e3p

Remediation and Enabling Works Strategy
Former Bridgewater Paper Mill

Reference:14-035-R2-0
Date: February 2021

REMEDIATION AND ENABLING WORKS STRATEGY

Former Bridgewater Paper Mill
North Road
Ellesmere Port

Prepared for:

Firethorn Investors Limited
4th Floor
85 Newman Street
London
W1T 3EU

Report Ref: 14-035-R1-2
Date Issued: 5 February 2021

E3P

Taylor Road
Trafford Park
Urmston
M41 7JQ

[redacted]

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	14-035		
VERSION	Version 1		
REMARKS	Final		
DATE	[redacted]		
PREPARED BY			
QUALIFICATIONS			
SIGNATURE			
CHECKED BY			
QUALIFICATIONS			
SIGNATURE			
AUTHORISED BY			
QUALIFICATIONS			
SIGNATURE			

EXECUTIVE SUMMARY

Site Address	Former Bridgewater Paper Mill, North Road, Ellesmere Port
National Grid Reference	338900, 378700
Site Area	13 Ha
Background	This document provides a comprehensive specification for the land remediation and subsequent enabling earthworks including geotechnical performance criteria required to ensure the construction of a development platform that will be geotechnically suitable for the proposed commercial and industrial end-use. The specification defines the land remediation works required to ensure all potentially unacceptable risk associated with identified contamination is addressed to ensure no complete pollution linkage upon completion of the development. This specification defines geotechnical parameters for the up-fill of soils as a structural fill, compaction of materials to construct a sub-base using stabilised and solidified recycled materials or imported aggregate and requirement for processing aggregates to ensure compliance with the necessary engineering properties.
Proposed Development	E3P understands that Firethorn Investors Limited are considering the future redevelopment for industrial use with associated infrastructure.
Site Investigation Reports & Assessment	This Remediation Strategy & Geotechnical Enabling Works Specification has been prepared in due consideration of the E3P Phase 1 & 2 Site Investigation report (ref: 12-904-r1) dated November 2019. All Site Investigation reports should be read as a precursor to this document.

CONTAMINATED LAND ASSESSMENT

Human Health Risk Assessment	Analysis of selected soil samples from across the site has identified isolate occurrences of asbestos, heavy metals and polycyclic aromatic hydrocarbons (PAH). Based on a future commercial/industrial end-use the identified determinands are not considered likely to pose a significant risk to human health as any potential pathways are likely to be broken by the presence of hardstanding and buildings. A remediation and enabling works strategy will need to be developed to ensure the safe management of dust due to the presence of asbestos fibres and locally hydrocarbon impacted soil and perched groundwater.
Controlled Waters Risk Assessment	Slightly elevated concentrations of metals and volatile organic compounds have been identified within both shallow and deep monitoring boreholes. Subsequent monitoring did not record any elevated concentrations. Monitoring of Rivacre Brook and the Manchester Ship Canal is recommended throughout any future remediation works but given that foundation structures for the proposed buildings will be shallow there is not likely to be the creation of any preferential pathways to the underlying principal aquifer. It is therefore considered that the site will represent a low risk to controlled waters.
Ground Gas	A former landfill was identified beyond Rivacre Brook to the west and this was identified as a potential source of ground gas that was detected in the west of the site during previous ground investigation.

	Assessment of previous and current results indicates that no significantly elevated ground gas concentrations are present beneath the area of proposed units 1 and 2 and that these areas will be classified as CS1 and that mitigation measure will not be required. However, the full assessment will be determined following the completion of the gas monitoring.
Potable Water Supply	Barrier Pipe is likely to be required but this can be determined following the completion of UKWIR assessment post remediation and enabling works.

GEOTECHNICAL ASSESSMENT

Relict Sub-Structures	Extensive relict substructures, infrastructure and materials deemed geotechnically deleterious are identified. All such materials will require removal from beneath proposed structures and infrastructure to the depths and extents as defined within this specification.
Adverse Ground Conditions	All potentially infilled ponds and historical features where deleterious/putrescible material is identified should be located and subject to the necessary remediation works.
Proposed Structural Foundations	Based on the assessment of the determined undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying bedrock for the majority of the site and localised areas of clays where an ABP of approximately 150 kN/m^2 can be achieved. However, given the significant topographical variances on the site, prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels. Due to the presence of soft clays within central sectors which underlay the proposed structures, it is recommended that a piled foundation is utilised bearing into the underlying bedrock between 1.50 m and >5.00 m bgl. It will be necessary to locally deepen foundations within the influence of existing or proposed trees in the north of the site.
Building Floor Slabs	A ground-bearing slab will be viable, but settlement analysis shows that it will be essential to construct it on a granular sub-base as per the design of the structural engineer to ensure that settlement tolerances are taken into consideration and that sufficient surface clays have been removed from tree influence areas to mitigate any seasonal volume changes in the clay influence zones. In order achieve an ABP of ~50 kN/m² for the floor slab the underlying soils will need to be engineered. Firstly the underlying obstructions will need to be removed and then the general underlying soils will need to be excavated, processed, placed and re-engineered or undertake ground improvement by HEIC (High Energy Impact Compaction) to ensure an ABP of ~50 kN/m² for a floor slab. Recycled aggregates generated during the processing of hard materials can be utilised in the construction of temporary works platforms and capping systems to a ground bearing slab. The soft clays identified will need to be considered as part of the floor slab design and will likely require detailed settlement analysis and modelling. Where natural material is used to upfill beneath structures, they may require stabilisation by the addition of lime to control moisture. It must be noted that a bound sub-base replacement system while viable is not necessary given the volume of recycled aggregate that will be generated.

Highways and Infrastructure	All proposed adopted roads will be constructed in accordance with the geotechnical engineering requirements as defined within the MCHW Series 600. Specific engineering and compaction of materials will be completed in strict accordance with the geotechnical specification contained within this report. All materials outside of structural/infrastructure development will be engineered and compacted to ensure consolidation associated with self-weight settlement is limited to < 50 mm in accordance with the E3P specification.

REMEDIATION AND ENABLING WORKS

Objectives	The remediation and enabling works will be delivered in a manner that will seek to ensure that the site is prepared to deliver the optimum foundation solution for the proposed structures, infrastructure and highways. The geotechnical foundation zoning plan and structural engineer's drawings should be referenced to determine the proposed foundation solution.
Remediation and Enabling Works	This document provides a comprehensive specification for the regeneration of the land in a manner that will negate the identified pollutant and ensure the development is suitable for the proposed end-use. The salient features of the Remediation & Enabling Works Strategy are summarised below: • Implementing all works in strict accordance with UK Environmental Permitting and local planning authority requirements. • Controlled removal of all trees and vegetation. • Ensure that all ecological mitigation measures are fully implemented. • Excavation, and removal of all existing above and below ground structures beneath the proposed structural foundation. • Sorting, processing and segregation all deleterious materials. • Materials deemed unsuitable for retention to be removed from site. • Location, delineation and excavation of ditches/ponds. • Location; isolation and management of any asbestos impacted soils. • Validation sampling to confirm all material retained on-site poses no risk to the identified receptors within the context of the CSM. • Processing of Made Ground to recycle aggregate as Class 6 Material. • Importation of chemically suitable materials (if required) to achieve the required development elevation. • Removal of any previously unidentified contamination hotspots. • Validation testing of materials placement to confirm suitability. • All work to be undertaken in strict accordance with UK Environmental Permitting and Local Planning Authority Requirements.
Geotechnical Engineering Requirements	The nominated earthworks and stabilisation contractor will be responsible for the placement and re-engineering of stiffened soil platform using engineered Class 1 & 2 soils to be capped with a 300 mm engineered sub-base and capping system. This performance specification defines the geotechnical compaction requirements for engineered soils and sub-bases to ensure compliance with the project engineering requirements. **Preparation of Formation (all areas) -** Prior to the placement of any soils, the formation area (reduced level excavation) will be assessed and certified as suitable to ensure that all identifiable soft spots or areas of variable strata have

	been identified, and engineered with a suitable soil or aggregate that has been compacted in accordance with the Geotechnical Performance Specification. In general, all soils (excluding certified recycled and quarried aggregates) must be engineered to achieve the following performance criteria: - Compaction to an excess of 95% of the Maximum Dry Density (4.5 kg/rammer) or 100% of the MDD (2.5 kg/rammer); - Maximum 5% air void ratio in engineered cohesive soils; - CBR in excess of the performance requirements for every engineered soil layer; - Maximum deformation under Plate Load using applicable loading for every layer must not exceed maximum settlement tolerance within engineered fill and sub-base replacement; - CBR in excess of 15% within engineered sub-base / sub-base replacement beneath the building floor slab (underside of MOT 1); and, - CBR in excess of 15% on engineered soil (sub-base replacement) / sub-base beneath external hardstand. **Building Floor Slab –** Engineering of a stiffened soil platform to ensure a net safe Allowable Bearing Pressure in excess of 50 kN/m^2 to achieve the settlement requirements of the Structural Engineer which is nominally <25 mm total and 10mm differential with a CBR >30% at formation (top of MOT 1). **External Hardstand –** Engineering of a stiffened soil platform to ensure total settlement of <25 mm with a differential settlement of <10 mm to achieve a CBR of >30% at formation (top of MOT 1).

BUILD PHASE REQUIREMENTS

Summary of Build-Phase Mitigation Requirements	The developer's works will also include the completion of the following additional elements: - Provision of a 300 mm cover system (or deeper depending on landscaping plan) using certified material with appropriate validation within proposed areas of public open space and soft landscaping. - Construction of appropriate potable water supply infrastructure.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

E3P has been instructed by Firethorn Investors Ltd to develop a remediation strategy and enabling earthworks performance specification for the proposed commercial and industrial development at the site known as Port Cheshire, which is in the location of the former Bridgewater Pape Mill.

1.2. SITE DETAILS

The central and the majority of the western sector of the site is currently un-used and comprises multiple level hardstanding associated with former roads, floor slabs and structures.

The west of the site similarly comprises areas of hardstanding, but these are utilised by an adjacent glass recycling firm (Recresco) for the storage and processing of glass. As a result of these operations, there are numerous stockpiles of glass cullet in this sector of the site.

1.3. REPORT OBJECTIVES

The objectives of this report are to:

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

1.4. SCOPE OF WORKS

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

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

1.5. PREVIOUS WORKS

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

- E4 Industry Environmental Audit of Bridgewater Paper Company, North Road, Ellesmere Port, Cheshire. Prepared on behalf of Ernst & Young. February 2010.

- ID Geo-Environmental Consulting Engineers. Geoenvironmental Appraisal of Land at The Former Bridgewater Paper Mill, Ellesmere Port. Prepared for the Manchester Ship Canal Company. Report No. 3653-G-R001 Rev A. Dated August 2012

- E3P Ltd. Geoenvironmental Site Assessment, Former Bridgewater Paper Mill, North Road, Ellesmere Port. Prepared for Firethorn Investors Ltd. Report No. 14-035-R1-2. Dated January 2021.

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

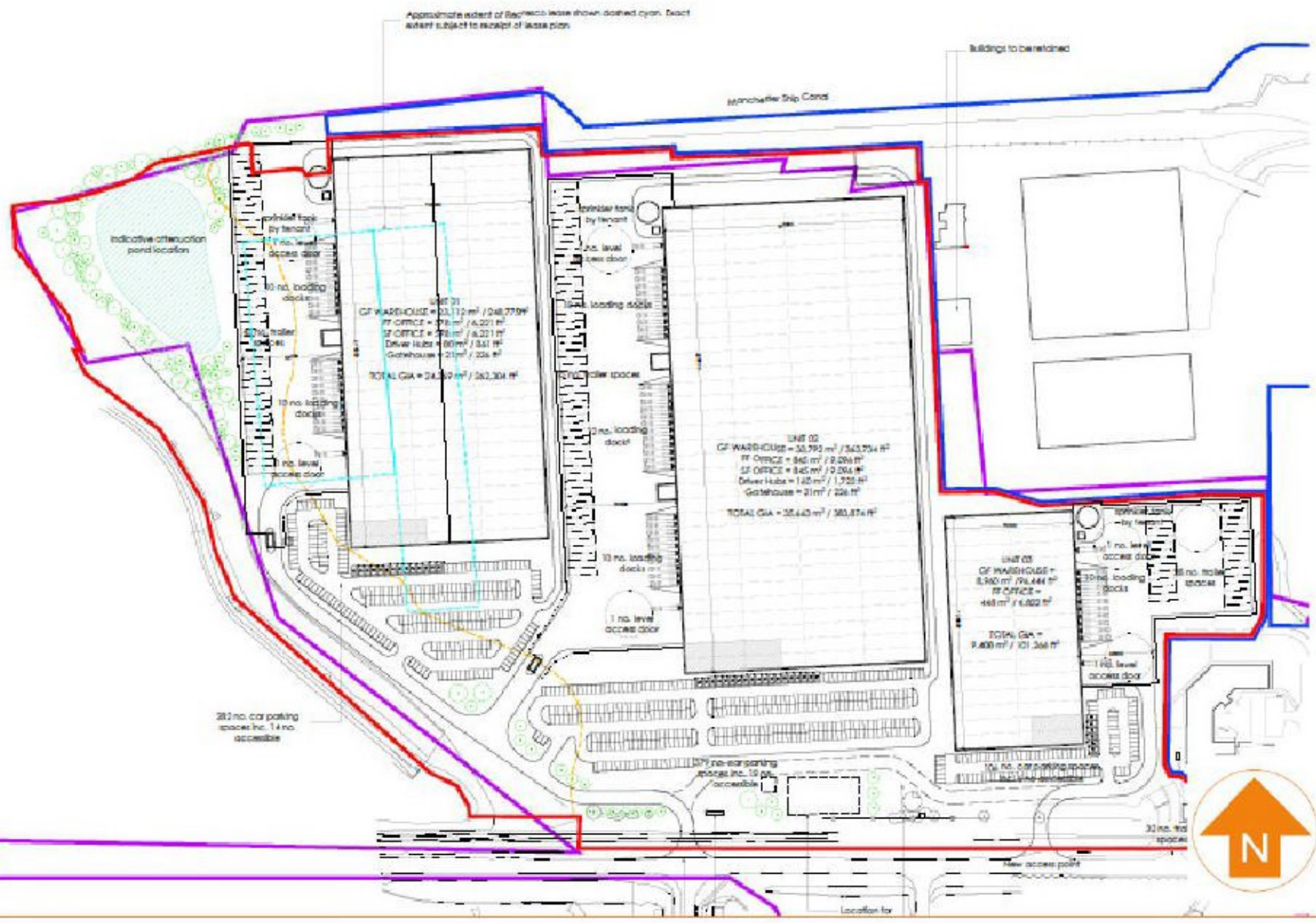
For the avoidance of any doubt, the E3P Geoenvironmental Site Assessment report should be read both as a precursor to and in conjunction with this document.

1.6. REDEVELOPMENT PLAN

Firethorn Investors Ltd intends to construct a commercial development comprising three warehouse units. Drawing 14-035-002 (Appendix III) identifies the proposed development layout.

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

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.7. SUMMARY OF PARTIES INVOLVED

FUNCTION/INTEREST	NAME OF PARTY
Local Planning Authority	Cheshire West and Chester Council
Developer	Firethorn Investors Ltd
Planning Consultant	WSP Global
Civil and Structural Engineer	SGI Ltd
Geoenvironmental Consultant	E3P Ltd
Main Contractor	TBC
Remediation/Enabling Works Contractor	TBC
Human Health Regulator	Cheshire West and Chester Council
Controlled Waters and Waste Regulator	Environment Agency
Highways Adoption Authority	Cheshire West and Chester Council

1.8. REGULATORY CORRESPONDENCE

Planning permission is currently being obtained.

1.9. SITE DETAILS

Site Address	Former Bridgewater Paper Mill, North Road, Ellesmere Port, CH65 1BW
National Grid Reference	338900, 378700
Site Area	13 Ha

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

A site location plan is presented in Appendix VII as Drawing 14-035-001.

1.10. SITE SUMMARY

TABLE 1.1 SITE DESCRIPTION AND SETTING

Occupancy/Use	The central and the majority of the western sector of the site is currently un-used and comprises multiple level hardstanding associated with former roads, floor slabs and structures. The west of the site similarly comprises areas of hardstanding, but these are utilised by an adjacent glass recycling firm (Recresco) for the storage and processing of glass. As a result of these operations, there are numerous stockpiles of glass cullet in this sector of the site. The majority of the above-ground structures have been demolished and removed from the site. The only above-ground structures that are present are:

		• Warehouse in the north-east – No internal access but appears to be of steel portal frame construction with cement bonded (presumed asbestos containing material (ACM)) cladding. • Form filter beds in the north-east – Concrete structures set partially below ground level and containing water. • Former effluent treatment plant building – No internal access but the building is of concrete/brick construction and bounds the railway siding to the north. • Former pump house in the north-east – Metal building containing disconnected electrical switchgear. • Weighbridge – Located by southern site entrance and comprising the weighbridge and adjacent kiosk. • Water tower – Located at the southern boundary and comprises steel tower and tank. The tank is connected to the surface by steel pipework. It is not known if these are still connected to the mains water supply. A review of United Utilities records would suggest that they are not, but this would need to be confirmed prior to demolition.
Environmental Setting	**Drift Geology**	Glacial Till. Alluvium (west).
	Bedrock Geology	Chester Formation Sandstone.
	Hydrogeology	Glacial Till is classified as an undifferentiated aquifer. The Chester Formation is classified as Principal Aquifer. The site is not located within a groundwater source protection zone and while the former paper mill is stated to have had abstraction boreholes historically these are reported to have been abandoned due to saline water intrusion.
	Hydrology	Rivacre Brook is located at the western boundary and the Manchester Ship Canal is located to the north. The Riveacre Brook flows into the Mersey Estuary which is located 200 m to the north.
	Flood Risk	Unaffected by flooding from rivers.
	Subsidence Hazard	No hazard identified in data searches.
Site History	Historical maps indicate that between 1872 and 1873, prior to the development of the paper mill, the site mainly comprised agricultural land with two ponds adjacent to the northeast boundary, two ponds in the central area, two ponds in the south. By 1938 the paper mill has been constructed and that by 1957 those works had been extended with numerous tanks, railway lines cranes, engine shed, pumping station and coal conveyor. It is stated by IDG that at this time the levels at the western boundary may have been levelled where the site borders Rivacre Brook.	
Landfill Sites and Ground Gases	A historical landfill site is identified beyond Rivacre Brook to the west. The waste types accepted are identified as inert, industrial, commercial, and household and it is reported to have been active from the mid-1970s to the mid-1980s.	
Radon	Unaffected – no special precautions required.	

1.11. SUMMARY OF REPORTED GROUND CONDITIONS

E3P has prepared a detailed Site Investigation Report (Ref: 14-035-R1-2, dated February 2021). The summary of reported ground conditions is given in Table 1.2.

TABLE 1.2 SUMMARY OF GROUND CONDITIONS

Site Investigation Works	E3P has completed an intrusive ground investigation comprising mechanically excavated trial pits, cable percussion boreholes and rotary open holes. Selected borehole locations were fitted with environmental monitoring installations to enable gas and groundwater monitoring.
Ground Conditions	**Hardstanding and Relict Structures** Due to the targeted nature of the site investigation, hardstanding was recorded in the majority of the exploration locations. In the main, hardstanding comprises reinforced concrete that was proven to have a typical depth of 0.15 m to 0.30 m thickness. In some localised areas, such as TP124c that slab was observed to be thicker at 0.45 m. In addition to surface concrete slabs, secondary slabs were also recorded in TP130 at 0.8-1.4 m bgl, TP302 at 0.8-0.9 m bgl and a concrete-lined void was recorded in TP137 between 0.2-2.0 m bgl. In TP137a, TP142, CP109 it was apparent that slabs had been buried beneath a thin (Ca.0.2 m) layer of Made Ground. **Made Ground** Made Ground was recorded in all but one location where the overlying concrete hardstanding was penetrated. The Made Ground and was proven to an average depth of approximately 0.7 m bgl. Locally thicker (>2.5 m) Made Ground was recorded in TP106 (2.6 m bgl), TP110 (3.7 m bgl), TP111 (3.5 m bgl), TP113 (3.2 m bgl) and TP115 (5.0 m bgl). TP110, TP111 and TP113 and TP115 were recorded in the southwest of the site and it should be noted that these locations were formed within a raised stockpile area. Made Ground is predominantly granular at the site, comprising variable grey to brown locally clayey, silty and sandy gravel. The gravel constituent is also variable across the site being of fine to coarse, angular to sub-angular mixed natural lithologies, concrete, brick, plastic, ash, slag and clinker. A previous ground investigation identified relic topsoil in the area of deep Made Ground in the west of the site from 0.4-1.0 m bgl (IDG-TP30) and 0.0-0.7 m bgl (IDG-TP33). This stratum was described as grey clayey silty sand with abundant roots and rootlets.
	Drift The drift stratum predominantly comprises firm to stiff, medium to high strength CLAY and this was recorded in all locations were the Made Ground or surface concrete could be penetrated. The full thickness of the CLAY was only proven in the cable percussion boreholes and it was proven to between 5.5 m bgl and 8.9 m bgl with a thickness ranging between 4.2 m (CP104) and 8.1 m (CP110).
	Solid SANDSTONE was recorded in all of the cable percussion boreholes beneath the drift. The SANDSTONE was drilled using a rotary open technique to facilitate the installation of deeper monitoring wells. No rock strength data was obtained as part of this phase of work.
	Groundwater Shallow perched groundwater within the Made Ground has been recorded at depths of between 0.41 m and 2.72 m bgl.

	Groundwater monitoring has been completed to determine a groundwater flow. This has been completed using groundwater depths collected on the 21 January 2021 and using topographical information from the Survey Operations Topographical Survey completed in January 2021. The data has been split into shallow and deep monitoring wells indicates that the shallow perched groundwater is perched and not in continuity with Sandstone aquifer. Furthermore, the perched groundwater does not appear to be in continuity with Rivacre Brook which is ca. 3-4m below site level. Assessment of water table elevation indicates that groundwater flow within the principal aquifer is to the northeast at an approximate gradient of 0.06.

1.12. SUMMARY OF CONTAMINATED LAND ASSESSMENT

Human Health	Analysis of selected soil samples from across the site has identified isolate occurrences of asbestos, heavy metals and polycyclic aromatic hydrocarbons (PAH). Based on a future commercial/industrial end-use the identified determinands are not considered likely to pose a significant risk to human health as any potential pathways are likely to be broken by the presence of hardstanding and buildings. A remediation and enabling works strategy will need to be developed to ensure the safe management of dust due to the presence of asbestos fibres and locally hydrocarbon impacted soil and perched groundwater.
Controlled Waters	Slightly elevated concentrations of volatile organic compounds have been identified within both shallow and deep monitoring boreholes. While the concentrations are not indicative of gross contamination additional monitoring and assessment is likely to be required as part of any future planning application. Should any areas of more significant impact be encountered then localised remediation may be required. Analysis has also identified slightly elevated concentrations of inorganic heavy metals. As these are typically f low solubility and mobility, they are not considered to pose a significant risk to controlled waters.
Ground Gas	A former landfill was identified beyond Rivacre Brook to the west and this was identified as a potential source of ground gas that was detected in the west of the site during previous ground investigation. Assessment of previous and current results indicates that no significantly elevated ground gas concentrations are present beneath the area of proposed units 1 and 2 and that these areas will be classified as CS1 and that mitigation measure will not be required. However, the full assessment will be determined following the completion of the gas monitoring.
Potable Water Infrastructure	Barrier Pipe is likely to be required but this can be determined following the completion of UKWIR assessment post remediation and enabling works.

