
| TPH C8-C10 (aromatic) | mg/kg | 5000 | 3500 | 4 |
| TPH C10-C12 (aromatic) | mg/kg | 5000 | 16000 | 4 |
| TPH C12-C16 (aromatic) | mg/kg | 5100 | 36000 | 4 |
| TPH C16-C21 (aromatic) | mg/kg | 3800 | 28000 | 1 |
| TPH C21-C35 (aromatic) | mg/kg | 3800 | 28000 | 1 |
| TPH C5-C6 (aliphatic)** | mg/kg | 570000 | 3200 | 4 |
| TPH C6-C8 (aliphatic)** | mg/kg | 600000 | 7800 | 4 |
| TPH C8-C10 (aliphatic)** | mg/kg | 13000 | 2000 | 4 |
| TPH C10-C12 (aromatic)** | mg/kg | 5000 | 16000 | 4 |
| TPH C12-C16 (aromatic)** | mg/kg | 5100 | 36000 | 4 |
| TPH C16-C21 (aromatic)** | mg/kg | 3800 | 28000 | 1 |
| TPH C21-C35 (aromatic)** | mg/kg | 3800 | 28000 | 1 |

* Values based on LQM S4UL for commercial without plant uptake 1% SOM and General Assessment Criteria (GAC) developed by CIEH / LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM

** Values based on LQM S4UL for Commercial 1% SOM and General Assessment Criteria (GAC) developed by CIEH / LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM

**Note 1**

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 0.001% by volume (weight).

N.F.D. – None Fibres Detected

0.001% - Soils may contain ≤0.001% asbestos using composite testing to ensure there is no potential risk to human health. This value is present within areas where there may be short term low level exposure of soils containing trace asbestos fibres by construction workers where an appropriate level of asbestos management is employed (dust suppression).

0.1% - Soils at a depth of >1.00m bgl may contain <0.1% asbestos using composite testing where they will be not likely to be disturbed in the future and will therefore be in an area of low sensitivity. Risk assessment completed in accordance with the Asbestos JIWG risk assessment tools.

Undefined – This will be dependent upon soils encountered during the earthworks, which may be placed at depths greater than 1.0m to ensure no potential risk to human health. Risk associated with off-site disposal should be considered against remaining in-situ.

**Notes 2**

Excludes matrices where free product is observed;

Tier 2 values for POS (resi) used for any imported soils used for cover system;

Commercial Tier 1 GAC modelled to assume no exposure pathway; and,

No viable exposure pathway beneath hard standing and cover system. Exceedance of target level should be subject to further risk assessment.

No soils are to be imported to site that would be classified as Hazardous Waste.

**Notes 3**

Main Exposure Pathways: 1 = Soil Ingestion, 2 = Dermal Contact & Ingestion 3 = Dust Inhalation 4 = Vapour Inhalation (indoor)

Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; NA – Not Applicable (no exceedance of assessment criteria); Loc of MC = Location of Exceedances

*Mercury – Based on elemental Mercury

**The Tier 2 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 2 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 2 values for aromatic compound for the non volatile fractions (C12-C35). 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.

Generic Controlled Waters Remediation Targets

| DETERMINAND | UNIT | EQS [1,2] AA | DWS [2,3,4] |
|---|---|---|---|
| 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 | 3000[6] |
| pH | | 6–9 | |
| Naphthalene | µg/l | 2 | – |
| Anthracene | µg/l | 0.1 | – |
| Benzo(a) Pyrene | µg/l | 0.00017* | 0.01 |
| Benzo (b) Fluoranthene | µg/l | 0.00017* | 0.1 |
| Benzo (k) Fluoranthene | µg/l | 0.00017* | |
| Indeno(123-cd)pyrene | µg/l | 0.00017* | |
| Benzo(ghi) Perylene | µg/l | 0.00017* | |
| Fluoranthene | µg/l | 0.0063 | – |
| TPH Aromatic C5-C7 (Benzene) | µg/l | 10 | 1 |
| TPH Aromatic C7-C8 (Toluene) | µg/l | 74 | 700 |
| TPH Aromatic C8-C10 (Xylene) | µg/l | 30 | 300 |
| TPH Aromatic C10-C12 (Naphthalene) | µg/l | 2 | 90 |
| TPH Aromatic C12-C16 | µg/l | - | 90 |
| TPH Aromatic C16-C35 | µg/l | - | 90 |
| TPH Aliphatic C5-C6 | µg/l | – | 1000[5] |
| TPH Aliphatic C6-C8 | µg/l | – | 1000[5] |
| TPH Aliphatic C8-C10 | µg/l | – | 300 |
| TPH Aliphatic C10-C12 | µg/l | – | 300 |
| TPH Aliphatic C12-C16 | µg/l | – | 300 |
| TPH Aliphatic C16-C21 | µg/l | – | 300** |
| TPH Aliphatic C21-C35 | µg/l | – | 300** |
| Tetrachlorethylene | µg/l | 10 | 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 | – | 0.5 |

#Solubility <0.01µg/l
AA – Annual Average
*Polyaromatic hydrocarbons (PAH) – Benzo(a)pyrene (BaP), Benzon(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 Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (legislation.gov.uk)
2.The Water Supply (Water Quality) Regulation 2018 (legislation.gov.uk)
3.Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum (who.int)
4.CL:AIRE publishes Petroleum Hydrocarbons in Groundwater guidance (claire.co.uk)
5.A total TPH criteria of 1000 mg/kg will act as a surrogate criterion for remaining aliphatic and aromatic TPH fractions.
6.Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996

# Appendix V: Import Criteria



| | |
|---|---|
| SITE OF IMPORTATION ADDRESS | |
| Client | |
| Main Contractor | |
| Earthworks Contractor | |
| Haulier | |
| Date of Planned Import | |

E3P
+44 (0) 161 707 9612
info@e3p.co.uk

| | |
|---|---|
| Overview of Planned Material Import | |
| Material Source (Site of Origin) and Postcode | |
| Site Investigation Report | **Report Title and Reference:**<br>**Date:**<br>**Information Supplied By:** |
| Reason for Generation of Excess Material at Site of Origin | |
| Chemical Test Results for Stockpile at Site of Origin | **Date:**<br>**Laboratory Certificate Ref:**<br>**Organisation Responsible for Stockpile Sampling:** |
| Geotechnical Material Classification and Testing | **Delete as Appropriate:** Class 1 / Class 2 / Class 6 / Topsoil |
| Pictures of Material Stockpile Pending Transportation | **Delete as Appropriate:** Yes / No |
| Person or Organisation Responsible for Ensuring Quality Control at Site of Origin | |
| Quantity of Material to Be Imported ($m^3$) | |
| Proposed Area of Deposition (Site of Reuse) | |
| Waste Exemption/Permit or CL:AIRE MMP | **Delete as Appropriate:** U1 Standard Rules / CL:AIRE MMP (Direct Transfer) / Bespoke |

# Appendix VII: Contractor Pre-Commencement Check Sheet



| 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 Hotpots, 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 |
| 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 |

| ACTIVITY | TESTING RESPONSIBILITY | CONTRACTORS METHOD STATEMENT REQUIRED (Y/N) | COMMENT/ACTION |
|---|---|---|---|
| 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 VIII 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.