1.13. SUMMARY OF GEOTECHNICAL ASSESSMENT

Underground Obstructions	Significant concrete and brick obstructions have been encountered within the Made Ground, indicative of relict foundations and structures. During a phase of cut-and-fill enabling works to create a development platform, all below-ground obstructions will require grubbing out to the base of the Made Ground.
Allowable Bearing Pressure	The underlying natural shallow CLAY drift deposits have been assessed as being very stiff, high strength with a net allowable bearing pressure (ABP) in the order of 39-150 kN/m^2 at circa 1–2 m bgl increasing to 104–173 kN/m^2 at circa 3–4 m bgl.
Foundation Options	Prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels. Therefore, upon completion of these enabling works, the Made Ground is likely to be present at varying depths and as such, it is likely that the most cost-effective option for the majority of the site would be to re-engineer the Made Ground using vibro-stone columns (VSCs) to support pad foundation.
Building Floor Slabs	Following enabling works, the site will likely have a variable thickness of Made Ground, that may extend to significant depth in places. Given the structures that are proposed, it is considered that ground-bearing floor slabs will require settlement analysis and detailed design in order to accommodate the variability of the formation and account for differential settlement. Given the depth of Made Ground and its loose/variable nature, it will be necessary to undertake some form of Ground Improvement work, either High Energy Impact Compaction (HEIC) or VSC, to ensure the total and differential settlement is within tolerable limits for the Uniformly Distributed Load of the floor slab and any external reinforced concrete yards/hardstanding. The deep Made Ground in the west will need additional consideration and will require specialist treatment due to the potential for differential settlement. An approach to this area may include: ▪ Remove all slabs and founds, crush and process suitable materials; ▪ Undertake reduced level excavation to ~5.0m below current GL and instigate High Energy Impact Compaction or Rapid Impact Compaction to treat full depth of historical fill; ▪ Upfill excavation placing material (lime stabilised) as structural fill; ▪ Undertake HEIC across the remainder of all slabs to ensure uniform settlement; ▪ Place capping using site won 6F2; ▪ Place MOT 1 sub-base.
Heave Precautions	Given that the underlying clay is of low volume change potential, heave precautions will not be required to the internal face of a foundation. However, heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) or ground beams within the modelled influencing distance of trees. As the underlying clay is low volume change potential, heave precautions are not required to the internal face of the external load-bearing walls (outside or within tree influence).

	TP145 has identified high plasticity CLAY. It is recommended to further delineate this area and if necessary, excavate the CLAY and backfill the void with suitably engineered material. Where a ground-bearing floor slab is to be constructed within the conjectured zone of tree influence, the clay will need to be removed to ensure that any desiccated soil cannot swell and induce heave to the structure. Alternatively, it may be possible to design the structure to resist the influence of clay heave using exaggerated sub-base and additional reinforcement within the slab, to be designed by the structural engineer.
Soakaway Drainage	The site is predominantly underlain by likely low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will be limited, and as the lateral continuity of the Made Ground cannot be assured, it is not recommended that soakaways are utilised for disposal of surface water runoff.
Sulphate Assessment	Concrete classification will be DS2 AC2s.
CBR Design %	Granular soils can be re-engineered to ensure a CBR in the order of 4–5% within the subgrade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 2–4% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.
Cut/Fill	Development levels are unknown at this time; however, cut-and-fill works will be required to prepare the development platform. A geotechnical specification of works will be required to document filled material types, compaction methodologies and validation testing relevant to the proposed development end-use. Given that a slope is present along the western boundary, a slope stability assessment will also be required.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: Waste Classification – Guidance on the classification and assessment of waste.

2. SITE REMEDIATION AND ENABLING WORKS

2.1. REMEDIATION OPTIONS APPRAISAL

A remediation options appraisal has been completed in accordance with the principals as set out within Environment Agency publication Land Contamination: Risk Management (LC:RM) updated May 2020.

The LC:RM requires that the following tired assessments are followed to ensure 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 appropriate remediation option.

2.2. DETEMRINATION OF SUFFICENCY OF INFORMAITON

The site has been subject to two extensive phases of ground invigation and the results from these provides a sufficient degree of certaintainty with respect to ground condition.

2.3. REQUIREMENT FOR REGULATORY 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.

- Requirement for regulatory permits;
- Noise restrictions;
- Baseline ambient air quality; and,
- Weather conditions.

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

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 reuse of materials on the site.

The importation of material for use within the proposed construction of a development platform will be subject to the 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.

It is considered that a suitable environmental permit can be obtained for the recovery, processing and re-use of material that is no longer considered to be a waste and therefore this is not a limiting factor in the selection of the remediation option.

The enabling earthworks will require the re-use of material that was discarded during open cast mining operations. This activity will require a mining waste regulation permit from the EA to ensure regulatory compliant re-use of this material.

Noise Restrictions

The site is not located within an area that has noise sensitive receptors in close proximity.

The contractor's environmental plan of works will include boundary noise monitoring stations to assess the noise impact, daily monitoring and mitigation measures to ensure no unacceptable degree of impact to the identified receptors if required Given that noise impact can be controlled, this is not considered a limiting factor in the selection of the correct remediation option.

Baseline Air Quality

The remediation and enabling works are not considered likely to generate significant impacts to controlled waters.

Weather Conditions

Given the size and scale and variable remediation works required, it will be possible to ensure that the programme allows for a differentiation in operations to ensure works can proceed in areas depending on the prevailing weather for a specific period of time.

2.4. CONTAMINANTS OF CONCERN (COC)

2.4.1. ASBESTOS AND PAH COMPOUNDS

The Tier 1 contaminated land risk assessment results indicate that the data exceeds the screening criteria for a commercial end-use for the following determinands:

- Asbestos
- Benzo(b)Fluoranthene
- Benzo(k)Fluoranthene
- Dibenzo(a,h)anthracene

The human health risk drivers for the asbestos and metal CoC are:

- Direct contact with the soil source by future construction workers;
- Inhalation of fibres by future construction workers;
- Direct contact with the soil source by future site users;
- Ingestion of impacted soils by future site users;
- Inhalation of fibres by future site users.

During construction, in particular remediation and enabling works, it will be necessary to ensure that all workers are briefed on the potential presence of localised areas of impacted soil and that appropriate welfare and personal protective equipment are provided. This should be identified within the Construction-phase Environmental Management Plan (CEMP).

Post development, the majority of the site will comprise buildings and areas of roads, parking and service yards. In these areas, there is no requirement to provide any additional mitigation as there is no plausible direct contact/ingestion pollutant linkage.

Limited areas of landscaping are presented in the proposed development plan. However, should these be provided it is likely that a cover system will be required.

A cover system is an appropriate remediation technique to address the potential risk from exposure to impacted soils as it will break the contaminant pathway. The specification of the cover system is dependent on a number of factors, such as the proposed landscaping plan.

Based on the findings of the site investigation, it is considered that a minimum 300 mm cover system will be required but this may need to be locally deepened depending on whether deeper rooting trees and bushes are planted.

A granular break layer is not considered to be required for the reasons:

- Groundwater levels are likely to be relatively static suggesting that vertical migration is unlikely to occur;
- No significant elevated mobile contaminants have been recorded;
- The site is likely to be underlain by granular recycled aggregates post remediation.

This should be confirmed with the Local Planning Authority.

2.4.2. ASBESTOS

Asbestos in the form of loose chrysotile fibres has been identified in the granular Made Ground with the soil stockpiles in the west of the site.

If any visible pieces of asbestos-containing material are identified during the site remediation and enabling work, this material must be dealt with in strict accordance with the Control of Asbestos Regulations (CAR) 2012, UK Waste Management Legislation and the Environmental Protection Act 1994. Due to the proximity of third party property, asbestos in air monitoring in accordance with HSG248 may be required to confirm that no asbestos fibres have been generated from the enabling works activities.

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

Further mitigation measures are provided in Section 5.3.

2.4.3. CONTROLLED WATERS

Leachate analysis completed on selected Made Ground samples identifies exceedances of the following:

- Arsenic
- Chromium
- Copper
- Lead
- Nickel
- Zinc

Groundwater analysis identified exceedance of the following:

- Arsenic

- Cadmium
- Copper
- Cyanide
- Nickel
- Selenium
- Trichloromethane
- 1,1,1-Trichloroethane
- Trichloroethene

The findings of the analysis are similar to those identified by IDG with respect to inorganic heavy metals and a more detailed review of the E3P data indicates that arsenic only marginally exceeds the drinking water standard where elevated concentrations have been recorded. Given the site's location and environmental setting, this marginal exceedance is not considered to be a significant risk.

Copper and nickel are recorded as being elevated above EQS values in both leachate analysis and groundwater analysis. Nickel in the groundwater analysis is present at higher concentrations in the deep monitoring wells (CP101 and CP105). The higher concentrations of nickel in the deeper wells may be representative of background concentrations in the Sandstone aquifer as there is no evidence to suggest a source with the Made Ground or shallow perched groundwater. Copper and Nickel are discussed further in Section 8.2.1.

Lead and zinc concentrations are recorded as being elevated within leachate testing but not within groundwater analysis. The results would appear to show that these determinands are not mobile at the site and only reflect the leachate test.

Phenol has been recorded above its EQS value within leachate analysis from the Made Ground TP117 and in the shallow groundwater sample from CP107 which is located in close proximity. No further elevated leachate or groundwater concentrations for phenol were recorded within soil, leachate or groundwater analysis suggesting this is localised area and does not pose a significant risk to controlled waters.

Cyanide has been identified in four of groundwater samples though only slightly elevated concentrations were recorded in CP105 and CP106 with concentrations lower than the limit of detection in CP101. The highest concentration (52 µg/l) was recorded in CP107 which also has the highest pH of 10.2 which may be helping to mobilise it, though there are no elevated soil concentrations from adjacent trial pits and no discernible pattern to suggest that the impact is site-wide or migrating laterally.

No elevated concentrations of PAH, TPH or Semi Volatile Organic Compounds (SVOC) have been recorded within any of leachate or groundwater samples tested.

Volatile Organic Compound (VOC) analysis undertaken on groundwater samples recorded slightly elevated concentrations of trichloroethene within CP101, CP104, CP105 and CP106. Only the highest recorded concentration of 5.5 µg/l, recorded within the deep groundwater at CP105. It is also noted that soil analysis (Table 8.3) records slightly elevated concentrations of VOC compounds within TP205 which is located to the south-east of the site (proposed Unit 3).

In order to undertake a further assessment, additional groundwater sampling was undertaken 25 January 2021 including from CP110 in the north that was re-drilled and installed into the principal aquifer.

The groundwater analysis from January 2021 did not record any elevated concentrations with all results being below the laboratory method limit of detection.

2.5. IDENTIFICATION OF FEASIBLE REMEDIATION OPTIONS

2.5.1. OBJECTIVES

The remediation works must be completed in a safe and sustainable manner that ensures that the post remediation condition of the site poses no unacceptable risk to controlled waters or the wider environs.

The developed Conceptual Site Model must ensure no complete pollutant linkage to ensure successful implementation.

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

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

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

2.5.2. AVAILABLE TECHNOLOGIES

Potential remedial technologies that can be applied in order to remediate the identified contaminants of concern are summarised in Table 4.1, below. The remedial techniques considered would potentially break any source-pathway-receptor linkages, thereby reducing the risk to human health from vapour inhalation to acceptable levels.

TABLE 4.1 SOIL REMEDIATION TECHNOLOGIES

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

2.5.3. SELECTION OF TECHNOLOGY OPTIONS

Based on the findings of the site investigation and contaminated land risk assessment, no significantly elevated levels were recorded that would require specific remediation based on a future commercial/industrial end-use. Therefore, it is considered that a cover system within any proposed landscaped areas will provide the most effective method of mitigating the potential risk to human health. Additionally, no specific risk to controlled waters has been identified but there are sensitive receptors in the Rivacre Brook and Manchester Ship Canal and monitoring of these watercourses are recommended during the remediation and enabling works.

Further assessment of remediation technologies may be required if any previously unencountered contamination is identified during the remediation and enabling works.

3. OVERVIEW OF WORKS

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

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

RE-1 – Pre-commencement Regulatory Compliance

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 EA.

The LAPC Part B Notification for the deployment of mobile crushing plant should be implemented prior to the establishment of 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 LPA and Environment Agency.

It is anticipated that there will be a requirement to treat impacted materials on site (hydrocarbon-impacted soil or groundwater). 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.

RE-2 – Environmental and Nuisance Control

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

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

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

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

RE-3 – Risk to Infrastructure and Adjacent Watercourses

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

All works to be completed adjacent to Rivacre Brook channel may require the appropriate EA permit, this should be obtained prior to the commencement of any activities (including demolition or ground improvement). It should be noted that works to the main river channel may be restricted during certain times of the year.

Regular visual inspection (daily) of Rivacre Brook and Manchester Ship Canal is recommended to ensure that the works are not causing any impact and to permit changes to working practices in the event that impacts are recorded.

Should any impact be observed or reported, further assessment and chemical testing may be required.

RE-4 – Ecological Mitigation

E3P has prepared an ecological survey and all works shall be progressed in accordance with all the identified mitigation measures.

A copy of the Ecological Survey is presented in Appendix VII.

RE-5 – Site Clearance Operations

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

The site is partially overgrown with self-seeded vegetation with extensive above- and below-ground structures; this 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 the site in accordance with waste permitting regulations.

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

RE-6 – Delineation, Excavation and Treatment of Identified Asbestos Impact

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

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

Where any visual evidence of ACM is identified, these materials should be carefully segregated and removed from the soil matrices (if/where possible).

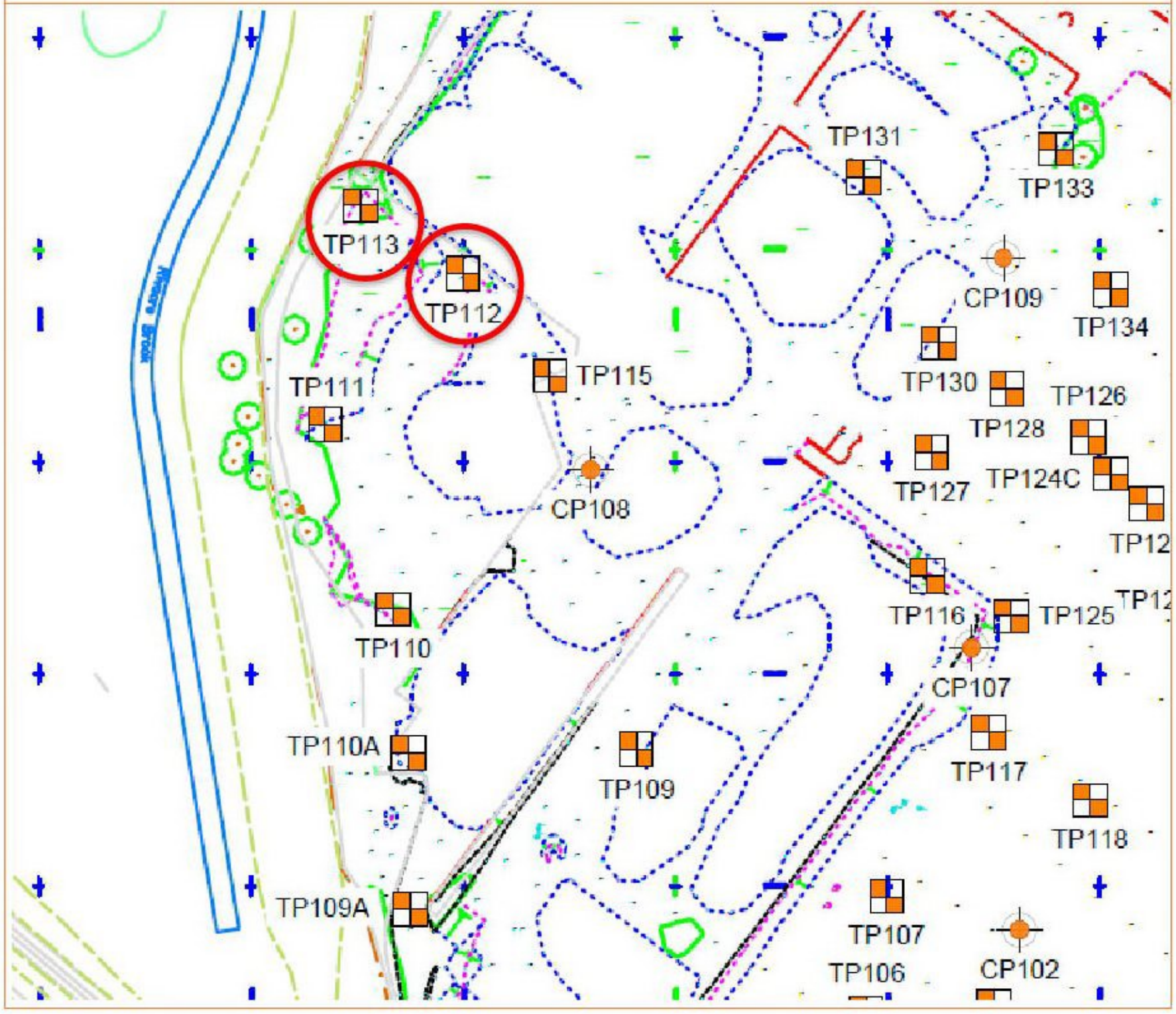
Validation sampling of the processed Made Ground should be completed to demonstrate compliance with the developed conceptual site model.

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

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

The location of known asbestos impacted soil is shown in Figure 3.2

FIGURE 3.2 LOCATION OF IDENTIFIED ASBESTOS IMPACT



RE-7 – Delineation, Excavation, Treatment and Disposal of Visual and Olfactory Hydrocarbon-Impacted Material

Areas of visible identifiable hydrocarbon impact are identified within the central sector of the site. While this material has been tested and confirmed as not posing a risk to future end-users, it is considered that this material should be segregated and further assessed.

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

Should as yet unidentified contaminant be 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.

Material deemed to be impacted through either visual or olfactory observations or as a result of notable PID readings (> 50 ppm) will be excavated and stockpiled on an impermeable membrane. The membrane will be placed upon a clay containment bund and covered to negate the risk of soils leaching and dispersal of any odours and/or vapours.

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

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

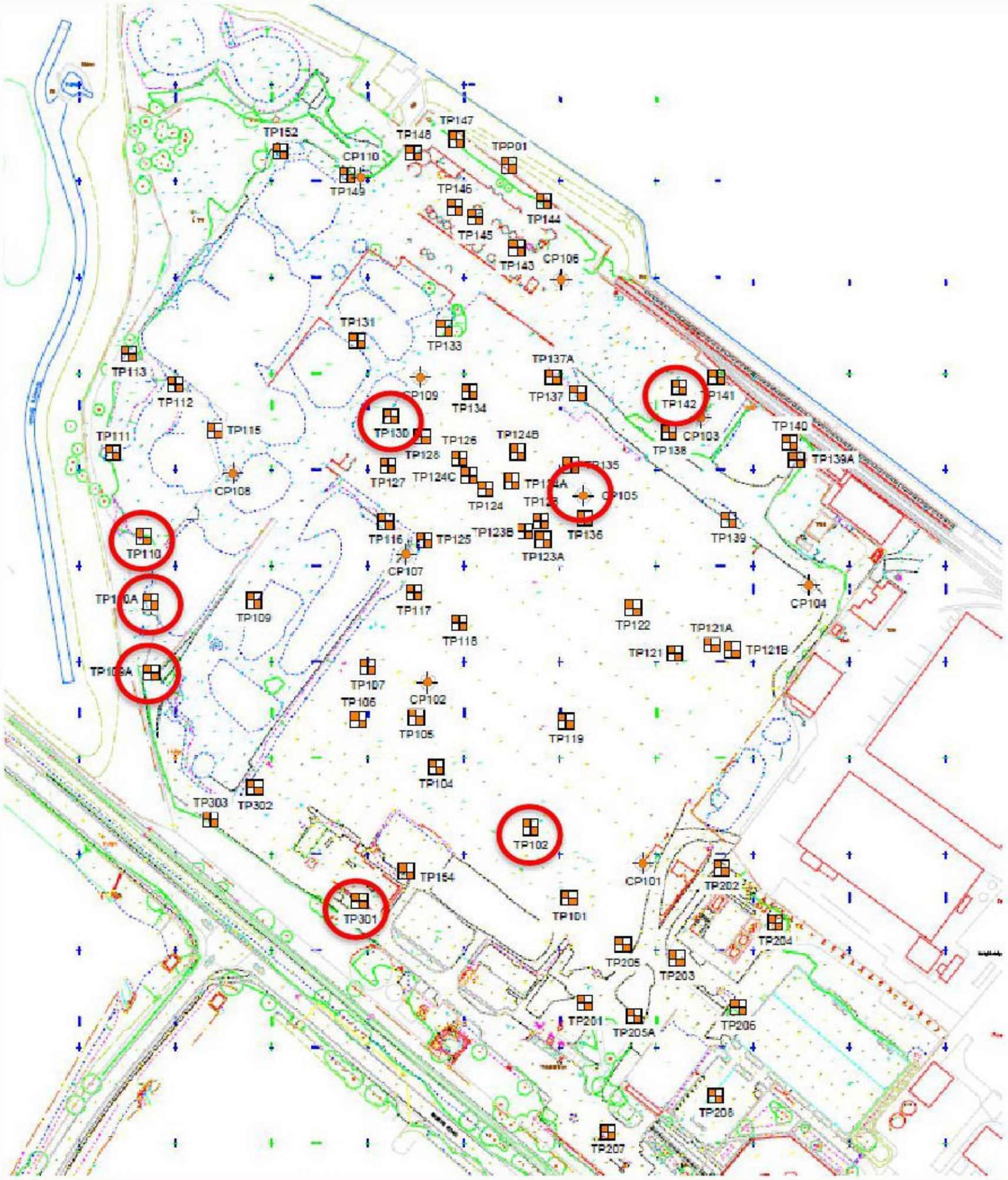
Validation samples will be collected at 10 linear metre centres from the side and base of the excavation.

The results of this validation testing will be directly compared to the site-specific remediation targets (as defined within Appendix III of this report) to demonstrate that no unacceptable level of risk to human health, controlled waters or the wider environment remain.

Should there be significant hydrocarbon impacted water in an excavation which prevents a hotspot from being delineated, measures to remove it should be considered. Measures can include removing from site in a tanker for off-site disposal, treating on-site, and discharging to sewer under an approved consent. Care should be taken to let any hydrocarbon impact enter any relict drainage and shall not be pumped onto the surface.

The location of know hydrocarbon impacted soils are shown in Figure 3.3.

FIGURE 3.3 LOCATION OF IDENTIFIED HYDROCARBON IMPACT



RE-8 – Excavation, Breaking and Processing of All Above- and Below-Ground Structures

Obstructions, relict foundations and infrastructure (apart from live services) are to be removed from the areas of proposed development, 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 6 using licensed plant.

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

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

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

RE-9 – Delineation, Excavation and Treatment of Infilled Historical Ponds

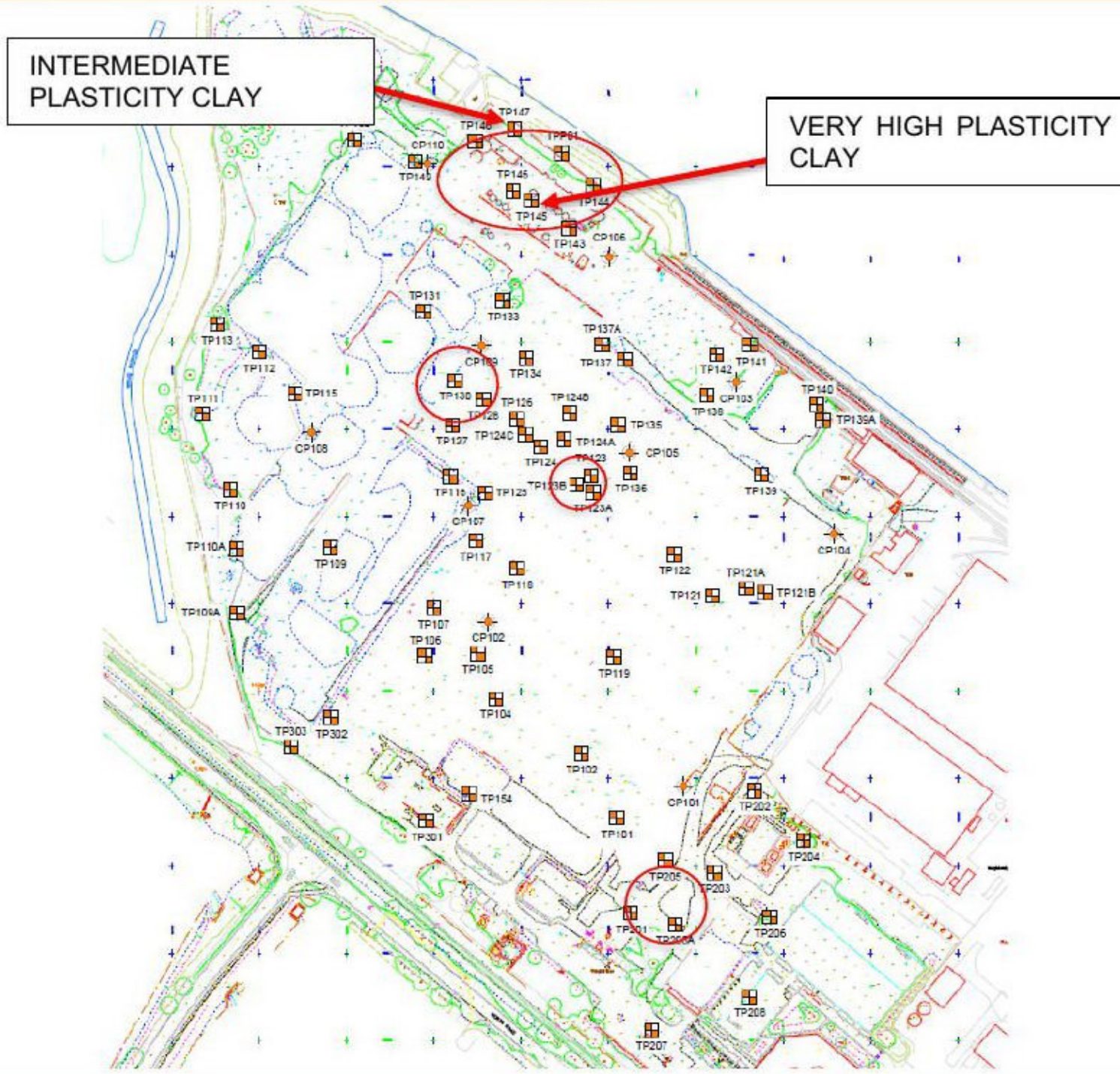
Prior to the commencement of the main earthworks (where possible), all known former infilled ponds should be identified and demarked and investigated as and when any overlying obstructions are removed to assess the nature of materials and extent of any deleterious elements.

The location of known historic infilled ponds are identified within in Figure 3.4 including the locations with very high and intermediate plasticity clay has been recorded.

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

A suitably qualified geotechnical engineer will need to monitor the works and confirm when all unsuitable material has been excavated and removed from beneath any proposed structure or infrastructure.

FIGURE 3.4 LOCATION OF HISTORICAL PONDS



RE-10 – Cut-And-Filling of Made Ground to Development Levels

The Made Ground is noted to be present to substantial depth and in the west of the site has been proven to > 5 m. It is considered that it will be possible to utilise vibro stone columns (VSC) within areas of segregated and placed granular Made Ground to treat the currently unknown potential for differential settlement and ensure a uniform safe allowable bearing pressure (ABP) in the order of 125 kN/m^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 prior to the placement of the appropriate platform, in compliance with the E3P Geotechnical Specification.

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

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

The deep Made Ground in the west will need additional consideration and will require specialist treatment due to the potential for differential settlement.

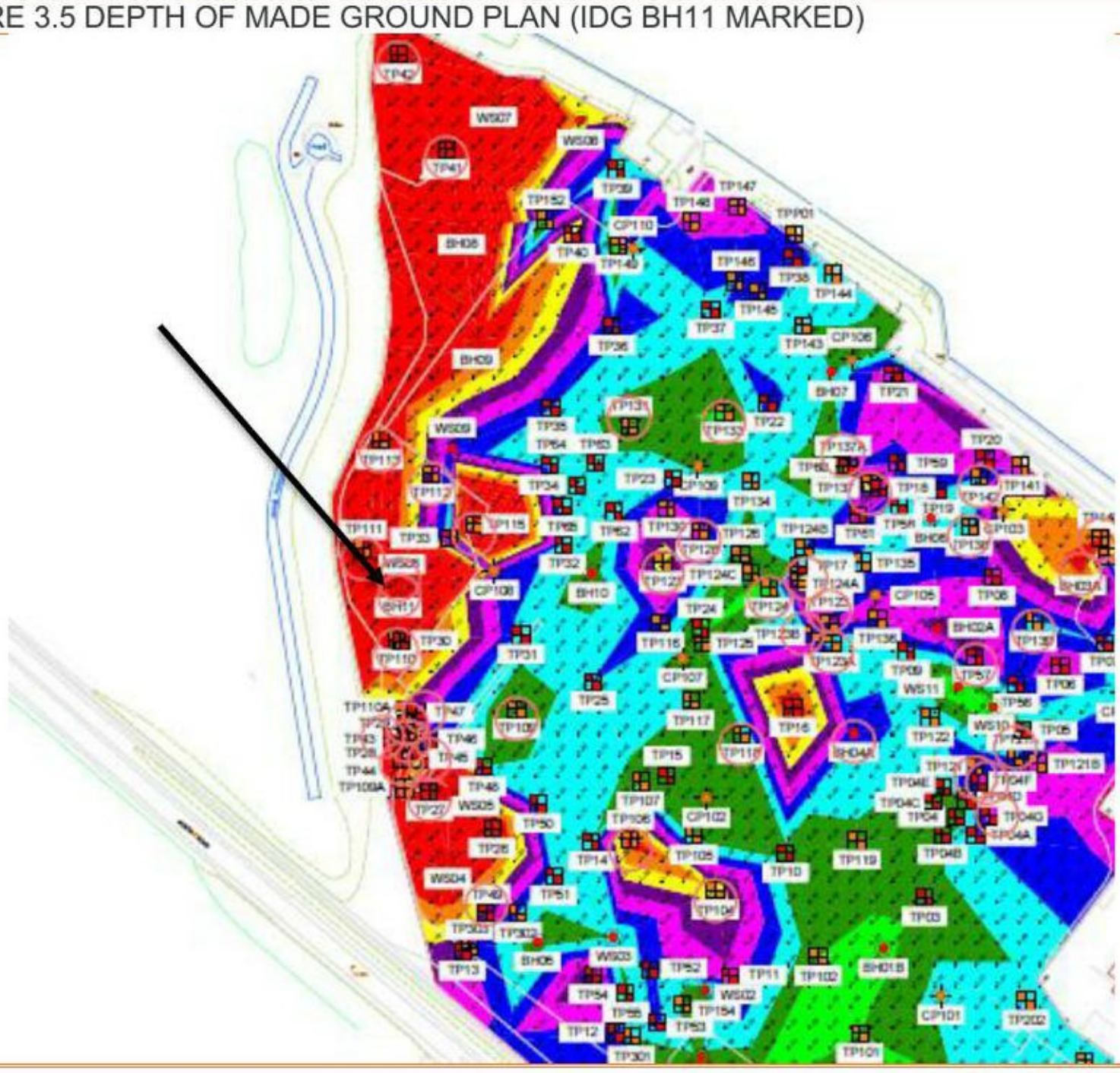
An approach to this area may include:

- Remove all slabs and founds, crush and process suitable materials;
- Undertake reduced level excavation to ~5.0m below current GL and instigate High Energy Impact Compaction or Rapid Impact Compaction to treat full depth of historical fill;
- Upfill excavation placing material (lime stabilised) as structural fill;
- Undertake HEIC across the remainder of all slabs to ensure uniform settlement;
- Place capping using site won 6F2;
- Place MOT 1 sub-base.

The main risk items with this approach include the requirement to bench the excavation in and the potential generation of excess material that could require off-site disposal. An alternative would be to utilise VSC columns across the entire slab area to ensure uniform settlement. Given the depth of Made Ground across the remainder of the slab, columns may not be required to a significant depth.

The area of deep Made Ground is shown in Figure 3.5.

FIGURE 3.5 DEPTH OF MADE GROUND PLAN (IDG BH11 MARKED)



RE-11 – Replacement of Materials, Geotechnical Engineering Requirements

Material is to be backfilled in strict compliance with the E3P Geotechnical Engineering Specification as presented in detail within Section 6 of this report, which generally requires the reinstatement and compaction criteria presented in Table 6.3.

RE-12 – Importation of Bulk Fill

Where there is a net shortfall of material required to achieve the proposed ground levels, it will be necessary to import natural inert soils and aggregate as per the engineering requirements (Section 6).

Imported material must be certified as suitable for use in strict accordance with the E3P chemical and geotechnical performance criteria (See Section 6) and in conjunction with the required duty of care notes and waste transfer exemption.

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

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

RE-13 – Independent Validation: Watching Brief

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

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

RE-14 – Waste Soils Surplus to Requirements

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

A formal waste classification assessment must be undertaken, irrespective of any future options or considerations for those materials that will be removed from the site. The 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.

The preferred alternative approach would be to locate a site in the locality that requires soils to achieve required development levels. Subject to suitability, these soils can be transferred to the receiving site, subject to an approved permit or materials management plan following guidance in the CL:AIRE *Definition of Waste: Code of Practice*.

RE-15 – Validation of Materials for Potable Water Supply Infrastructure

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

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

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

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

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

Where imported material is required to construct the potable water infrastructure pipework, this material will need to comply with the requirements of UKWIR pipework thresholds for the specified pipework. For the avoidance of doubt, the PE thresholds are presented in 9.2. Failure to meet the required specification may necessitate further remedial works.

RE-16 – Remedial Verification Report

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

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

3.1. 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 development.

Upon removal of the hotspot of unsuitable made ground in the northern sector, validation samples will be collected from the base (two samples) and sidewalls (four samples) of the excavation to reasonably demonstrate no residual impact to the underlying strata.

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

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

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

Where 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.

The sampling frequency for materials to be managed under the remediation strategy is presented within Table 3.2.

TABLE 3.2 SPECIFICATION OF CHEMICAL VALIDATION LABORATORY ANALYSIS

MATERIAL USE	TESTING FREQUENCY	SUITE OF ANALYSIS
Site-Generated		
Site-Generated 6F2	1 Sample per 1000 m^3	A/B/C/D
Site-Won MADE GROUND General Backfill	1 Sample per 250 m^3	G
Site-Won MADE GROUND General Backfill	1 Sample per 1000 m^3	A/B/C/D
Site-Won MADE GROUND General Backfill	1 Sample per 2000 m^3	I
Site-Won Natural Backfill	1 Sample per 2000 m^3	A/B/C/D
Site-Generated Subsoil (150 mm Cover)	1 Sample per 250 m^3	A/B/C/D
Site-Generated Topsoil Cover (150 mm Cover)	1 Sample per 50 m^3	A/B/C/D
Hotspot Validation Samples	1 Sample per 10 m of linear excavation to base and sidewall	E/G
Imported		
6F2	1 Sample per 1000 m^3	A/B/C/D
Subsoil Greenfield Source (150 mm Cover)	1 Sample per 200 m^3	A/B/C/D
Subsoil Brownfield Source (150 mm Cover)	1 Sample per 50 m^3	A/B/C/D
Topsoil Greenfield Source (150 mm Cover)	1 Sample per 200 m^3	A/B/C/D
Topsoil Brownfield Source (150 mm Cover)	1 Sample per 50 m^3	A/B/C/D
General Engineering Fill (Class 1 and 2 Soil)	1 Sample per 1000 m^3	A/B/C/D
Imported Brownfield Material	1 Sample per 1000 m^3	I

Notes
Suites of Analysis:

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

E. Speciated PAH, Banded TPH and VOCs.
F. SVOC/Speciated TPH.
G. On-Site Screening for VOC Using Calibrated PID.
H. Leachate 2:1 Speciated PAH and Banded TPH.
I. Leachate Analysis of Inorganic Heavy Metals, TPH, Sulphate and PAH.

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

3.2. REMEDIATION CONTRACTORS SITE MANAGEMENT AND RESPONSIBILITY

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

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

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

4. MATERIALS MANAGEMENT AND LEGISLATIVE COMPLIANCE

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

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

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

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

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

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

It is noted that if 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 reuse of materials on the site.

The importation of material for use within the proposed construction of a development platform will be subject to the 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. ENVIRONMENTAL MONITORING AND VALIDATION

5.1. SITE MANAGEMENT

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

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

5.2. COMPLETION

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

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

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

5.3. MITIGATION OF RISK FROM SOILS WITH ASBESTOS FIBRES

5.3.1. PRE-COMMENCEMENT WORKS

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

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

5.3.2. CONTROL, MONITORING AND REPORTING OF GENERAL AERIAL EMISSIONS FROM DUST AND PARTICULATES

DAMPING DOWN OF SOILS – MITIGATE PARTICULATE (DUST) EMISSION

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

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

GENERAL CONTROL OF DUST

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

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

PERSONAL PROTECTIVE EQUIPMENT (PPE)

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

Overalls:

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

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

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

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

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

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

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

6. E3P GEOTECHNICAL ENGINEERING SPECIFICATION

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

- The complete footprint of the proposed industrial building will be subject to a process of enabling earthworks to remove all organic materials and stockpile, prior to the completion of site wide cut/fill utilising naturally occurring materials to construct the development platform. All material will be placed and engineered in accordance with this specification to ensure compliance as a structural upfill;

- Where Class 1 & 2 materials are using in the cut/fill earthworks, stabilisation agents such as lime may be required to control the moisture content and ensure compaction as engineered structural fill;

- All hard materials will be processed as a Class 6 recycled material for subsequent compaction;

- The development platform to the building footprint (+2.0m on all elevations) will be set at the required level below FFL. It is considered likely that the sub-base to floor slabs and external reinforced hardstanding will be constructed using recycled Class 6 material.

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

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

Particular attention must be given to variable weather conditions when re-engineering fine-grained soils as a moisture content fluctuation (3% +/-) of the tolerable limit will result in an unacceptable degree of compaction loss without appropriate modification and stabilisation. The contractor will be responsible for extensive control testing to demonstrate that the optimum moisture content for all engineering material is within the pre-defined control limits.

Where relict structures infrastructure has been removed, the reduced level excavation should be formed in a manner where the sides are graded at no greater than a 45o angle that will facilitate the resulting backfilling of the excavation with Class 1 / 2 or 6 soils that are to be engineered to achieve the required performance specification.

The contractor will be responsible for proof rolling and where necessary Ground Improvement in the sub-stratum to ensure it is compacted with all potential variable stratum or soft spots to be removed and replaced with material that is engineered in accordance with the requirements of this specification.

The contractor will undertake to provide a detailed survey of all reduced level excavations with survey positions of a maximum 25 m grid increasing to 5 m centres where a change in topography greater than 500 mm occurs at any one point. The reduced level survey is to be provided to the supervising engineer for review and approval prior to the backfill of the excavation and placement of structural fill material.

In general, all soils (excluding certified recycled and quarried aggregates) must be engineered to achieve the following performance criteria:

- Moisture content to be within 2% (+/-) of the defined optimum / control value;
- CBR to meet the required performance spec for the relevant stratum in each and every engineered soil layer; and,
- Maximum deformation under Plate Load to meet the geotechnical specification within each and every compacted layer.

6.1. LOCALLY-WON FILL MATERIAL

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

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

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

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

6.2. CLASSIFICATION OF FILL MATERIAL

This specification should be read in conjunction with the following:

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

6.2.1. GENERAL CLASSIFICATION

The contractor should ensure that all earthworks materials comply with Clause 601 of the *Specification for Highway Works and* shall fall into one of the following general classifications as defined in Table 6/1 of the *Specification for Highway Works*.

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

Materials can be engineered in accordance with the Methods for General Cohesive Fill (Class 1 or 2) however it is essential the performance criteria of a Class 7A Material is achieved.

6.2.2. 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.

Prior to the addition of any stabilising agents, laboratory bench testing will be undertaken in accordance with the method and rationale as outlined within the DMRB HA74/07.

For any stabilisation works certain limiting factors must be considered by the contractor in their design:

- Soils can only be stabilised through the addition of lime/OPC when the ambient air temperature is >7 degrees; and,
- Ground temperatures cannot fall below 3 degrees.

In addition to any grading requirement for a material type, 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 150mm shall not be deposited within the restored surface level unless directed otherwise by the Engineer.

Prior to the commencement of any works, the following laboratory tests are to be completed by the contractor to demonstrate the suitability of materials for use as structural fill and were required to provide bench testing to confirm the applicability of stabilisation agents.

Pre-Commencement Earthworks Testing Frequency / Performance

To determine the geotechnical classifications of any material to be placed and compacted in layers, representative samples will be taken at a frequency of **1 per 2,000m³** and submitted for particle size distributions (PSDs). Maximum Dry Density and Natural and Optimum Moisture Content determinations.

To determine the geotechnical classifications of any cohesive material to be placed and compacted in layers, representative samples will be taken (following removal of any inclusions of oversize material, metal, timber, plastic, etc.) at a frequency of **1 per 1,000m³** and submitted for liquid and plastic limits, plasticity index and natural moisture content determinations. Organic matter determinations shall be prescribed at the discretion of the supervising consultant, dependent on visual observations.

Representative samples of all proposed backfill shall be taken at a frequency of **1 per 3000m³ (minimum 3nr)** and submitted for Dry Density / Optimum Moisture Content analysis using either a 4.5Kg or 2.5kg rammer to determine the optimum moisture content and maximum dry density for the engineering of structural fill.

For an unaltered fill material to be deemed suitable for use, the natural moisture content must be within 2% (+/-) of the optimum to achieve the required maximum dry density. Where the laboratory test indicates that the soil parameters are outside these requirements, stabilising agents should be added and tests should be undertaken to assess suitability for use to the contractor's own design.

6.3. GENERAL PERFORMANCE REQUIREMENTS – ENGINEERED FILL

The contractor shall employ only plant and working methods which 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.

Building Floor Slab – Completion of necessary cut / fill works, compaction of shallow granular soils and subsequent construction of a stiffened soil platform to ensure a net safe Allowable Bearing Pressure of 50 kN/m^2 to achieve the settlement requirements of the Structural Engineer (nominally <25 mm with a differential settlement of <10 mm) with the construction of a specialist 300 mm sub-base replacement layer or placement of suitable aggregate to ensure a CBR >15% to the top of sub-base and >30% at MOT 1.

External Hardstand – Completion of all necessary cut / fill works, compaction of sub-grade and subsequent Engineering of a 300 mm stiffened soil platform to ensure total settlement of <25 mm with a differential settlement of <10 mm to achieve a CBR of >15% at the formation and 30% at top of MOT1.

Preparation of Formation (all other areas) - Prior to the placement of any engineered soils, the formation area (reduced level excavation) will be assessed and certified as suitable to ensure the removal of all soft spots that would be defined as either soft/low strength cohesive or loose granular stratum to ensure all anthropogenic and natural stratum that remains in-situ exceeds the performance requirements.

The contractor will be responsible for proof rolling and where necessary Ground Improvement in the sub-stratum to ensure it is compacted with all potential variable stratum or soft spots to be removed and replaced with material that is engineered in accordance with the requirements of this specification.

In general, all soils (excluding certified recycled and quarried aggregates) must be engineered to achieve the following performance criteria:

- Compaction in excess of 95% of the Maximum Dry Density (MDD) defined using a 4.5 kg rammer or 100% of the MDD derived from a 2.5 kg rammer laboratory simulation;
- Maximum <5% air void ratio in engineered cohesive soils during uplift layers;
- Moisture content to be within 2% (+/-) of the defined optimum/control value;
- CBR to meet the required performance spec for the relevant stratum in each and every engineered soil layer; and,
- Maximum deformation under Plate Load to meet the geotechnical specification within each and every compacted layer.

TABLE 6.1 SPECIFICATION FOR GEOTECHNICAL ENGINEERING WORKS - GROUND BEARING FLOOR SLAB

CONSTRUCTION DETAIL	MATERIAL	TEST TYPE	FREQUENCY / 1 PER:	PERFORMANCE REQUIREMENT
MOT Sub-Base (Engineers Drawing)	MOT – Type 1	Max Deformation & CBR by Plate Load	1000 m^2	CBR to be >30% (structural engineer design)
		PSD	1000 m^3	Type MOT 1 Grading
		Frost Susceptibility	5000 m^3	<5% Heave
300mm Engineered Capping	Stabilised Subbase Replacement or Suitable Aggregate	Max Deformation & CBR by Plate Load	2000 m^2	>15% & <5mm settlement 200 kN/m^2
		CBR by DCP	1000 m^2	>15%
		In-situ Density by NNDGT or SRD	625 m^2	>95% of Max DD (4.5 kg)
Engineered Structural Up-Fill (Stabilised to control moisture as required)	Engineered Cohesive	In-situ Density by NNDGT or SRD	625 m^2	>100% of Max DD (2.5 kg) <5% Air Voids >95% of Max DD (4.5 kg) <5% Air Voids
		Max Deformation & CBR by Plate Load	4000 m^2 (placed)	>3%
		CBR by DCP	1000 m^3	>5%
		Odometer (core)	10,000 m^3	<0.1 m^2/MN
	Engineered Granular	In-situ Density by NNDGT or SRD	650 m^2	>100% of Max DD (2.5 kg) >95% of Max DD (4.5 kg)
		Max Deformation & CBR by Plate Load	4000 m^2 (placed)	>3%
		CBR by DCP	1000 m^3	>3%
Base of Formation	Granular or Cohesive	CBR by DCP	4000 m^2	>3%
		Hand Shear vane	500 m^2	Cu >30 kN/m^2

TABLE 6.2 SPECIFICATION FOR GEOTECHNICAL ENGINEERING WORKS – EXTERNAL HARDSTAND

CONSTRUCTION DETAIL	MATERIAL	TEST TYPE	FREQUENCY / 1 PER:	PERFORMANCE REQUIREMENT
MOT Sub-Base (Engineers Drawing)	MOT – Type 1	Max Deformation & CBR by Plate Load	1000 m^2	CBR to be >30% (structural engineer design)
		PSD	1000 m^3	Type DOT 1 Grading
		Frost Susceptibility	5000 m^3	<5% Heave
300mm Engineered Capping	Stabilised Subbase Replacement or Suitable Aggregate	Max Deformation & CBR by Plate Load	1000 m^2	>30% & <6 mm settlement 150 kN/m^2
		CBR by DCP	1000 m^2	>15%
		In-situ Density by SRD or NNDGT	650 m^2	>100% of Max DD (2.5 kg) >95% of Max DD (4.5 kg)
Base of Formation	Granular or Cohesive	CBR by DCP	1000 m^2	>3%

Notes:
Maximum dry density shall be determined by obtaining representative samples of all material that will be engineered using laboratory determinations to confirm the Optimum Moisture Content & Maximum Dry Density for soils in either the unaltered or modified (stabilised) state.

CBR by Plate Load will utilise a 450mm Plate with the test to be conducted in strict accordance with BS1377 (Part 9). Note this will mean the loading of the test until all movement of the plate has stopped, i.e. until the average settlement rate is less than 0.02mm per 5 minute interval. A minimum modelled load of 150Kn/m2 will be applied to all PLT Testing for the purposes of this contract.

In-situ density method to be selected by the contractor with written approval required from the supervising organisation in terms of appropriateness of application.

The depth of differing stratum as indicated within the E3P specification is for guide purposes only and the contractor must refer to the Structural Engineers drawings for specific build up requirements.

Where soil is to be stabilised and used as an engineered fill material the contractor will be required to provide a site specific method statement for the proposed works to be fully inclusive of laboratory bench testing to demonstrate the suitability for use.

TABLE 6.3 E3P EARTHWORKS GEOTECHNICAL COMPACTION SPECIFICATION

SOIL/MATERIAL TYPE	CLASS	DESCRIPTION	COMPACTION EQUIPMENT	LAYER THICKNESS	ROLLER PASSES
Granular Fill **(Sand and Gravel Matrices)**	1 A	Sandy Gravel with some cobbles	> 5000 kg vibrating roller	225 mm	4
	1 B	Sand or Gravel of same grading size	> 5000 kg vibrating roller	250 mm	10
	1 C	Coarse gravels with many cobbles	> 5000 kg vibrating roller	400 mm	5
Cohesive Fill **(Clay with Minor Sand and Gravel Component)**	2 A	Wet Clays	> 1000 kg vibrating tamping roller (sheep foot only)	100–225 mm	3
	2 B	Dry Clay	> 5000 kg vibrating roller or 1400 kg tamping (trench roller)	225 mm or 125 mm	4 or 12
	2 C	Gravelly Clay	> 5000 kg vibrating roller or 1400 kg tamping (trench roller)	225 mm or 125 mm	4 or 12
	2 D	Silty/Sandy Clay	> 5000 kg vibrating roller or 1400 kg tamping (trench roller)	225 mm or 125 mm	4 or 12
Recycled Aggregate Crush **(< 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

6.3.1. USE OF FILL MATERIALS

In addition to any grading requirement, the maximum particle size of any fill material shall be no more than two-thirds of the compacted layer thickness except that cobbles having an equivalent diameter of more than 150mm 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.

Prior to the addition of any stabilising agents, laboratory bench testing will be undertaken in accordance with the method and rationale as outlined within the DMRB HA74/07.

For any stabilisation works certain limiting factors must be considered by the contractor in their design:

- Soils can only be stabilised through the addition of lime/OPC when the ambient air temperature is >7 degrees.
- Ground temperatures cannot fall below 3 degrees.

In addition to any grading requirement for a material type, 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 150mm shall not be deposited within the restored surface level unless directed otherwise by the Engineer.

Prior to the commencement of any works, the following laboratory tests are to be completed by the contractor to demonstrate the suitability of materials for use as a structural fill and were required to provide bench testing to confirm the applicability of stabilisation agents.

6.3.2. PRE-COMMENCEMENT EARTHWORKS TESTING FREQUENCY / PERFORMANCE

To determine the geotechnical classifications of any material to be placed and compacted in layers, representative samples will be taken at a frequency of 1 per 1,000m³ and submitted for particle size distributions (PSDs). Maximum Dry Density and Natural and Optimum Moisture Content determinations.

To determine the geotechnical classifications of any cohesive material to be placed and compacted in layers, representative samples will be taken (following removal of any inclusions of oversize material, metal, timber, plastic, etc.) at a frequency of 1 per 1,000m³ and submitted for liquid and plastic limits, plasticity index and natural moisture content determinations. Organic matter determinations shall be prescribed at the discretion of the supervising consultant, dependent on visual observations.

For an unaltered fill material to be deemed suitable for use, the natural moisture content must be within 2% (+/-) of the optimum to achieve the required maximum dry density. Where the laboratory test indicates that the soil parameters are outside these requirements, stabilising agents should be added to assess suitability for use to the contractor's own design.

6.4. GENERAL REQUIREMENTS

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

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

TABLE 6.4 COMPACTION/BACKFILL REQUIREMENTS

LAND USE REQUIREMENT	COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERIA
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 net Allowable Bearing Pressure (ABP) **These works are to be completed within the building structure footprint and +2 m of all elevations.** Material must be 90% granular in composition with less than 10% fines (which are classified as materials < 0.6 microns in size). No material greater than 125 mm in size is permitted, with 90% of the soils placed conforming to grading < 90 mm. 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. Material to be placed in a manner so as to ensure a minimum CBR of 5% at formation to facilitate machine movement and piling mat construction. Where site-won materials are used to upfill, levels must be compacted to an "end product" performance specification where the in-situ density exceeds 95% of the maximum (determined by laboratory conditions). 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. The substratum must be prepared to ensure a vibro-stone column treatment depth is not less than 80% of the immediate adjacent profile.
Adopted Highways (+ 2 m from Back of Footpath)	*Method Compaction – Highways Design Manual Series 600* is to be followed, with in-situ validation testing to meet the requirement of adoptions authority. A CBR > 5% is required at subgrade formation (prior to placement of capping).
Estate Roads	*Method Compaction – Highways Design Manual Series 600* is to be followed to achieve a CBR > 5%.

LAND USE REQUIREMENT	COMPACTION METHODOLOGY AND GENERAL PERFORMANCE CRITERIA
Landscaping, 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 *Highways Design Manual Series 600*.

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 a site for this purpose.

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

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

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

The contractor shall keep earthworks free of water, including:

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

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

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

6.4.1. CONSTRUCTION OF FILLS – HIGHWAYS

All fills shall be constructed:

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

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

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

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

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

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

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

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

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

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

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

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 failure of the contractor to comply with requirements of the contract, the contractor shall carry out such further work as is required to comply with the contract.

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

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

6.4.3. UNACCEPTABLE MATERIAL

The contractor is solely responsible for ensuring full and detailed analysis of all reported ground conditions and areas of risk in terms of the potential for unacceptable material to be present within the proposed earthworks. Limitations in the available information should be highlighted to the supervising engineer prior to the commencement of earthworks. The contractor is to make full and unequivocal arrangements to investigate the potential presence 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 contract specific Appendix 6/1:

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

Unacceptable material Class U1B shall be:

Contaminated materials, including controlled wastes (as defined in the Environmental Protection Act 1990 Part IIA) whose level of contamination is above that given either in contract specific Appendix 6/14

or in contract specific Appendix 6/15, but excluding all hazardous wastes (as Volume 1 Series 600 Specification for Highway Works Earthworks W2 Amendment – February 2016 defined in the Hazardous Waste (England and Wales) Regulations 2005) and radioactive wastes (as defined in the Radioactive Substances Act 1993).3(02/16).

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

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

6.5. EARTHWORKS MATERIAL TESTS

Prior testing of the potential sources of fill shall be undertaken by the contractor and submitted to the consulting engineers for approval. This testing shall include, but not necessarily be limited to, the compaction and backfill requirements detailed in Table 6.5.

TABLE 6.5 COMPACTION/BACKFILL REQUIREMENTS

<table>
<tr><th>LAND USE</th><th>COMPACTION METHODOLOGY and GENERAL PERFORMANCE CRITERIA</th></tr>
<tr><td>Liquid and Plastic Limits</td><td>BS 1377: Part 2</td></tr>
<tr><td>Grading</td><td>BS 1377: Part 2</td></tr>
<tr><td>Uniformity Coefficient</td><td>Calculated from grading curve</td></tr>
<tr><td>Moisture Content
Multi-point moisture condition value (MCV) (to assess optimum moisture content).</td><td>BS 1377: Part 2</td></tr>
<tr><td>Organic Matter (Maximum 2.5% Total Organic Content)</td><td>BS 1377: Part 3</td></tr>
<tr><td>Water Soluble Sulphate</td><td>TRL Report 447 Test No 1</td></tr>
<tr><td>Total Sulphate Content</td><td>TRL Report 447 Test No 4</td></tr>
<tr><td>Earthwork In-situ Tests
Subsequent to the filling and compaction of the material, a series of in-situ tests shall be undertaken to confirm the success of the compaction process. This testing shall include, but necessarily be limited to, the following:

<table><tr><th>Test</th><th>Test Method</th></tr><tr><td>Plate Load Tests (Equivalent CBR)</td><td>BS 1377: Part 9</td></tr></table>
Disposal of Materials
The contractor shall be responsible for the safe disposal of any excess of unsuitable material found on the site.</td><td>Clause 632 (BS 1377: Part 4)</td></tr>
<tr><td>Max DD / OMC (Proctor) Compaction Testing</td><td>BS 1377: Part 4</td></tr>
</table>

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

7. RECORD-KEEPING AND VERIFICATION

7.1. RECORD-KEEPING

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

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

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

7.2. VERIFICATION

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

The validation report will include the following:

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

8. CONTINGENCY PLAN

8.1. PREVIOUSLY UNIDENTIFIED CONTAMINANTS

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

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

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

9. SECOND PHASE MITIGATION AND MANAGEMENT – BUILD PHASE

This document details the construction works that are required to ensure full compliance with the Remediation Strategy and Enabling Works Strategy, Regulatory Authorities, Building Control & Warranty Providers:

- Laboratory testing of the imported topsoil;
- Chemical validation of any additional subsoil imported for use within landscaping;
- Placement and validation of sub-soil (clean material) in a minimum 150 mm layer;
- Placement and validation of topsoil in a minimum 150 mm layer; and,
- Placement and chemical validation of imported topsoil within all landscaped areas;

The validation protocols are presented within the E3P Remediation and Enabling Works Strategy and are presented below. It should be noted that the requirement of the final landscaping scheme may require deeper areas of cover system should deeper rooting trees/bushes be needed.

9.1. PLACEMENT OF COVER SYSTEM

The Remediation and Enabling Works Strategy for the site, with respect to human health of the future site users, include 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:

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

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

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

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

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

TABLE 9.1 SPECIFICATION FOR SOIL TESTING

MATERIAL USE	TESTING FREQUENCY	SUITE OF ANALYSIS
Subsoil Greenfield Source (450 mm Garden Cover)`	1 Sample per 200 m^3	A/B/C/D
Subsoil Brownfield Source (450 mm Garden Cover)	1 Sample per 50 m^3	A/B/C/D
Topsoil Greenfield Source (150 mm Garden Cover)	1 Sample per 200 m^3	A/B/C/D
Topsoil Brownfield Source (150 mm Garden Cover)	1 Sample per 50 m^3	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).
C. Asbestos (ID).
D. CLEA Inorganic Heavy Metals.

9.1.1. PROCEDURE FOR PLACEMENT OF CHEMICALLY SUITABLE COVER SYSTEM

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

The placement of 300 mm of clean material will be undertaken during the build phase works of the project.

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

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

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

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

The garden validation procedure is detailed in Table 9.2.

TABLE 9.2 LANDSCAPE VALIDATION PROCEEDURE

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

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

PLATE 1 EXAMPLE PLOT COVER SYSTEM VALIDATION

Plot No: 4 (Car Park Landscaping)		
Depth of Strata (m bgl)	0.00-0.30	Validated TOPSOIL

Depth of Cover System Materials

Depth of Cover System Materials

Depth of Cover System at Ground Level and in Relation to Unit / Structure

9.2. POTABLE WATER SUPPLY – CONTAMINANT ASSESSMENT CRITERIA

Contaminant Group	PE-threshold[A]	Maximum Permissible concentration at proposed pipeline depth[A]	Maximum permissible site concentration[A]
Total VOC	0.5	N/A	N/A
Total BTEX And MTBE	0.1	N/A	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A	< 0.3
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	< 0.1	< 0.1
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	5.7	5.7
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	49	149
Phenols (From SVOC Analysis)*	2	< 0.3	< 0.3
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	< 0.3	< 0.3

Notes

A. All concentrations in mg/kg.

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the Client as indicated in Section 1.2.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

TERMS

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
CA	Coal 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

APPENDIX III
DRAWINGS

0 20 40 60 80 100m
Scale 1:2000

Existing Intake Pump House

Buildings to be retained

Manchester Ship Canal

Indicative attenuation pond location

Sprinkler tank + pumphouse by tenant

1 no. level access door

10 no. loading docks

42 no. trailer spaces

UNIT 01
GF WAREHOUSE = 23,112 m² / 248,775ft²
FF OFFICE = 578 m² / 6,221 ft²
SF OFFICE = 578 m² / 6,221 ft²
Driver Hubs = 80 m² / 861 ft²
Gatehouse = 21m² / 226 ft²
TOTAL GIA = 24,369 m² / 262,304 ft²

10 no. loading docks

1 no. level access door

Sprinkler tank + pumphouse by tenant

1 no. level access door

10 no. loading docks

53 no. trailer spaces

UNIT 02
GF WAREHOUSE = 33,792 m² / 363,734 ft²
FF OFFICE = 845 m² / 9,096 ft²
SF OFFICE = 845 m² / 9,096 ft²
Driver Hubs = 160 m² / 1,722 ft²
Gatehouse = 21m² / 226 ft²
TOTAL GIA = 35,663 m² / 383,874 ft²

12 no. loading docks

1 no. level access door

Sprinkler tank + pumphouse by tenant

1 no. level access door

28 no. trailer spaces

UNIT 03
GF WAREHOUSE = 8,960 m² /96,444 ft²
FF OFFICE = 448 m² / 4,822 ft²
TOTAL GIA = 9,408 m² / 101,266 ft²

10 no. loading docks

1 no. level access door

282 no. car parking spaces inc. 14 no. accessible

224 no. parking spaces inc. 19 no. accessible

106 no. car parking spaces inc. 6 no. accessible

North Road

Existing access utilised

Location for primary sub-station if required

Potential access to Unit 3 from proposed access

Proposed signage location

Proposed new junction

Schedule of Accommodation

Unit	Ground Floor GIA	Office GIA	Gatehouse	Driver Hubs	TOTAL UNIT GIA	Car Parking (Accessible)	Parking Ratio (/m²)
Unit 1	23112m² / 248,775ft²	1,156m² / 12,442ft²	21m² / 226ft²	80m² / 861ft²	**24,369m² / 262,304ft²**	282 (14)	1:87
Unit 2	33,792m² / 363,734ft²	1,690m² / 18,192ft²	21m² / 226ft²	160m² / 1,722ft²	**35,663m² / 383,874t²**	379 (19)	1:95
Unit 3	8,960m² / 96,444ft²	448m² / 4,822ft²	-	-	**9,408m² / 101,266ft²**	106 (6)	1:89
TOTAL SITE GIA					**69,440m² / 747,444ft²**	767 (39)	

NOTES AEWTP027C

- All dimensions and levels are to be checked on site.
- Any discrepancies are to be reported to the architect before any work commences
- This drawing shall not be scaled to ascertain any dimensions. Work to figured dimensions only.
- This drawing shall not be reproduced without express written permission from AEW.
- Title overlay drawings and ownership boundaries are produced using all reasonable endeavors. AEW cannot be responsible for the accuracy or scale discrepancy of base plans supplied to them.
- All works are to be undertaken in accordance with Building Regulations and the latest British Standards.
- All proprietary materials and products are to be used strictly in accordance with the manufacturers recommendations.

CDM 2015

Client notified of duties:

Principal Designer:

Unless noted below, all known hazards have been highlighted on the drawing:

Note

- Exact boundaries to be confirmed with reference to land registry plans and topographical survey.
- HGV circulation subject to tracking analysis.

Site Boundary
44.77 acres / 18.12 ha

Land retained by Peel Ports
31.50 acres / 12.75ha

LDO Boundary taken from Cheshire West and Chester
Drawing: North Road Industrial
Area - LDO Area
(DWG required for accuracy)

2-3m of made ground (Taken from SGI drawing ref C1442-SK01)

HSE Outer Zone (Information overlay from HSE Crosses Consultation Zone Ref C1442)

HSE Middle Zone (Information overlay from HSE Crosses Consultation Zone Ref C1442)

HSE Inner Zone (Information overlay from HSE Crosses Consultation Zone Ref C1442)

REV	Date	Drawn by: -	Checked by: -
P4	05/11/20	KS	DOH
Red line boundary updated. HSE constraint zones added. Layout amended to avoid existing buildings			
P3	29/10/20	KS	DOH
Unit 2 access road amended to suit HGV tracking. Unit 3 proposed access point omitted and existing access utilised. Unit 01 yard altered to the north.			
P2	19/10/20	MB	DOH
Unit sizes updated. Sprinkler tanks shown. Unit 03 entrance updated.			
P1	30/09/20	MB	AS
Initial Issue			

Status: S2 — Purpose of Issue: For Comment

drawing stage: **Stage 2 Concept Design**

client: **Firethorn Trust**

project: **Port Cheshire**
North Road
Ellesmere Port

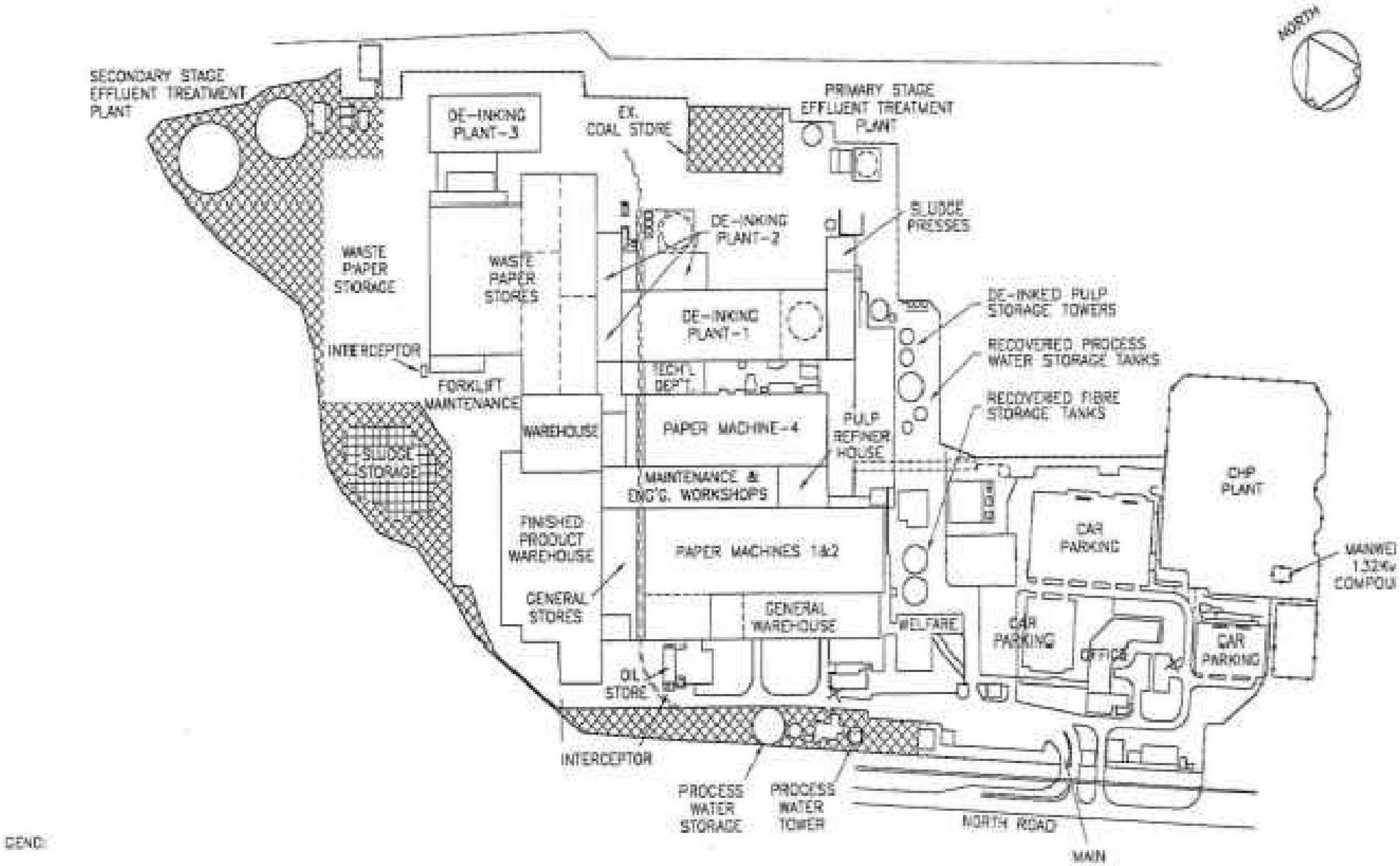
drawing title: **Feasibility Site Plan**
Three Unit Scheme

date: 30/09/20 drawn: MB
scale@A2: 1:2000 checked: AS

Rev: **P4**

Job No: **11915-AEW-XX-XX-DR-A-0002**

aew architects
0161 214 4370
www.aewarchitects.com



LEGEND

Notes:		Client: SGI	Job No: 14-035	Date: 04.02.2021	e3p	Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk
			Drawing No: 003	Scale: NTS		
P1	REVA	02.02.2021	HM	AE	Job Title: Bridgewater Paper Mill	Drawing Title: Historical Features Plan
Phase	Issue	Date	Drawn	Checked		

Location Symbols

- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVC	04.02.2021	HM	AE
P1	REVB	29.01.2021	HM	AE
P1	REVA	16.11.2020	HM	AE

Client: SGI

Job No: 14-035

Date: 04.02.2021

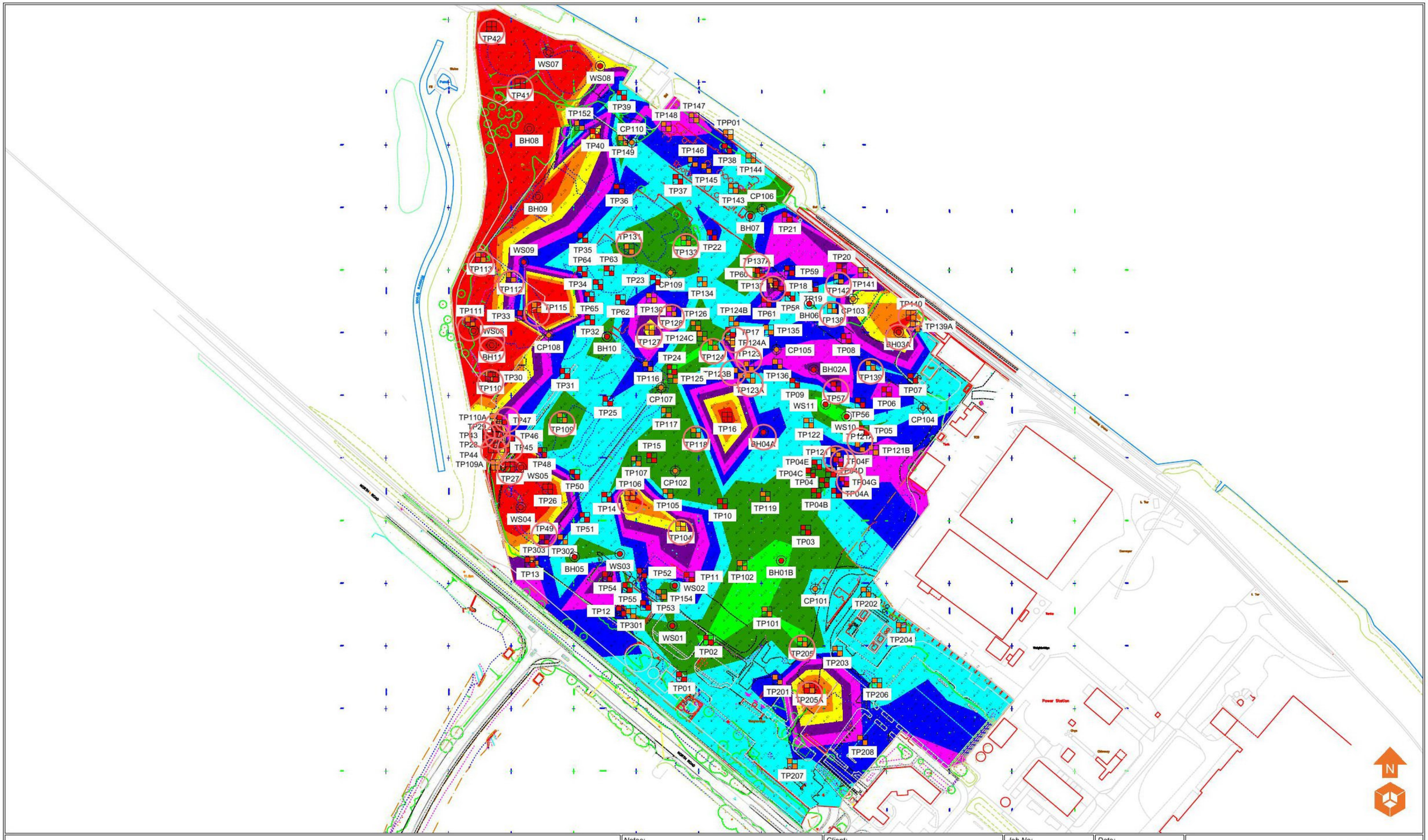
Drawing No: 004

Scale: NTS

Job Title: Bridgewater Paper Mill

Drawing Title: Exploratory Hole Location Plan

e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



Location Symbols

- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location
- Approximate Trial Pit Location (ID April 2012)
- Approximate Cable Percussive Borehole Location (ID April 2012)
- Approximate Window Sample Location (ID April 2012)
- Full Extent of Made Ground Not Identified

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.29m
- Depth of Made Ground 0.30 - 0.59m
- Depth of Made Ground 0.60 - 0.89m
- Depth of Made Ground 0.90 - 1.19m
- Depth of Made Ground 1.20 - 1.49m
- Depth of Made Ground 1.50 - 1.79m
- Depth of Made Ground 1.80 - 2.09m
- Depth of Made Ground 2.10 - 2.39m
- Depth of Made Ground >2.40m

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVC	04.02.2021	HM	AE
P1	REVB	17.11.2020	HM	AE
P1	REVA	16.11.2020	HM	AE

Client: SGI

Job No: 14-035

Date: 04.02.2021

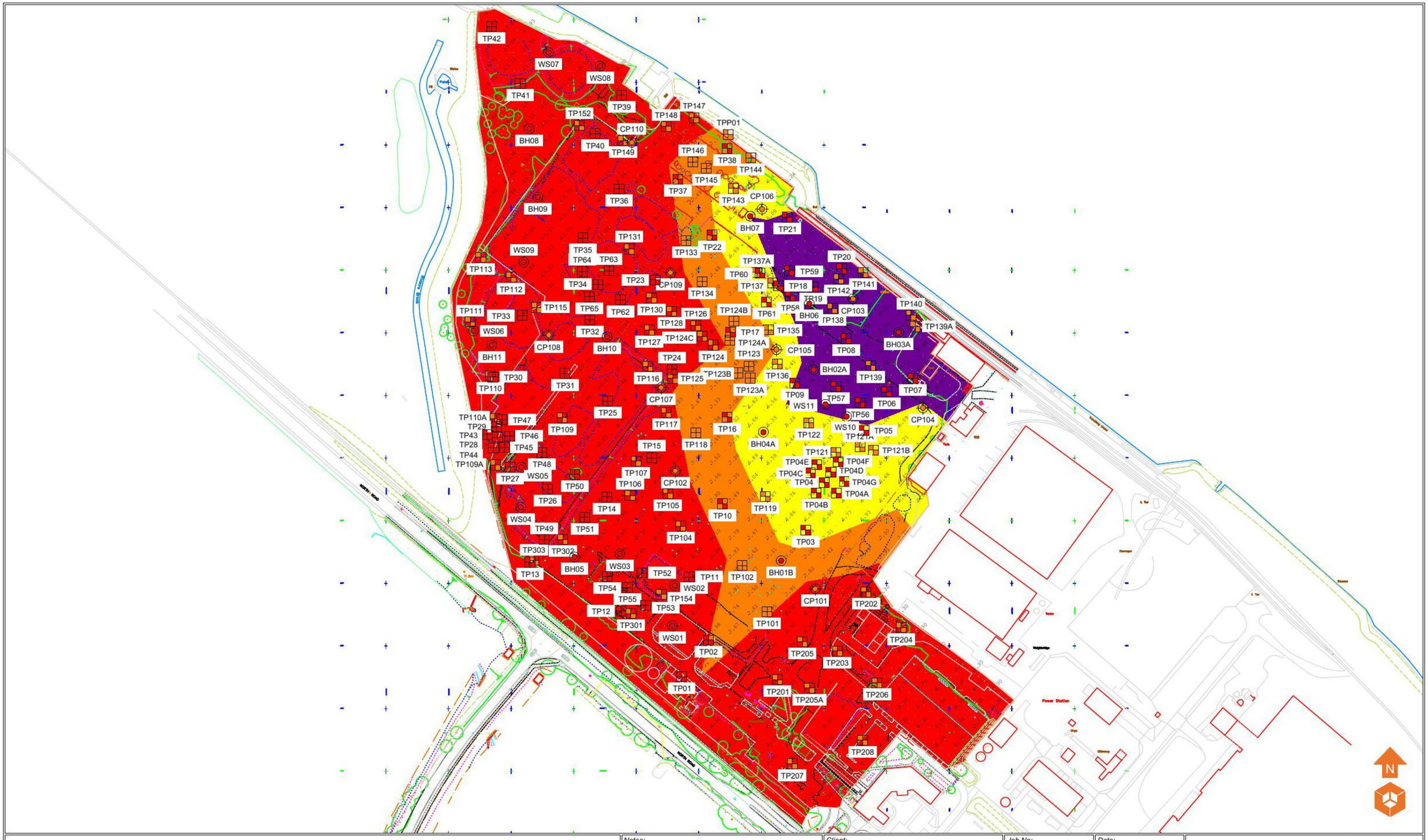
Drawing No: 005

Scale: NTS

Job Title: Bridgewater Paper Mill

Drawing Title: Depth of Made Ground Plan

e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk



Location Symbols

- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location
- Approximate Trial Pit Location (ID April 2012)
- Approximate Cable Percussive Borehole Location (ID April 2012)
- Approximate Window Sample Location (ID April 2012)

Bedrock Depth (m)

- Depth to Bedrock 0.00 - 0.99m
- Depth to Bedrock 1.00 - 1.99m
- Depth to Bedrock 2.00 - 2.99m
- Depth to Bedrock 3.00 - 3.99m
- Depth to Bedrock 4.00 - 4.99m
- Depth to Bedrock 5.00 - 5.99m
- Depth to Bedrock 6.00 - 6.99m
- Depth to Bedrock 7.00 - 7.99m
- Depth to Bedrock >8.00m

Notes:

P1	REVA	04.02.2021	HM	AE
Phase	Issue	Date	Drawn	Checked

Client: SGI

Job No: 14-035

Date: 04.02.2021

Drawing No: 006

Scale: NTS

Job Title: Bridgewater Paper Mill

Drawing Title: Depth to Bedrock Plan

e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Location Symbols

- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location

Development Constraints

- Visual Olfactory Evidence of Contamination
- Substructure
- ACM Fibres in Made Ground
- Approximate Area of Historical Ponds
- Low Level VOC
- Existing Stockpiles
- Deep Made Ground

Notes:

Client: SGI

Job No: 14-035

Date: 04.02.2021

Drawing No: 008

Scale: NTS

Phase	Issue	Date	Drawn	Checked
P1	REVA	04.02.2021	HM	AE

Job Title: Bridgewater Paper Mill

Drawing Title: Development Constraints Plan

e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Summary of Heave Precaution Requirements

Volume Change Potential	*Required Foundation Depth (m)*	*Minimum Void Dimensions for Foundations, Ground Beams & Suspended In-Situ Concrete Ground Floors*		*Minimum Void Dimensions Under Pre-Cast Concrete & Suspended Timber Floors*
		Thickness of Void Former Against Side of Foundation of Ground Beam (mm)	*Thickness of Void Former on Underside of Edge Beam & Floor Slab (mm)*	*Void Dimension (mm)*
Low Volume Change Potential (<20%)	>2.00	No Special Precautions		200
	2.00-2.50	-	50	
Medium Volume Change Potential (20-40%)	1.50-2.00	25	50	250
	2.00-2.50	25	100	
	>2.50	Engineer Design		Engineer Design
High Volume Change Potential (>40%)	1.50-2.00	25	75	300
	2.00-2.50	35	150	
	>2.50	Engineer Design		Engineer Design

Minimum Width of Strip Footings

Type of Ground (Including Engineered Fill)		*Condition of Ground*	*Total Load of Load-Bearing Walling more than (kN/linear metre)*					
			20	30	40	50	60	70
			Minimum Width of Strip Foundation (mm)					
Gravel	Sand	Medium Dense to Dense	250	300	400	500	600	650
Clay	Sandy Clay	Stiff	250	300	400	500	600	650
Clay	Sandy Clay	Firm	300	350	450	600	750	850

Items Considered

Bearing Capacity	TBC
Trees	TBC
Historical	TBC
Groundwater Table	TBC
FFL	TBC
Contamination	TBC
Remediation	TBC
Volume Change Potential	TBC
Root Protection Areas	TBC

Residual Risks

Foreseeable Risks That Cannot be Avoided	*Applicable (Y/N)*	*Action to Reduce Risk*	Justification for Design Decision
Deep Excavations	Y	Identify locations on drawing and depths on schedule	Lesser risk than other alternatives
Trench Collapse	Y	Risk highlighted on drawing	Lesser risk than other alternatives
Use of Working Platform for Pile/Vibro Operations	Y	Compliance with working platform directive required	Pile/Vibro foundation less risky than other alternatives

Anticipated Foundation Types

- TS — Traditional Strip Foundations. Minimum depth 900mm below proposed Final Finished Level. Maximum safe bearing pressure limited to 100kN/m2.
- MT — Mass Trench Fill Foundations. Minimum depth 1200mm below proposed Final Finished Level. Maximum safe bearing pressure limited to 100kN/m2.
- V — Vibro Stone Ground Compaction. In accordance with NHBC Chapter 4.2
- P — Piled Foundations. Where the maximum foundation depth exceeds 2.50m a piled foundation option rather than a trench fill / deep reinforced strip foundations may be adopted. Column or line loads supported by ground beams.
- R — Raft Foundations. Maximum safe bearing pressure limited to 50kN/m2 on approved engineered granular fill. Raft foundations to be designed by a structural engineer in accordance with Chapter 4.5 of NHBC 2021. Raft foundations are considered suitable to mitigate against potential influence of clay heave / desiccation in accordance with Section 4.2, sub section D7E.
- TB — Traditional Strip / Trench Block Foundations. Traditional strip founded at 450mm below current level with build up in Trench Block and subsequent backfill to development level.
- Colours on Plot Corners to be Used When Referring to Foundation Schedule. (Pending Final Layout & Levels)

Depth to Target Founding Strata

- Footings 0.75 - 0.90m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 0.90 - 1.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.25 - 1.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.50 - 1.75m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.75 - 2.00m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.00 - 2.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.25 - 2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2

Engineered Foundation Solutions

- Footings >2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Vibro
- Low Volume Change Potential Clay. Heave precautions required to underside of cast in-situ floor slab (with no sub-floor void) within corrected zone of tree influence. Heave precautions not required to foundation.

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVB	05.02.2021	HM	AE
P1	REVA	04.02.2021	HM	AE

Client: SGI

Job No: 14-035

Date: 05.02.2021

Drawing No: 009

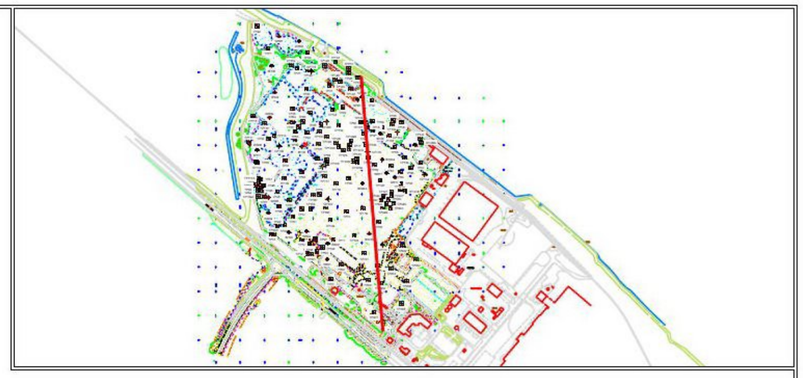
Scale: NTS

Job Title: Bridgewater Paper Mill

Drawing Title: Concept Foundation Zoning Plan

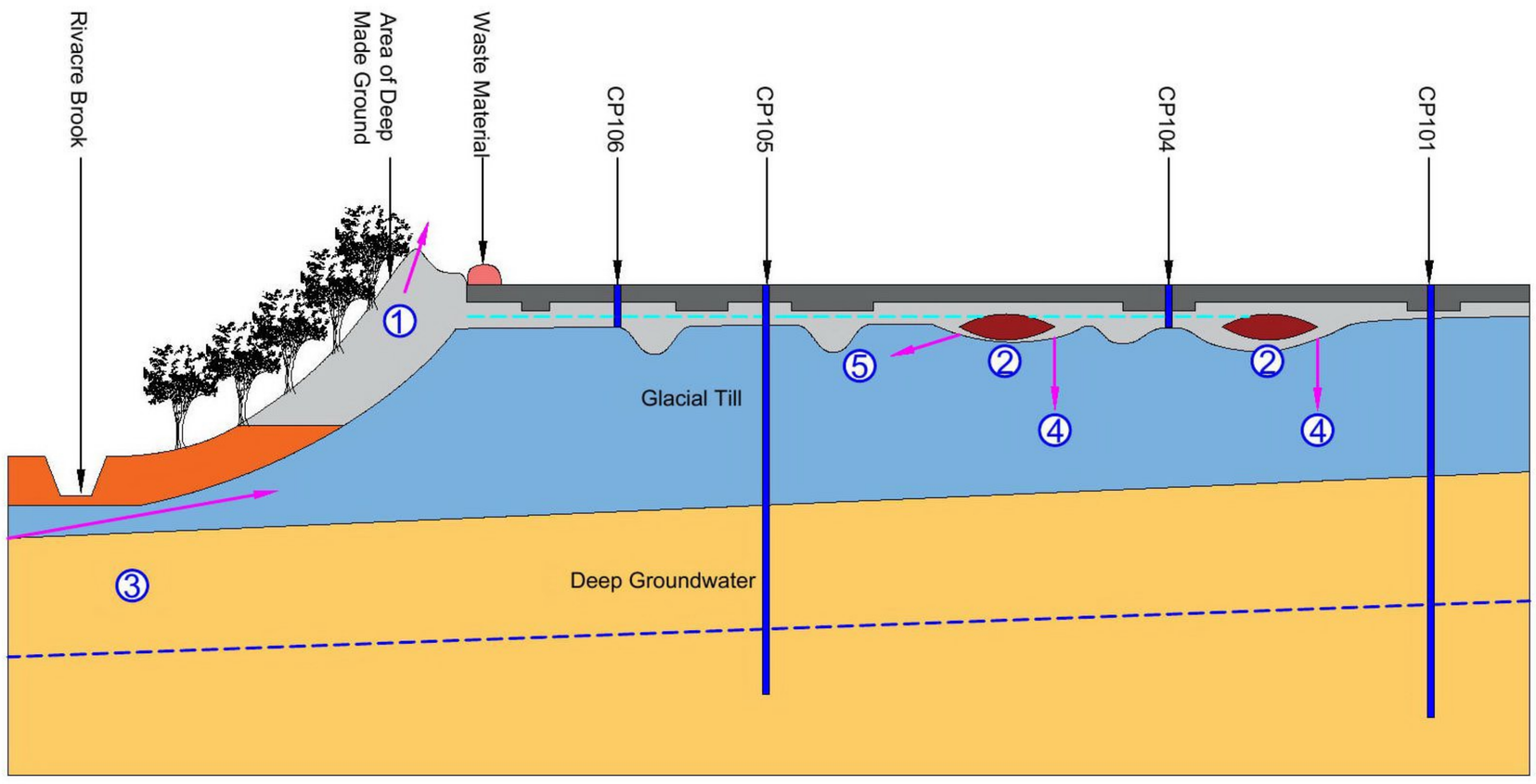
e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

ID	SOURCE	RECEPTOR	POTENTIAL PATHWAY
		HUMAN HEALTH	
1	ACM	Construction Workers / End User	Inhalation
2	Htdrocarbon		Dermal Contact
3	Ground Gas		Inhalation / Accumulation
4	Hydrocarbon	Principal Aquifer	Vertical Migration
5	Hydrocarbon	Rivacre Brook	Lateral Migration



S

N



Geological Features

- Deep Groundwater
- Shallow Groundwater
- Made Ground (Obstructions)
- Glacial Till
- Alluvium
- Waste Material
- Existing Hardstanding

Notes:

P1	REVA	17.11.2020	HM	AE
Phase	Issue	Date	Drawn	Checked

Client: SGI

Job No: 14-035

Date: 17.11.2020

Drawing No: 010

Scale: NTS

Job Title: Bridgewater Paper Mill

Drawing Title: Conceptual Site Model

e3p

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

APPENDIX IV
E3P REMEDIATION/ VALIDATION CRITERIA

HUMAN HEALTH REMEDIATION TARGETS – INDUSTRIAL / COMMERCIAL USE

DETERMINAND	UNITS	WITHIN 300 mm COVER SYSTEM (POS)	UNDER HARD STANDING AND >300 mm TO 1.0M 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	200	1100	1
Elemental Mercury	mg/kg	16	58	2
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	210	210	2
Asbestos	Fibres	NFD	≤0.001	4
Naphthalene	mg/kg	4900	190	2
Acenaphthylene	mg/kg	15000	83000	3
Acenaphthene	mg/kg	15000	84000	1
Fluorene	mg/kg	9900	63000	1
Phenanthrene	mg/kg	3100	22000	3
Anthracene	mg/kg	74000	520000	3
Fluoranthene	mg/kg	3100	23000	3
Pyrene	mg/kg	7400	54000	3
Benzo(a)Anthracene(	mg/kg	29	170	3
Chrysene	mg/kg	57	350	3
Benzo(b)Fluoranthene	mg/kg	7.1	44	3
Benzo(k)Fluoranthene	mg/kg	190	1200	3
Benzo(a)Pyrene	mg/kg	5.7	35	3
Indeno(123-cd)Pyrene	mg/kg	82	500	3
Dibenzo(a,h)Anthracene	mg/kg	0.57	3.5	3
Benzo(ghi)Perylene	mg/kg	640	3900	3
TPH C5-C6 (aliphatic)	mg/kg	570000	3200	2
TPH C6-C8 (aliphatic)	mg/kg	600000	7800	2
TPH C8-C10 (aliphatic)	mg/kg	13000	2000	2
TPH C10-C12 (aliphatic)	mg/kg	13000	9700	2
TPH C12-C16 (aliphatic)	mg/kg	13000	59000	1
TPH C16-C35 (aliphatic)	mg/kg	250000	1600000	1
TPH C5-C7 (aromatic)	mg/kg	56000	26000	1
TPH C7-C8 (aromatic)	mg/kg	56000	56000	2
TPH C8-C10 (aromatic)	mg/kg	5000	3500	2
TPH C10-C12 (aromatic)	mg/kg	5000	16000	2
TPH C12-C16 (aromatic)	mg/kg	5100	36000	2
TPH C16-C21 (aromatic)	mg/kg	3800	28000	1
TPH C21-C35 (aromatic)	mg/kg	3800	28000	1
1.2 Dichloroethene	mg/kg	29	0.67	1
Trichloroethane	mg/kg	140000	660	1
1122 Tetrachloroethane	mg/kg	1400	270	1
1112 Tetrachloroethane	mg/kg	1400	110	1
Tetrachloroethene	mg/kg	1400	19	1
Tetrachloromethane	mg/kg	890	2.9	1
Trichloroethene (TCE)	mg/kg	120	1.2	1

Trichloromethane	mg/kg	2500	99	1
Chloroethene	mg/kg	3.5	0.059	1

Notes 1

NFD = No Fibres Detected

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

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

Notes 2
Excludes matrices where free product is observed.

Tier 1 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.

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

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

i. Value derived from LQM Suitable 4 Use Levels (S4ULs) for commercial end use with plant uptake.
ii. Value derived from LQM Suitable 4 Use Levels (S4ULs) for commercial end use without plant uptake – these levels used below 300 mm cover system within commercial landscaping as soils will be present within a commercial 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) commercial .
iv. Value derived from LQM Suitable 4 Use Levels (S4ULs) for public open space (POS) park – these levels used below 300 mm POS cover system as soils will not be disturbed by any future site users and exposure to these soils will be similar to a park end use.
v. Value derived from LQM 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 commercial land use with homegrown produce.
vii. Value derived from Category 4 Screening Levels (C4SL) for commercial land use without homegrown produce.
viii. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) commercial .
ix. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) park.
x. Mercury – based on elemental mercury.
xi. PAH and TPH levels used are for 1% SOM.
xii. Xylenes based on p-xylene (o-xylene 2600 mg/kg, m-xylene 3500 mg/kg) and is capped by its solubility.
xiii. Value derived from LQM Suitable 4 Use Levels (S4ULs) for commercial end use with plant uptake due to the volatilisation risk.
xiv. BTEX is not SOM-related due to inhalation pathway.

REMEDIATION TARGETS – COMPARISON OF GROUNDWATER / LEACHATE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS SCREENING VALUE[1, 2, 3]	DWS [3,4,5]
		AA	
Arsenic	µg/l	50	10
Cadmium	µg/l	0.08-0.25	5
Chromium (VI)	µg/l	3.4	–
Chromium (III)	µg/l	4.7	50
Copper	µg/l	1	2000
Total Cyanide	µg/l	1	50
Lead	µg/l	1.2	10
Mercury	µg/l	–	1.0
Nickel	µg/l	4	20
Selenium	µg/l	–	10
Zinc	µg/l	10.9	–
pH		6–9	
Naphthalene	µg/l	2	10*
Anthracene	µg/l	0.1	
Benzo[b]fluoranthene	µg/l	0.00017*	
Benzo[k]fluoranthene	µg/l	0.00017*	
Benzo(a)pyrene	µg/l	0.00017*	
Indeno(123-cd)pyrene	µg/l	0.00017*	
Benzo(ghi)pyrene	µg/l	0.00017*	
Fluoranthene	µg/l	0.0063	
Benzo(ghi)perylene	µg/l	1.7–4	
TPH C5-C6 (benzene)	µg/l	10	1
TPH C6-C8 (toluene)	µg/l	74	700
TPH C8-C10 (ethyl benzene)	µg/l	20	300
TPH C10-C12 (xylene)	µg/l	30	500
TPH C12-C16	µg/l	2	90[5]
TPH C16-C35	µg/l	50#	90[5]
TPH C5-C6	µg/l	–	15000
TPH C6-C8	µg/l	–	15000
TPH C8-C10	µg/l	–	300
TPH C10-C12	µg/l	–	300
TPH C12-C16	µg/l	–	300
TPH C16 – C21	µg/l	–	300**

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

Notes
Solubility <0.01µg/l
AA – Annual Average
* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water
** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
5. WHO Guidelines for Drinking Water Quality. Third edition (2004)

APPENDIX V
E3P MATERIAL IMPORT CRITERIA

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

E3P
HELIPORT
BUSINESS PARK,
LIVERPOOL ROAD
ECCLES,
MANCHESTER,
M30 7RU
+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:** **Date:** **Information Supplied By:**
Reason for Generation of Excess Material at Site of Origin	
Chemical Test Results for Stockpile at Site of Origin	**Date:** **Laboratory Certificate Ref:** **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 VI
CONTRACTOR PRE-COMMENCEMENT CHECK SHEET

GEOTECHNICAL ENABLING WORKS PRE-START FORM

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

Activity	Testing Responsibility	Contractors Method Statement Required (Y/N)	Comment/Action
Deployment of Environmental Permit			Ref No:
Deployment of LAPC Part B – Mobile Plant Permit			Ref No:
CL:AIRE MMP and Qualified Person Declaration			Ref No:
Identification of All Invasive Plant Species and Production of Eradication Plan with Appropriate Supervision by Specialist			Appointed specialist:
Removal of All Vegetation			Note disposal location:
Removal of All Root Bulbs and Root Networks			Note disposal location:
Identification of Contamination 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

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

APPENDIX VI
CONTRACTOR COMPLETION CHECK SHEET

GEOTECHNICAL ENABLING WORKS COMPLETION FORM

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

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

POST-REMEDIATION AND ENABLING LIMITATIONS

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

APPENDIX VII
ECOLOGICAL SURVEY

e3p

Preliminary Ecological Appraisal Report
Port Cheshire, Ellesmere Port

Reference:80-411-R1-2
Date: February 2021

PRELIMINARY ECOLOGICAL APPRAISAL REPORT

Port Cheshire
Ellesmere Port

Prepared for:
Quartz

Report Ref: 80-411-R1-2
Date Issued: 04/02/2021

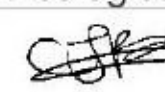
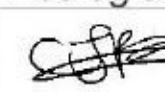
E3P

Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

+ 44 (0) 161 707 9612
https://e3p.co.uk/

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	80-411		
VERSION	Version 1	Version 2	
REMARKS	Final	Final – minor amendments	
DATE	November 2020	February 2021	
PREPARED BY	H. Morgan	H. Morgan	
QUALIFICATIONS	BSc (Hons) ACIEEM, Senior Ecologist	BSc (Hons) ACIEEM, Senior Ecologist	
SIGNATURE			
CHECKED BY	C. Barlow	C. Barlow	
QUALIFICATIONS	BSc (Hons), MSc, MIEnvSc, CEnv, MCIEEM, Principal Ecologist	BSc (Hons), MSc, MIEnvSc, CEnv, MCIEEM, Principal Ecologist	
SIGNATURE			
AUTHORISED BY	S. Cox	S. Cox	
QUALIFICATIONS	BSc (Hons), FGS, AIEMA, MIEnvSc, CEnv, Director	BSc (Hons), FGS, AIEMA, MIEnvSc, CEnv, Director	
SIGNATURE			

EXECUTIVE SUMMARY

Site Address	North Road Industrial Estate, North Road, Ellesmere Port, CH65 1AB
Coordinates	E 338929, N 378705
Site Area	Approximately 15.5 ha
Current Site Use and Adjacent Site Use	The site comprised a disused area of hardstanding and bare ground, that had been colonised by scattered scrub, with a section of woodland to the west. Previously, the site of the Bridgewater Paper Mill, with the majority of the buildings and structures now demolished. Further industrial developments surrounded the site to the south and east. Adjacent to the west was Booston Wood and Rivacre Brook, with Manchester Ship Canal and the River Mersey to the north.
Designated Sites	The site lies adjacent to the Mersey Estuary Ramsar, SPA and SSSI. HRA screening, to assess any potential impacts of the development on the designated site, is required. Booston Wood LWS lies adjacent to the western site boundary.
Survey Results	The site was found to comprise a large area of hardstanding with smaller areas of broadleaved woodland, semi-improved grassland, dense scrub, scattered scrub and introduced shrub present within the site boundary. The site was found to have the following potential ecological constraints: • B1, B9 and B10 within the site boundary had low bat roosting potential. • B6 and B8 adjacent to the site boundary had low bat roosting potential. • Potential presence of great crested newts within an on-site waterbody and associated terrestrial habitat. • Confirmed records of great crested newts in ponds within 250 m north west of the site. • Potential presence of nesting birds within the broadleaved woodland, dense scrub and introduced shrub. • Confirmed record of nesting peregrines within the site boundary. • Potential presence of badgers within the local area. • Potential presence of otters within the adjacent watercourses. • Potential presence of hedgehogs within the broadleaved woodland, semi-improved grassland, dense scrub and scattered scrub. • Invasive plant species (wall cotoneaster, small-leaved cotoneaster and field horsetail) present on-site.

Conclusions	The following further surveys are recommended: • One nocturnal bat survey on B1, B9 and B10 between May and August. • Great Crested Newt population size class assessments on the on-site pond and three ponds within 250 m of the site boundary. The following mitigation is recommended: • Updated badger walkover prior to start of works. • Precautionary Working Methods for badger. • Precautionary Working Methods for otter. • Precautionary Working Methods for reptiles. • Common amphibians are to be removed by hand from the working area during the clearance phase. • If any vegetation requires removal, it should be removed outside of the breeding bird season (March to September inclusive). If this is not possible, a nesting bird check should be undertaken by a suitably qualified ecologist up to 24 hrs before works commence. If a nest, or nest in construction, is located, then a stand-off distance should be maintained until the young have fledged. • During site clearance, any scrub and debris piles, that require removal, should be demolished by hand to ensure no sheltering hedgehogs are impacted by the works. It is recommended that vegetation clearance takes place outside of December-March to avoid impacting hibernating hedgehogs. • Eradication of invasive species prior to works commencing on-site. In line with the NPPF, the development should strive to achieve no net loss in biodiversity.

Table of Contents

1. INTRODUCTION

1.1. BACKGROUND

E3P were commissioned by Quartz to undertake a Preliminary Ecological Appraisal at Port Cheshire, Ellesmere Port, hereafter referred to as "the site".

This report has been prepared by Huw Morgan BSc (Hons) ACIEEM, Senior Ecologist at E3P, who has seven years professional experience as an ecological consultant. Huw has undertaken multiple Preliminary Ecological Appraisals and condition assessments for various projects across the UK. Huw also holds a class 2 great crested newt Natural England licence, a Natural England barn owl survey class licence and has key experience with birds and plants.

An extended Phase 1 Habitat survey was undertaken by TEP Limited in September 2010 and updated in July 2012 (report reference: NJL Consulting, 2012). TEP Limited also advised on potential impacts associated with decommissioning of plant and demolition of buildings of the former Paper Mill. A bat roost was recorded inside the inking shed DIP#3 which resulted in the production of a Reasonable Avoidance Method Statement to allow removal of the plant and a Natural England licence application (made in May 2011) to allow demolition of the inking shed. This included pre-demolition installation of six bat boxes onto trees on the adjacent Mount Manisty.

1.2. PROPOSED DEVELOPMENT

Development proposals include the demolition of the remaining structures on-site and the construction of an industrial development, with landscape planting and an attenuation pond proposed within the northern western area of the site.

1.3. SITE LOCATION

The site is located north of Ellesmere Port, within a predominantly industrial area of Overpool. North Road lies adjacent to the southern site boundary, with the M53 approximately 110 m south of the site. Rivacre Brook is present approximately 25 m west of the site, within Booston Wood, and a disused railway line forms the northern site boundary, terminating halfway along the northern site boundary. Manchester Ship Canal lies adjacent to the north of the site and railway line, with the River Mersey located beyond this, approximately 170 m north of the site. Please refer to Figure 1.1 for the approximate site location.

FIGURE 1.1 APPROXIMATE SITE LOCATION

1.4. OBJECTIVES

The objectives of the Preliminary Ecological Appraisal are as follows:

- Identify the major habitats present.
- Ascertain the presence or potential presence of any legally protected species and habitats.
- Recommend any further surveys or mitigation that may be required.

The Preliminary Ecological Appraisal comprises a desk study and site walkover. This survey has been completed as a baseline assessment of the site, and as such please see the end of the report for further surveys and mitigation proposed.

2. METHODOLOGY

2.1. DESKTOP STUDY

The following sources of information and ecological records were consulted:

- MAGIC – A web-based interactive mapping system, on which geographic information regarding key environmental schemes and designations are collated, including details of statutory conservation sites, accessed November 2020.
- Aerial mapping and ordinance survey maps.
- Local data records, including RECORD – The Biodiversity Information System for Cheshire, Halton, Warrington and Wirral, received 04th November 2020

A 1 km search area was utilised for the data search, with this being deemed an appropriate distance for the zone of influence of the site. The 1 km search was selected due to the size of the site and the site largely being made up of man-made habitats associated with a former paper mill. The surrounding areas have also been taken into account which is largely made up of industrial estates associated with Ellesmere Port and therefore have limited value for wildlife.

The data search included the request for details of protected and notable species of flora and fauna within 1 km of the central grid reference of the site. In addition, a request was made for any non statutory designated sites within 1 km of the site boundary.

Please note that a lack of up-to-date records does not confirm absence of a species from the area. Lack of records may simply be a result of a lack of protected species surveys being undertaken within the local area.

2.2. VEGETATION AND HABITATS

A Preliminary Ecological Appraisal of the proposed development site was undertaken by Huw Morgan with assistance from Olivia McKechnie on 05th November 2020. The weather was dry, still and overcast.

The walkover survey was undertaken to the standard methodology as detailed by the *JNCC Handbook for Phase 1 Habitat Survey, 2010*. The assessment follows the methodology as per "Guidelines for Preliminary Ecological Appraisal" (CIEEM, 2017).

A vegetation and habitat plan has been produced for the proposed development site and the immediate surrounding area (please refer to Appendix I). The mapping is based on the *Joint Nature Conservation Committee Phase I Habitat Survey Methodology* (JNCC 2010).

Searches were made for uncommon, rare and statutorily protected plant species, those species listed as protected in the Wildlife and Countryside Act 1981 (as amended) and species which are indicators of important and uncommon plant communities. All plant nomenclature follows Stace (2019).

Searches were carried out for the presence of invasive species, including those listed on the revised (April 2010) Schedule 9 of the *Wildlife and Countryside Act 1981 (*as amended*)* including Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*).

2.3. HABITAT CONDITION ASSESSMENT

The Phase 1 habitat types were translated into UKHab habitat types using the UK Habitat Classification User Manual and Field Key (The UK Habitat Classification Working Group, 2018).

Each UKHab habitat type was then assessed using the detailed methodology for assessing condition of habitats outlined in The Biodiversity Metric 2.0 Auditing and Accounting for Biodiversity Technical Supplement (2019).

2.4. FAUNA

A thorough search of the site for signs of protected species of fauna was undertaken during the site walkover. These searches considered the following:

- Suitability of any ponds to support notable amphibians, and the suitability of the site's terrestrial habitats to support amphibians.
- Suitability of the site to support reptiles by way of habitat structure and refuge piles, as well as links to the wider landscape.
- Signs of badgers, by way of setts, mammal paths, foraging signs or latrines to indicate usage of the site by the species.
- Search of any watercourses for signs or suitability for water vole and otter by way of burrows, resting places, holts and foraging signs.
- Suitability of the site to support roosting, foraging and commuting bats.
- Suitability of the site to support notable bird species.
- Suitability of the site to support notable invertebrates.
- Search of the site for any invasive species.

2.5. PRELIMINARY ROOST ASSESSMENT

The Preliminary Roost Assessment (PRA) was undertaken by Huw Morgan and Olivia Mckechnie who holds a Natural England Bat Licence (2020-44631-CLS-CLS) on 05th November 2020.

The survey involved undertaking a systematic search of the structures and trees, searching for signs of bats, or spaces where bats would be able to access. The methodology followed that described in *Bat Surveys for Professional Ecologists, 3rd Edition (Collins, 2016)*.

The structures and trees were categorised for their bat roosting potential as described in Table 2.1 in accordance with Collins (2016).

TABLE 2.1 BAT ROOSTING POTENTIAL CLASSIFICATION OF STRUCTURES AND TREES

CATEGORY	DESCRIPTION
Negligible	A structure or tree with no potential roosting features present or a tree of an age or species that would not support roosting bats.

CATEGORY	DESCRIPTION
Low	A structure or tree with one or more potential roost sites. However, the potential roost sites do not provide suitability for large numbers of bats (i.e. for maternity or hibernation).
Moderate	A structure or tree with one or more potential roosting feature which could support bats but is of a suitability meaning that it would be unlikely to support a roost of high conservation status.
High	A structure or tree with several potential roosting features which would be able to support large number of bats on a regular basis and for longer periods of time.

The survey was undertaken utilising suitable binoculars and ladders to access all areas where safe to do so.

2.6. HABITAT SUITABILITY INDEX

All ponds within a 250 m radius of the site boundary were evaluated using the *Habitat Suitability Index (HSI) (*Oldham et al., 2000*)* which was undertaken by Huw Morgan (2015-101083-CLS-CLS) and Olivia Mckechnie.

The ponds were examined with reference to the ten HSI scoring criteria, which are as follows:

- SI1: Geographical location.
- SI2: Pond area.
- SI3: Pond drying.
- SI4: Water quality (as indicated by the diversity of aquatic plants and invertebrates).
- SI5: Shade.
- SI6: Waterfowl.
- SI7: Fish.
- SI8: Abundance of other ponds within 1 km radius.
- SI9: Quality of terrestrial habitat.
- SI10: Macrophyte cover (i.e. aquatic and emergent plants).

A score is given according to the most appropriate criteria level set within each attribute and a total score is calculated between 0 and 1. Pond suitability is assessed according to the following scale:

- < 0.50 = Poor.
- 0.50–0.59 = Below average.
- 0.60–0.69 = Average.
- 0.70–0.79 = Good.
- > 0.80 = Excellent.

2.7. SURVEY LIMITATIONS

An Ecological Appraisal does not constitute a full botanical survey. Instead, key species are identified to give a representative description of each habitat type.

This survey was undertaken in November and as a result of seasonal vegetation die back, it is possible that some species of flora may have been missed or misidentified. It is possible that some invasive/non-native species could have been missed during the survey.

Internal access to all of the buildings on-site was not possible during survey due to the entrances being boarded up.

Access to all areas within 30 m of the site was not possible due to fencing and walls around the boundary of the site preventing access, therefore, some features may have been missed.

These constraints have been taken into consideration during the assessment.

3. SURVEY RESULTS

3.1. SITE CONTEXT

The site is located at the former Bridgewater Paper Mill which has since been demolished. The site has since been left unmanaged and is currently being used by a neighbouring business to store crushed glass and other materials.

The site comprised mainly hardstanding, surrounded by industrial developments to the east and south, anticipated to have limited ecological value.

Multiple areas of woodland are present in proximity to the site, such as Booston Wood Local Wildlife Site (LWS), which also forms part of the western aspect of the site, Mount Manisty, approximately 95 m north of the site, Rivacre Wood, approximately 800 m south west of the site and Well Wood, Clayhill Wood and Church Wood that together form Rivacre Valley Local Nature Reserve (LNR) approximately 430 m south west of the site. These areas of woodland are connected and anticipated to form foraging, commuting and resting habitat for a variety of local wildlife, as well as nesting and roosting habitat for birds and bats within the trees present. Ancient woodland comprises Clayhill Wood and part of Church Wood, expected to provide unique habitat for communities of flora, fungi, invertebrates and specialist species of birds and mammals.

A railway line is present 1.7 km south of the site, where it crosses the Rivacre Valley LNR. The railway line then branches north, and a disused section of the line forms the northern site boundary, terminating halfway along the northern site boundary. This feature may have important commuting value for local wildlife, connecting the site to the wider landscape.

Rivacre Brook flows through Rivacre Valley LNR. The brook is then culverted to the north under the M53 and emerges in Booston Wood, flowing along the western site boundary approximately 25 m west of the site, before culverting under the Manchester Ship Canal and joining the River Mersey further north. This brook may form a commuting and foraging resource for a variety of terrestrial mammals and birds.

On the northern site boundary is Manchester Ship Canal with the River Mersey beyond. The river is formed of coastal saltmarshes, mudflats and sections of open water, anticipated to form key habitat for wildfowl and wading bird species. The canal and river are expected to act as important commuting and foraging features for a variety of local wildlife.

One waterbody lies within the site boundary and three waterbodies are present within 250 m of the site, approximately 55 m south west (WB2) and 220 m west (WB3) and 216 m west of the site (WB4). All the waterbodies are connected to the site via Booston Wood.

3.2. DESIGNATED SITES

The site is located within the impact risk zone of Mersey Estuary Site Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar, located approximately 90 m north of the site boundary. Mersey Estuary is designated as it is an internationally important site for wildfowl and consists of large areas of intertidal sand and mudflats. The site also includes an area of reclaimed marshland, salt-marshes, brackish marshes and boulder clay cliffs with freshwater seepages.

The Manchester Ship Canal forms part of the southern boundary of the site and separates a series of pools from the main estuary. These pools together with Hale Marsh, located further upstream, are important roosting sites for wildfowl and waders at high tide. Throughout the winter the estuary supports large numbers of wildfowl and waders. The birds feed on the rich invertebrate fauna of the intertidal sediments as well as plants and seeds from the salt-marsh and adjacent agricultural land. The estuary is also a valuable staging post for migrating birds in spring and autumn including golden plover (*Pluvialis apricaria*), redshank (*Tringa tetanus*), shelduck (*Tadorna tadorna*), teal (*Anas crecca*), pintail (*Anas acuta*), dunlin (*Calidris alpine alpine*) and black-tailed godwit (*Limosa islandica*).

Rivacre Valley LNR is located approximately 430 m south west of the site boundary. The LNR comprises ancient woodland with Rivacre Brook running through the site where kingfisher (*Alcedo atthis*) are known to be present.

Booston Wood LWS lies adjacent to the western site boundary.

3.3. HABITATS

The main habitats encountered during the survey are described in the following subsections. Please refer to Appendix I for the Phase 1 Habitat Plan.

3.3.1. BUILDINGS, WALLS AND HARDSTANDING

The site is made up almost entirely of hardstanding with concrete slabs, hardcore, car parks, roads and pavements associated with the former paper mill which has since been demolished. The hardstanding has been left unmanaged and colonised in large areas by flora comprising Canadian fleabane (*Erigeron canadensis*), broad-leaved dock (*Rumex obtusifolius*), yarrow (*Achillea millefolium*), ragwort (*Jacobaea vulgaris*), butterfly bush (*Buddleja davidii*), white melilot (*Melilotus albus*), purple toadflax (*Linaria purpurea*), bramble (*Rubus fruticosus*), bristly oxtongue (*Helminthotheca echioides*), rosebay willowherb (*Chamerion angustifolium*) and saplings of silver birch (*Betula pendula*), goat willow (*Salix caprea*) and grey willow (*Salix cinerea*).

Eleven buildings and two walls were present within and adjacent to the site boundary. A detailed assessment and further photographs of the buildings and walls are outlined within Appendix II.

PLATE 1 SHOWING AREA OF HARDSTANDING

3.3.2. NEUTRAL SEMI-IMPROVED GRASSLAND

Small strips of neutral semi-improved grassland were present in the south-eastern area of the site, located around the former car parking areas. Areas of grassland looked to be previously present in the northern area of the site, however, it has since transitioned into scattered scrub in these areas. The flora in these grassland areas comprised Yorkshire fog (*Holcus lanatus*), Canadian fleabane, broad-leaved dock, butterfly bush, ox-eye daisy (*Leucanthemum vulgare*), bristly oxtongue, rosebay willowherb, bramble, dog-rose (*Rosa canina*), common knapweed (*Centaurea nigra*), ribwort plantain (*Plantago lanceolata*), hawthorn (*Crateagus monogyna*), spear thistle (*Cirsium vulgare*), dogwood (*Cornus sanguinea*), teasel (*Dipsacus fullonum*) and bush vetch (*Vicia sepium*).

PLATE 2	SHOWING NEUTRAL SEMI-IMPROVED GRASSLAND

3.3.3. BROADLEAVED WOODLAND

Areas of broadleaved woodland were present across the site with young self-seeded woodland located in the north-western and south-eastern areas of the site. Small areas semi-mature woodland run along the northern boundary and southern boundaries of the site and a large semi-natural broadleaved woodland associated with Booston Wood lies adjacent to the western boundary of the site. Tree species present comprised silver bitch, grey willow, goat willow, crack willow (*Salix fragilis*), hawthorn, sycamore (*Acer pseudoplatanus*), dog-rose, gorse (*Ulex europaeus*), ash (*Fraxinus excelsior*), oak (*Quercus robur*), alder (*Alnus glutinosa*) and Italian alder (*Alnus cordata*).

PLATE 3	SHOWING AN AREA OF BROADLEAVED WOODLAND

3.3.4. DENSE SCRUB

Small areas of dense scrub were present in the northern area of the site and along the south-western boundary of the site and were associated with the scattered scrub and broadleaved woodland. The species present comprised bramble, dog-rose, rosebay willowherb and grey willow.

PLATE 4 SHOWING DENSE SCRUB

3.3.5. SCATTERED SCRUB

Areas of scattered scrub were present in the northern area of the site, along the south-western boundary of the site and across areas of hardstanding. The scattered scrub appeared to be growing in areas of former semi-improved grassland which has transitioned into scattered scrub due being unmanaged. Large areas of the scattered scrub were waterlogged due to recent heavy rainfall. The scrub species present comprised grey willow, goat willow, crack willow, alder, silver birch, gorse, butterfly bush and bramble with an understorey of grassland species comprising Yorkshire fog, cock's foot (*Dactylus glomerata*), ribwort plantain, red clover (*Trifolium pratense*) and field horsetail (*Equisetum arvense*).

PLATE 5 SHOWING SCATTERED SCRUB

3.3.6. INTRODUCED SHRUB

Small stands of introduced shrub were present in the southern area of the site associated with the former car parking areas. The introduced shrub was likely planted for decorative purposes for the previous buildings on-site. The shrub species present comprised small-leaved cotoneaster (*Cotoneaster microphyllus*), wall cotoneaster (*Cotoneaster horizontalis*), Franchet's cotoneaster (*Cotoneaster franchetii*), daisy bush (*Brachyglottis greyi*), yucca sp. (*Yucca sp.*), evergreen spindle (*Euonymus japonicus*), red-barked dogwood (*Cornus alba sibirica*), laurustinus (*Viburnum tinus*), spotted laurel (*Aucuba japonica*) and barberry species (*Berberis sp.*).

PLATE 6 SHOWING INTRODUCED SHRUB

3.3.7. WATERBODIES

One waterbody was located within the site boundary. A further three waterbodies were identified within 250 m of the site boundary. The on-site waterbody was located in the north-west corner of the site within an area of scattered scrub with grey willow, goat willow and bulrush growing within. The waterbody was shallow and likely dries out during the summer months. The three waterbodies within 250 m of the site comprised a drainage pond for North Road and a large and smaller waterbody located within Booston Wood.

Please refer to Appendix III for full descriptions and photographs of the waterbodies.

3.3.8. RUNNING WATER

Rivacre Brook runs along the western site boundary running from south to north before culverting under the Manchester Ship Canal and entering the Mersey Estuary. The brook runs through Booston Wood and is heavily shaded with sloping muddy banks. The bankside vegetation is limited and is largely comprised of bramble, common nettle and rosebay willowherb. The brook appears to be susceptible to flooding and periods of fast flow with debris and flattened vegetation noted around the banksides.

PLATE 7 SHOWING RUNNING WATER

3.3.9. CONDITION ASSESSMENT

The habitats detailed in the above sections have been translated from Phase 1 habitat types to UK Hab habitat types. Full details of the UK Hab habitat types and the condition assessment are outlined in Table 3.1.

TABLE 3.1 HABITAT BASELINE CONDITION ASSESSMENT RESULTS

HABITAT TYPE (PH1)	HABITAT TYPE (UKHAB)	CONDITION ASSESSMENT	DESCRIPTION
BUILDINGS	Urban; Developed Land; Sealed Surface	N/A	N/A
HARDSTANDING	Urban; Developed Land; Sealed Surface	N/A	N/A
BARE GROUND	Open Mosaic Habitats on Previously Developed Land	Negligible	All of the condition criteria are being failed. *1. Known history of disturbance or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added which in turn has led to a low nutrient environment*. History of disturbance of site is known, however, aside from the demolition of the buildings, no further modification of the site has been undertaken. Site currently used for storage of broken glass which is not considered to be of any nutritional value. *2. The site contains some vegetation. This will comprise of early successional communities consisting of stress-tolerant species.* The hardstanding lacks successional communities with vegetation comprising only of scattered scrub and poor semi-improved grassland. *3. The contains unvegetated, loose bare substrate and pools may be present and desirable.* Hardstanding is well sealed with no loose, bare substrate present. No pools are present within the hardstanding. *S4. The site shows a spatial variation, forming a mosaic of one or more of the early successional communities plus bare substrate or pools.* No mosaic of early successional communities is present within the site with only hardstanding and poor semi-improved grassland present within the hardstanding area. Bare substrate and pools are also not present.
NEUTRAL SEMI-IMPROVED GRASSLAND	Grassland – Modified Grassland	Poor	Most of the condition criteria are being failed. Cover of undesirable species above 15%, usually resulting in a dense scrub or tree cover, or high cover of exotic species.

HABITAT TYPE (PH1)	HABITAT TYPE (UKHAB)	CONDITION ASSESSMENT	DESCRIPTION
BROADLEAVED WOODLAND – SEMI-NATURAL	Lowland mixed deciduous woodland	Moderate	Habitat type clearly fails at least 2 of the condition criteria. *3. A diverse age and height structure of the trees, 6. Standing and fallen dead wood of over 20 cm diameter are present including fallen large dead branches/stems and stumps, 8. The area is protected from damage by agricultural and other adjacent operations.*
DENSE SCRUB	Heathland and shrub- Mixed scrub	Moderate	Meets Condition Assessment Criteria for Moderate. The single woody species cover is greater than 75% The age range is missing some size classes. Scrub type of high biodiversity in poor condition.
SCATTERED SCRUB			
INTRODUCED SHRUB	Heathland and shrub- Mixed scrub	Poor	Cover of undesirable and invasive species above 20%
STANDING WATER	Eutrophic standing waters	Moderate	Meets Condition Assessment Criteria for Moderate: There is only moderate water quality. There is insufficient extent of semi natural riparian land. Submerged and floating plants are limited by still presence.

3.4. PROTECTED AND NOTABLE SPECIES

3.4.1. AMPHIBIANS

Consultation with RECORD identified records of great crested newts (*Triturus cristatus*) with the 1 km search area, all in association with a pond located approximately 200 m west of the site where a peak count of 279 individuals were recorded in 2018. However, surveys undertaken during the same time period by ERAP (ERAP, 2019) recorded a peak count of 75 within ponds across the same area identified by RECORD.

Consultation with MAGIC identified no great crested newt European Protected Species Licences with the 1 km search area, the closest licence was located approximately 3.1 km south-west of the site, active in 2011 to 2012 for the destruction of a great crested newt resting place. However, consultation with MAGIC has shown three licence returns within 1 km of the site with a pond located within Booston Wood (WB4), approximately 165 m west of the site known to have great crested newts present in 2014. In addition, two ponds to the south of the site within, and adjacent to, Rivacre Valley LNR were also known to have great crested newts present in 2014, located approximately 630 m and 860 m south of the site.

One waterbody was identified on-site (WB1), which was assessed as having good suitability regarding great crested newts. Three waterbodies were identified within 250 m of the site, WB2 was assessed as good and WB3 and WB4 were assessed as average. The habitats surrounding the pond were made up of broadleaved woodland and scattered scrub, providing excellent terrestrial opportunities for the species.

Please refer to Appendix III for full waterbody descriptions and HSI Assessment.

Records of common frog (*Rana temporaria*) were identified within the search area, within an area of woodland, Mount Manisty, adjacent to the Mersey Estuary SSSI and approximately 280 m east of the site, where 21 individuals were identified.

Overall, it is assessed that the site has the potential presence of great crested newts and common amphibians.

3.4.2. BATS

Consultation with RECORD did not identify any records of bats within the search area.

Consultation with MAGIC Mapping identified the presence of a Natural England Bat Mitigation Licence located within the site boundary, which was active in 2011-2013 for the destruction of a common pipistrelle (*Pipistrellus pipistrellus*) non-breeding roost, assumed to be from the demolition of the previous industrial development on-site.

Eleven buildings and two walls were located within or directly adjacent to the site boundary which were assessed for their suitability to support roosting bats, as detailed in Collins (2016). Table 3.2 summarises the results of the inspection. A detailed description of each building and wall with accompanying photographs can be found within Appendix II.

TABLE 3.2 BAT ROOSTING POTENTIAL CLASSIFICATION OF ON-SITE BUILDINGS

BUILDING / WALL NUMBER	DESCRIPTION	SUITABILITY
B1	Single storey red brick building with pitched tiled roof. A small opening in the brickwork on the northern aspect and gaps in the boarded-up windows may provide roosting opportunities for crevice dwelling bat species on an occasional basis.	Low
B2	Small, single room, brick building with wooden barge boards and a flat roof. No features present that could support roosting bats.	Negligible
B3	Single room, red brick building with a pitched tiled roof. No features present that could support roosting bats.	Negligible
B4	A large concrete water tower constructed of concrete and metal. No features present that could support roosting bats.	Negligible
B5	An old metal bike shed with no features that could support roosting bats.	Negligible

BUILDING / WALL NUMBER	DESCRIPTION	SUITABILITY
B6	A warehouse located adjacent to the eastern site boundary with asbestos sheeting walls and roof. The overlapping sheets and gaps between the walls and roof may provide roosting opportunities for crevice dwelling species on an occasional basis.	Low
B7	A large steel storage tank on a brick bund located adjacent to the eastern site boundary. No features that could support roosting bats were identified.	Negligible
B8	A red brick, two storey building with a flat roof located adjacent to the eastern site boundary. Gaps in the barge board around the building may provide roosting opportunities for crevice dwelling bat species on an occasional basis.	Low
B9	Concrete two storey building with a flat roof. A hole in the concrete wall on the western aspect and gaps under the boarded up windows may provide roosting opportunities for crevice dwelling bat species on an occasional basis.	Low
B10	A red brick structure with a mono-pitched corrugated roof, connected to the disused railway. A crack in the brickwork may provide roosting opportunities for crevice dwelling bat species on an occasional basis.	Low
B11	A single room electric substation with no features present that could support roosting bats.	Negligible
W1	A concrete wall located along the northern site boundary. No features were present that could support roosting bats.	Negligible
W2	A concrete wall located along part of the northern site boundary. No features were present that could support roosting bats.	Negligible

No trees within the site boundary were assessed as having bat roosting potential.

The majority of the site is anticipated to have limited foraging value for bats due to the large areas of hardstanding that make up most of the site. However, the semi-improved grassland, broadleaved woodland, dense scrub and scattered scrub located around the boundaries of the site may attract invertebrate prey for bats. The habitats within the site are generally common within the local area but could have value for foraging bats. However, it is anticipated that the bats within the local area will utilise the habitat of greater value in proximity to the site, rather than that present on-site i.e. the Manchester Ship Canal to the north and Booston Wood to the west as the on-site habitats don't provide connectivity to the wider area.

3.4.3. BADGER

Consultation with RECORD identified did not identify any records of badger (*Meles meles)* within the 1 km search area. No badger setts or field signs of badger were located on-site or within 30 m of the site boundary where access was possible.

The site is assessed as having suitability for badger as sett building opportunities are present within the broadleaved woodland, dense scrub and semi-improved grassland around the northern area of the site and within Booston Wood, adjacent to the western site boundary.

3.4.4. OTHER TERRESTRIAL MAMMALS

No records of European hedgehog (*Erinaceus europaeus*) were located within 1 km of the site boundary.

The site was assessed as having suitability for hedgehogs with the broadleaved woodland, semi-improved grassland, dense scrub and scattered scrub providing the most valuable habitat for this species. The surrounding area was also assessed as having suitability due to the presence of Booston Wood to the west of the site.

3.4.5. OTTER AND WATER VOLE

Consultation with RECORD did not identify any records of otter (*Lutra lutra*) or water vole (*Arvicola amphibious*) within the 1 km search area.

No watercourses are present within the site boundary. The Manchester Ship Canal and Rivacre Brook run along the northern and western boundary respectively. Both watercourses were assessed as having suitability for otter. The brook runs through Booston Wood and is likely to act as a commuting feature between the Mersey Estuary and the wider area, there are also holt building opportunities within the woodland close to the brook. The canal is likely to be a key foraging and commuting area for otter due to being directly connected to the Mersey Estuary. Otter holt building opportunities may be present along the banks of the canal. No otter holt building opportunities were present within the site boundary due to a lack of substantial tree roots or other features that could support an otter holt.

Both watercourses were assessed as being unsuitable for water vole due to the size, limited suitable bankside vegetation and poor water quality of the canal and the brook being heavily shaded with limited suitable bankside vegetation. The brook also appears to be susceptible periods high water flow and flooding, with evidence of this observed during the survey.

3.4.6. BREEDING BIRDS

Consultation with RECORD identified numerous records of notable birds within the search area, including barn owl (*Tyto alba*), oystercatcher (*Haematopus ostralegus*), kestrel (*Falco tinnunculus*), peregrine (*Falco peregrinus*), redshank, grey heron (*Ardea cinerea),* skylark (*Alauda arvensis*), reed bunting (*Emberiza schoeniclus*), teal, buzzard (*Buteo buteo),* great black-backed gull (*Larus marinus*), bar-tailed godwit (*Limosa lapponica*), meadow pipit (*Anthus pratensis*), back-headed gull (*Chroicocephalus ridibundus*), herring gull (*Larus argentatus*), dunlin, curlew (*Numenius arquata*), whimbrel (*Numenius phaeopus*), grey wagtail (*Motacilla cinerea*), little egret (*Egretta garzetta*), mallard (*Anas platyrhynchos*), greenshank (*Tringa nebularia*), turnstone (*Arenaria interpres*), cormorant (*Phalacrocorax carbo*), linnet (*Linaria cannabina*), sparrowhawk (*Accipiter nisus*), rock pipit (*Anthus petrosus*), black-tailed godwit, gadwall (*Anas strepera*), golden plover, knot (*Calidris canutus*), lesser whitethroat (*Sylvia curruca*), great crested grebe (*Podiceps cristatus*), green woodpecker (*Picus viridis*), stock dove (*Columba oenas*), ringed plover (*Charadrius hiaticula*), kingfisher (*Alcedo atthis*), snipe (*Gallinago gallinago*), common gull (*Larus canus*), merlin (*Falco columbarius),* great white egret (*Ardea alba),* common sandpiper (*Actitis hypoleucos*), jack snipe (*Lymnocryptes minimus*), lapwing (*Vanellus vanellus*), pochard (*Aythya ferina*), marsh harrier (*Circus aeruginosus*), little grebe (*Tachybaptus ruficollis*), pintail, common tern (*Sterna hirundo*), common scoter (*Melanitta nigra*), dunnock (*Prunella modularis*), water rail (*Rallus aquaticus*), red-breasted merganser (*Mergus serrator*), redstart (*Phoenicurus phoenicurus*), hen harrier (*Circus cyaneus*), shoveler *(Anas clypeata*), wheatear (*Oenanthe oenanthe*), starling (*Sturnus vulgaris*), green sandpiper (*Tringa ochropus*), grey plover (*Pluvialis squatarola*) and lesser black-backed gull (*Larus fuscus*).

The vast majority of the records were associated with the Mersey Estuary, approximately 90 m north of the site.

During the survey, jay (*Garrulus glandarius*), robin (*Erithacus rubecula*), carrion crow (*Corvus corone*), magpie (*Pica pica*), herring gull, feral pigeon (*Columba livia domestica*), long-tailed tit (*Aegithalos caudatus*), snipe, kestrel, sparrowhawk, mistle thrush (*Turdus viscivorus*), pied wagtail (*Motacilla alba*) and grey wagtail were identified within the site boundary. Wigeon (*Anas penelope*) and oystercatcher were identified on the Mersey Estuary, viewed from Booston Wood.

Common bird species are anticipated to be present within the broadleaved woodland, dense scrub, scattered scrub and introduced shrub. The site is assessed as having negligible value for ground nesting birds due to the limited area and the short height of the grassland which would provide no cover from predators. It is also considered that the scattered scrub present across the hardstanding is too sparse to support nesting birds, therefore, the key habitats for nesting birds are considered to be around the boundaries of the site and within the north-west corner.

The site was also assessed for its suitability for little ringed plover (*Charadrius dubius*), due to the species favouring brownfield sites. However, due to the well-sealed hardstanding and lack of suitable areas for nesting within the site such as gravel, shingle or sand (Conway et al., 2019), it is considered that the site is unsuitable for little ringed plover.

A pair of peregrine falcon, a Schedule 1 species is known to nest on the water tower within the site boundary (NJL Consulting, 2012).

3.4.7. REPTILES

Consultation with RECORD did not identify any records of reptiles within the 1 km search area.

The site was found to provide limited value for reptiles, given the majority of the site comprised hardstanding, which lacks the structure and habitat quality to support the species group. The broadleaved woodland and scrub habitats in the northern area of the site could provide some terrestrial cover for the species and is connected to Booston Wood and the wider area.

3.4.8. INVERTEBRATES

The data search identified one notable invertebrate within the search area, ringlet butterfly (*Aphantopus hyperantus*) which is a local BAP species. Numerous other common invertebrates such as common blue butterfly (*Polyommatus icarus*), common carder bee (*Bombus pascuorum*) and orange-tip butterfly (*Anthocharis cardamines*) were also identified within the search area, the majority of which were located within Rivacre Valley LNR approximately 430 m south west of the site boundary.

Overall, the presence of notable invertebrates within the site is reasonably discounted due to a lack of good quality habitat that would support notable invertebrates.

3.5. INVASIVE PLANT SPECIES

Consultation with RECORD identified records of Himalayan balsam (*Impatiens glandulifera*) within the search area, located within a neighbouring industrial development, approximately 170 m south west of the site.

Wall cotoneaster, small-leaved cotoneaster and field horsetail were present within the site boundary, associated with the introduced shrub and semi-improved grassland.

4. ECOLOGICAL CONSTRAINTS AND MITIGATION

4.1. DEVELOPMENT PROPOSALS

Development proposals include the demolition of the remaining structures on-site and the construction of an industrial development, with landscape planting and an attenuation pond proposed within the northern western area of the site.

4.2. DESIGNATED SITES

The site is located within the impact risk zone of the Mersey Estuary SSSI, SPA and Ramsar site, located approximately 90 m north of the site. Manchester Ship Canal present on the northern site boundary also connects to the River Mersey further to the west. The Mersey Estuary is designated as it is an internationally important site for wildfowl and consists of large areas of intertidal sand and mudflats. As per the criteria listed on MAGIC mapping (accessed November 2020), the proposed site will require further consultation with Natural England to proceed. A Habitat Regulations Assessment (HRA) screening assessment will be required to assess whether the proposed development will have any 'likely significant effects' on the designated site.

Rivacre Valley LNR is located approximately 430 m south west of the site boundary and is connected to the site by Rivacre Brook which is present approximately 25 m west of the site boundary. Rivacre Brook also joins the River Mersey further north. Rivacre Brook runs through Booston Wood LWS located adjacent to the western site boundary.

It is recommended that a minimum 10 m buffer zone is maintained around Rivacre Brook, the Manchester Ship Canal and the River Mersey in which no works are permitted. In addition, all best practice guidance relating to pollution will be adhered to in order to protect the watercourses. This will include best practice use of refuelling machinery to avoid fuel spills. Site drainage will need to be considered to ensure that no highly silted or polluted run-off from the site workings will enter the watercourses. All site operatives will undergo a site induction which will brief them as to their working limits and legal responsibilities.

Best practice protection measures as detailed within PPG5 Pollution Prevention Guidelines (2007) are to be put in place to protect the watercourses. The following control measures would be required during any ground works and during the construction phase to ensure there are no impacts on the watercourses and water table or any wildlife utilising it:

- All operational plant will be kept well maintained and should not enter/be stored within the buffer zone.
- Turning off plant when not in use.
- Dampening of the operational areas will be regularly undertaken during dry weather conditions to avoid dust. Dust management will be extended to cover the plant and all operational areas and will be complied with throughout the period of development.

- Measures to prevent pollutants from entering ground and surface water is standard construction practice through the use of a bunded fuel storage and refuelling area at a discrete distance from any watercourses. These measures should be underwritten by spill management equipment being kept on-site and capable of being effectively utilised by trained operatives to contain any accidental spillage within any part of the operational area.

- A toolbox talk should be completed by a qualified ecologist to ensure contractors are aware of Rivacre Brook, Booston Wood LWS, Manchester Ship Canal and the Mersey Estuary SSSI, SPA, Ramsar and their ecological importance.

- During night hours, no lighting is to be located towards Rivacre Brook, Booston Wood LWS, Manchester Ship Canal and the Mersey Estuary SSSI, SPA, Ramsar to ensure no wildlife are deterred from using it.

- A 'Site Tidy' protocol is to be put in place on-site. All litter is to be appropriately controlled, whilst on-site materials are to be adequately stored over-night.

- All excavations will be battened at a 45-degree angle to allow escape should animals become trapped.

No increase in visitor numbers are anticipated on the Mersey Estuary SSSI, SPA, Ramsar, Booston Wood LWS or Rivacre Brook LNR as a result of the proposed industrial development.

4.3. HABITATS

The site comprises habitats that were found to be widespread within the local area; however, they did contain value for wildlife such as bats, birds and terrestrial mammals. The hardstanding is of lowest value for wildlife, with the waterbody, broadleaved woodland and dense scrub comprising the areas of highest value.

4.3.1. BROADLEAVED WOODLAND

It is recommended that, where possible, the broadleaved woodland areas listed as a BAP habitat are retained and protected through development. It is anticipated that some areas may require removal, and where this is needed, the trees should be replaced as soon as practicable. Any replacement planting should endeavour to be on the same aspect as that to be lost.

It is recommended that the landscape planting comprises native species and species known to be of value for the attraction of wildlife. This will include fruiting and flowering species. Species deemed suitable for this development could include berry-bearing native species such as:

- Hawthorn;
- Rowan (*Sorbus aucuparia*);
- Holly (*Ilex aquifolium*);
- Whitebeam (*Sorbus aria*);
- Spindle (*Euonymus europaea*);
- Dog rose;

- Guelder rose (*Viburnum opulus*); and
- Elder (*Sambucus nigra*).

All planting should be from a trusted pest-free source and, where possible, be of local provenance.

Any trees or shrubs within the site or boundary, to be retained, are to be appropriately protected during the construction phase. Temporary protective demarcation fencing will be used to protect the trees and shrubs. The fencing must extend outside the canopy of the retained trees and must remain in position until all plots have been developed to ensure protection is provided throughout the construction phase.

The fencing will be in accordance with BS 5837:2012 *Trees in Relation to Design, Demolition and Construction: Recommendations*.

4.3.2. WATERBODIES

One waterbody was located within the site boundary, it is currently unknown if this is to be retained or lost to development. Please refer to Section 4.5.1 for specific details on amphibians.

It is recommended that, where possible, the waterbody is retained and enhanced through development to retain open water habitat within the site.

Enhancements to the waterbody would be dependent on results of further amphibian surveys but could broadly include:

- Thinning of over-shading trees;
- Management of nutrient levels within the waterbodies;
- Eradication of fish (if present);
- Planting of emergent vegetation to provide egg-laying material for breeding amphibians; and
- Planting of rough grassland around the perimeters of the ponds to provide terrestrial habitat for amphibians.

If it is not possible to retain and enhance the waterbody within the site, then compensation waterbodies should be created. Waterbody design should follow guidance set out in Froglife and English Nature (2001) for pond design and construction. Ponds should be created to comprise different depths to support different species of wildlife including amphibians and invertebrates. If compensation waterbodies are to be created, it is recommended that a net increase in open water habitat on-site is provided.

4.3.3. NEUTRAL SEMI-IMPROVED GRASSLAND

Small areas of unmanaged semi-improved grassland are present within the site boundary which are anticipated to be removed during the construction works. The areas are grassland have largely been encroached by scattered and dense scrub resulting in poor quality grassland.

It is recommended that new areas of neutral grassland are created and a seed mix is selected based on the soil pH, site aspect, drainage and topography. It is also recommended that the seed mixes will comprise species tolerant of local conditions (standing water, soil type etc.) and comprise a wide range of native species of grasses and wildflowers.

These newly created grassland areas will be of high value for great crested newts, bats, badgers, reptiles, ground nesting birds and invertebrates.

It is recommended that management of the grassland is undertaken, particularly in the first years after creation to allow the grassland to establish.

Management of the grassland could broadly include:

- Control and removal of common competitive weeds such as ragwort and thistle species;
- Annual cutting during the winter months with hand tools to a height of 150 mm;
- No fertilisers being used;
- Any arisings from the management be left in a compost heap to benefit wildlife, and
- Annual removal of noxious and injurious weeds.

4.4. PROTECTED AND NOTABLE SPECIES

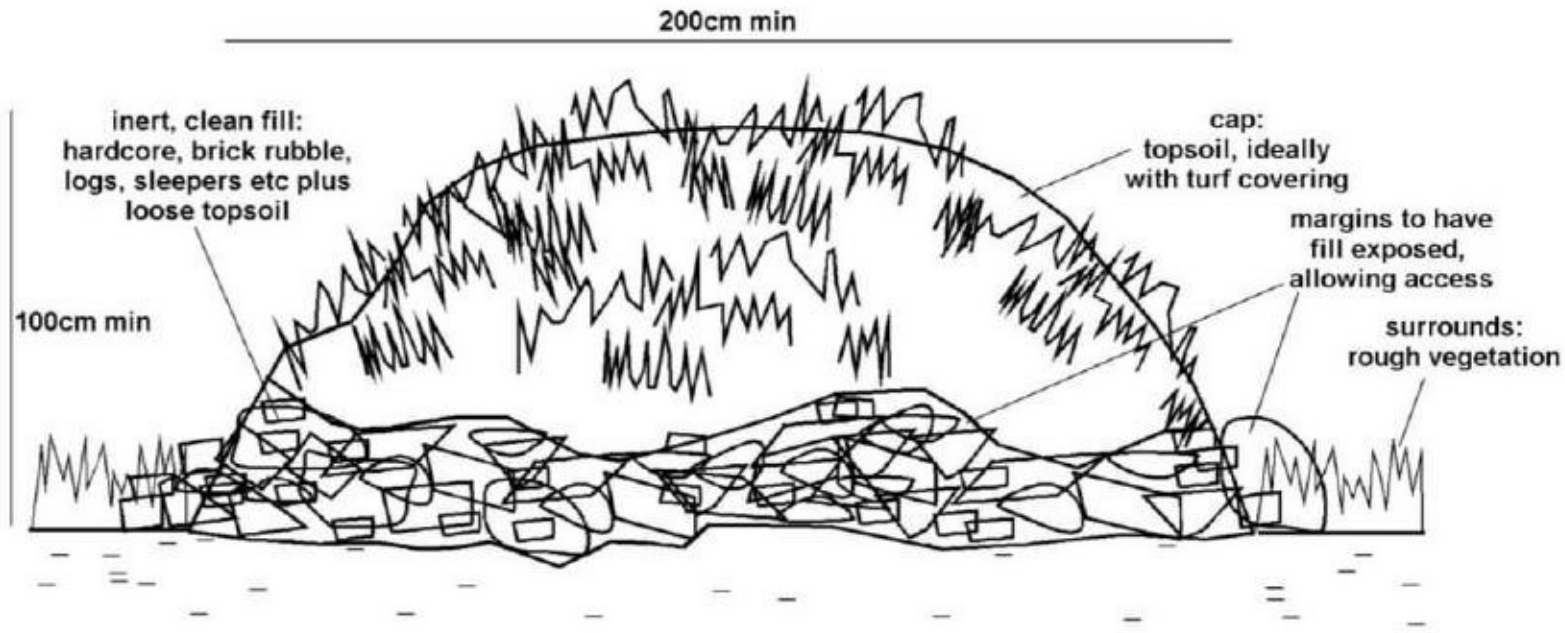
4.4.1. AMPHIBIANS

The site may support small numbers of common amphibians within the broadleaved woodland, semi-improved grassland and scrub habitats on-site. It is recommended that during the clearance phase of works, any common amphibians encountered be moved by hand, away from construction activities.

As described in Section 4.4.2, efforts should be made to retain and enhance the waterbody on-site or provide significantly better habitats for amphibians should this not be possible. Detailed mitigation is dependent on the outcomes of further amphibian surveys within the site.

It is recommended that areas of hibernacula are close to the waterbody to provide suitable terrestrial habitat for amphibians. A suggested hibernaculum design is detailed in Figure 4.1. This design mimics artificial and natural conditions in which great crested newts have frequently been found overwintering. Dimensions should not be below 2m length x 1m width x 1m height. The illustrated design would be suitable for locating on an impermeable substrate. On free-draining substrates, the design is largely similar but the bulk of the fill is sited in an excavated depression in the ground. Hibernacula should ideally be positioned across a site, both close to and distant from breeding ponds, always in suitable terrestrial habitat and above the flood-line.

FIGURE 4.1 SHOWING EXAMPLE HIBERNACULUM DESIGN



4.4.2. BREEDING BIRDS

The site was assessed as having value for passerine species within the broadleaved woodland, dense scrub, scattered scrub and introduced shrub. The broadleaved woodland and dense scrub are of highest value for the species group and it is recommended that these areas are retained and enhanced where possible.

It is recommended that should any vegetation require removal within the breeding bird season (March–September inclusive), that a suitably qualified ecologist inspect the area no more than 24 hours prior to the removal. Should any nests, or nests in construction be located, a suitable stand-off distance should be maintained until the young have fledged. The ecologist will advise on suitable stand off and provide a toolbox talk to all site contractors regarding their working limits and legal implications.

Post-development, bird boxes should be installed throughout the development to enhance the site's value for the species group.

A pair of peregrine falcons, a Schedule 1 species, are known to nest on the water tower within the site boundary. This species has been known to nest on-site since 1953 and is considered to be a species of county importance for Cheshire. It is recommended that this water tower is retained to prevent the destruction of a Schedule 1 species nest site.

It is also recommended that construction works commence outside the peregrine nesting season (March-July inclusive (Hardey, et al, 2006)) to prevent sudden disturbance to any nesting peregrines present. It is also recommended that no construction works be allowed within 50 m of the water tower during the peregrine nesting season to avoid disturbance to the birds while they are on the nest and raising young.

4.4.3. BATS

The site was found to have limited value for foraging and commuting bats due to the large areas of hardstanding that make up most of the site. However, the semi-improved grassland, broadleaved woodland, dense scrub and scattered scrub located around the boundaries of the site provide foraging and commuting routes across the wider landscape. The brook and canal located adjacent north-west and north of the site respectively are likely to act as important commuting and foraging routes for bats within the local area.

Therefore, it is recommended that the proposed lighting plan considers the habitats of highest importance and maintains the broadleaved woodland, scrub, semi-improved grassland and adjacent watercourses as dark areas. It is recommended that any security lighting during construction is appropriately placed to avoid being directed at retained habitats. Lighting should also placed to avoid being directed at the buildings adjacent to the site boundary assessed as having bat roosting potential.

It is recommended that lighting is to be pre-fixed on the proposed buildings, located near retained habitats or proposed habitats, to minimise the impact of lighting. Lighting should follow the protocols outlined in the Institute for Lighting Engineers document "Guidance for the Reduction of Obtrusive Lighting" (2005) and BCT's "Bats and Artificial Lighting in the UK" (2018) to minimise disturbance and sky-glow off site.

It is recommended that any planting within the site be of native fruiting/flowering species in order to enhance the site for foraging bats post-completion. Bat boxes could be installed throughout the site post-construction to enhance the site for the species group.

It is also considered that the creation of the attenuation pond in the north-west corner of the site will increase foraging opportunities for this species and mitigate for the loss of any current on-site foraging habitat.

4.4.4. BADGERS

No badger setts were located during the survey, though the habitats were identified as being suitable for the species. Badgers are highly mobile and can create new setts in a short period of time. It is recommended that an updated site walkover prior to the development is carried out to identify any new badger setts.

If a badger sett is located, a stand-off distance may be required as well as precautionary working methods. If the sett requires closure, a Natural England Badger Licence would be required. Please note that badger licences can only be obtained between July and November each year to avoid potential impact on pregnant females.

The following precautionary working methods will be adhered to during construction phase to ensure that no badgers within the local area are impacted by the proposed development:

- All site operatives will be inducted to the presence of the species and their working limits and legal responsibilities.
- All site operatives will be inducted as to identifying potential badger setts, and should be vigilant if they suspect they locate a new sett during works and inform the project ecologist immediately.
- All excavations will be battened at a 45 degree angle to allow escape should animals become trapped.
- All site machinery and materials will be appropriately stored to avoid harm to the species, notably between July and November each year when extra care is needed to avoid potential impacts on pregnant females.

It is not anticipated that the development will have a significant negative impact on badgers within the local area.

4.4.5. OTTERS

Rivacre Brook and the Manchester Ship Canal located adjacent to the north-west and north of the site respectively were assessed as having suitability for foraging and commuting otters. No otter holt building opportunities were present within the site, but Booston Wood adjacent to the site has opportunities within the roots of trees along Rivacre Brook.

All site operatives will be given a Toolbox Talk on the presence of the species and its legal protection. Site operatives will be required to sign the Toolbox Talk in order to confirm they have understood the details provided. Contact details of the ecologist will be provided to the site operatives.

The following Precautionary Working Methods should be adhered to for all works on-site:

- All site personnel are to be inducted through use of a Toolbox Talk, on the presence of otters, their legal protection and working limits.
- No artificial lighting will be installed, both during the works period and following on from the completion of the project, to ensure the river is maintained as a dark area for otter.
- Any temporarily exposed open pipe system should be capped in such a way as to prevent otters gaining access, as this may happen when contractors are off-site.
- As otters are naturally inquisitive, any excavations that are left overnight will include a ramp of 45° or less on one face to allow otter and other wildlife to climb out should they fall into the excavation.
- Commuting otters may lie-up in stacked pipes or beneath pallets. These features should be inspected daily before the start of works.

4.4.6. REPTILES

The broadleaved woodland, dense scrub and scattered scrub around the northern area of the site was assessed as having some potential for reptiles.

The habitats of suitable value for the species group are to be retained where possible. It is recommended that the following Precautionary Working Methods are to be followed during site clearance of woodland and scrub habitats, to minimise potential impacts on the species:

- All site contractors are to be inducted as to the potential presence of the species group, their legal responsibilities and working limits, by a suitability qualified experienced ecologist.

- Any scrub to be removed will be strimmed to a length of approximately 150 mm under the supervision of the ecologist. It will be checked by an ecologist for the presence of reptiles, and once the area is deemed free, the area will be turfed with a toothed bucket.

- During works the site should be kept tidy of debris and material, and any vegetation within the working areas should be maintained below 50 mm in height to discourage amphibians or reptiles from re-entering these areas

- If a reptile is identified, works should cease and the project ecologist contacted immediately to capture the individual.

4.4.7. HEDGEHOGS

During site clearance, the scrub and debris associated with the broadleaved woodland, semi-improved grassland, dense scrub and scattered scrub should be demolished by hand to ensure no sheltering hedgehogs are impacted by the works. If hedgehogs are located, they should be carefully moved by hand to an area outside of construction workings.

Post-development, a series of hedgehog houses could be installed throughout the site to enhance the site's value for the species group. In addition, gaps in residential fences could be provided to allow the species to commute though the site.

4.5. INVASIVE PLANT SPECIES

Wall cotoneaster and small-leaved cotoneaster were identified during the site walkover. As such, it is recommended, prior to the development, that these species should be eradicated following the most current guidance set out by the Environment Agency by a qualified contractor.

Field horsetail was also identified during the survey and it is recommended that this eradicated due to the damage it can cause to areas of hardstanding. Field horsetail is not listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and therefore does not require removal by an Environment Agency contractor.

5. FURTHER SURVEYS

5.1. GREAT CRESTED NEWTS

The site was assessed as having value for great crested newts within its breeding phase due to a waterbody being located in the north-west corner of the site. Great crested newts are also known to be present within 250 m of the site in ponds within Booston Wood LWS recorded in 2018.

Therefore, it is recommended that a population size assessment is undertaken on the on-site waterbody and on the three waterbodies within 250 m of the site. This would be in the form of bottle trapping surveys undertaken between mid-March and June. Six surveys would be required to establish a population size estimate for great crested newts and to determine further mitigation requirements. Four surveys could be undertaken to confirm absence.

All surveys should be undertaken in line with guidance set out by Natural England and be undertaken by a Natural England licenced surveyor.

A Natural England Mitigation Licence will be required if great crested newts are found to be present within the on-site waterbody or within waterbodies within 250 m of the site boundary and if suitable terrestrial on-site habitat will be lost to development. A licence can only be applied for once planning permission has been granted.

5.2. BATS

Three buildings within the site boundary (B1, B9, B10) and two buildings adjacent to the site (B6, B8) were assessed as having Low bat roosting potential. If any of these buildings are to be demolished, a single nocturnal bat survey is required on each building between May and August. The surveys would be valid for two years to inform a planning application. If bats are identified roosting within the building, three surveys would be required to characterise the roost and a European Protected Species Licence will be required with up to date surveys from the survey season prior to the application submission.

5.3. TABLE OF FURTHER SURVEYS

Please refer to Table 5.1 for a summary of further surveys required to inform a planning application.

TABLE 5.1 FURTHER SURVEYS RECOMMENDED

SURVEY TYPE	TIMESCALES
Nocturnal Bat Surveys	One survey, on buildings to be demolished, between May and August (inclusive)
Great Crested Newt Population Size Class Assessments	Six surveys between mid-April and June (inclusive)

6. BIODIVERSITY NET GAIN

The scheme should strive to achieve biodiversity net gain, as per "Biodiversity Net Gain; Good Practice Principles for Development" CIEEM, CIRIA, IEMA (2016). Full details of this and a calculation of net gain could be completed after detailed landscape plans have been prepared. The following habitat measures will increase the on-site biodiversity:

- Retaining the Broadleaved Woodland;
- Native Hedgerow Planting;
- Native Scrub Planting;
- Wildlife Ponds;
- Broadleaved Trees; and,
- Wildflower Meadows.

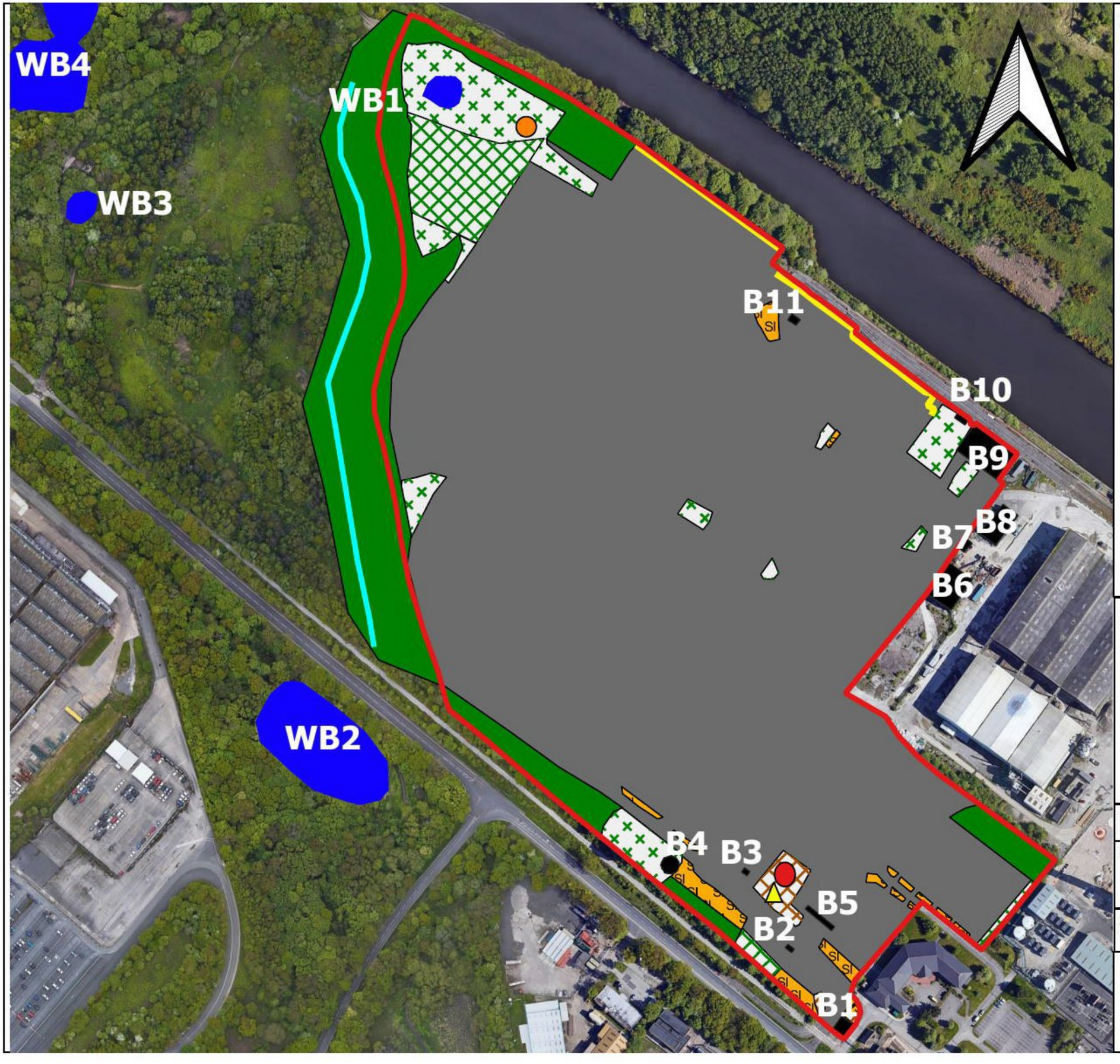
Habitat measures should be provided within areas of open space or designated wildlife zones. A 30-year management plan should be produced to ensure biodiversity is secured on-site.

7. REFERENCES

- Bat Conservation Trust (2018). Bats and Artificial Lighting in the UK: Bats and the Built Environment Series.
- Chartered Institute of Ecology and Environmental Management (2017). Guidelines for Preliminary Ecological Appraisal.
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.
- Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd edition. The Bat Conservation Trust, London.
- Conway G.J., Austin G.E., Handschuh M., Drewitt A.L. and Burton N.H.K (2019). Breeding populations of Little Ringed Plover and Ringed Plover in the United Kingdom in 2007. BSJ.
- Crawford (2010) Environment Agency's Fifth Otter Survey of England 2009–2010 .
- Dean, M., Strachan, R., Gow, D., Andrews, R., Mathews, F., & Chanin, P. (2016). The Water Vole Mitigation Handbook.
- Environment Alliance (2007). PPG5: Pollution Prevention Guidelines; Works and Maintenance In or Near Water; PPG5.
- ERAP (2019). North Road Business Park, Ecological Survey and Assessment.
- English Nature (2001). Great Crested Newt Mitigation Guidelines.
- Froglife (2001). Great Crested Newt Conservation Handbook.
- Froglife (2009). Just Add Water: How to Build a Wildlife Pond. Sixth Edition.
- Institute of Lighting Engineers (2005). Guidance Notes for the Reduction of Obtrusive Light.
- JNCC (2010). Handbook for Phase 1 habitat survey: A technique for environmental audit. English Field Unit, Nature Conservancy Council.
- Natural England Joint Publication JP029 (2019). The Biodiversity Metric 2.0. Auditing and Accounting for Biodiversity, User Guide, Beta Version.
- NJL Consulting (2012). Former Bridgewater Paper Mill Site EIA, Environmental Statement.
- Stace, C. A. (2019). New Flora of the British Isles. Fourth Edition. Cambridge University Press.
- Oldham, R. S., Keeble J., Swan, M. J. S. & Jeffcote, M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143–155.
- Hardey, J., Crick, H. Q. P., Wernham, C. V., Riley, H. T., Etheridge, B. and Thompson, D. B. A. (2006). Raptors: a field guide to survey and monitoring. The Stationery Office: Edinburgh.
- UK Habitat Classification Working Group (2018). UK Habitat Classification User Manual.
- Wildlife and Countryside Act (2010) Schedule 9 of the Wildlife and Countryside Act 1981.

END OF REPORT

APPENDIX I
PHASE 1 HABITAT PLAN



Key:

- Site Boundary
- Wall
- Running Water
- Building
- Hardstanding
- Waterbody
- Broadleaved Woodland
- Dense Scrub
- Scattered Scrub
- Semi-Improved Grassland
- Introduced Shrub

Notes

- Field Horsetail
- Small-Leaved Cotoneaster
- Wall Cotoneaster

Issue	Revision	Date	Drawn	Authorised
2	1	February 2021	LT	HM
Client: Quartz			Job No.	Date February 2021
			Drawing No. 80-411-001	Scale 1:5700
Job title: Port Cheshire, Ellesmere Port			Drawing title: Phase 1 Habitat Plan	

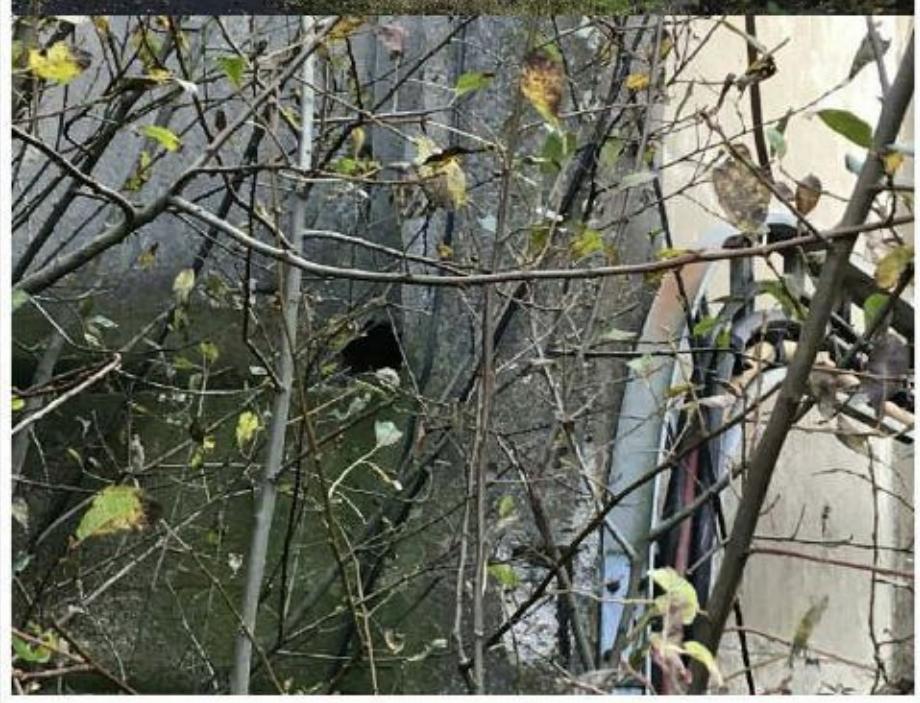
e3p
Environmental Engineering Partnership Ltd
Manchester Office
Taylor Road, Urmston M41 7JQ
Tel: 0161 707 9612
Email: info@e3p.co.uk
Website: www.e3p.co.uk

APPENDIX II
STRUCTURE DESCRIPTIONS

REF.	DESCRIPTION	PHOTOGRAPH
B1	B1 was a single storey red brick building with a pitched tiled roof, located at the site entrance. The roofing tiles and brickwork were found to be in good condition, apart from an opening in the brickwork on the northern aspect of B1, that may provide roosting opportunities for crevice dwelling bats, such as pipistrelle species on an occasional basis. The windows were boarded. The boards were found to be lifted in places, which may provide roosting opportunities for crevice dwelling bats on an occasional basis. B1 was assessed as having **Low** bat roosting potential.	
B2	B2 was a single room brick building with wooden barge board and a flat roof. The roof and windows were broken and damaged, allowing light and weather conditions into the internal structure of the building, reducing its suitability for roosting bats. The brickwork was found to be in good condition, with no potential roosting features present. B2 was assessed as having **Negligible** bat roosting potential.	

B3	B3 was a single room red brick building with pitched tiled roof. The windows were smashed, allowing light and weather conditions into the internal structure of the building, reducing its suitability for roosting bats. The brickwork was found to be in good condition, with no potential roosting features present. B3 was assessed as having **Negligible** bat roosting potential.	
B4	B4 was a large water tower, constructed of concrete and metal. No potential roosting features were present within B4. B4 was assessed as having **Negligible** bat roosting potential.	
B5	B5 was a bike shed constructed of metal sheeting, with no potential roosting features present. B5 was assessed as having **Negligible** bat roosting potential.	

B6	B6 was located adjacent to the eastern site boundary and is to be retained throughout development. B6 was a warehouse with asbestos sheeting walls and roof, with an asbestos sheeting barge board present. The crevices formed between the overlapping sheeting and beneath the barge board may provide roosting opportunities for crevice dwelling bats on an occasional basis. B6 was assessed as having **Low** bat roosting potential but will not be affected by development.	
B7	B7 was located adjacent to the eastern site boundary and is to be retained throughout development. B7 was a steel above ground storage tank on brick bund, with no potential roosting features present. B7 was assessed as having **Negligible** bat roosting potential.	

B8	B8 was located adjacent to the eastern site boundary and is to be retained throughout development. B8 was a red brick two storey building with flat roofing felt roof. There were some broken windows allowing access for bats into the internal structure of the building, however a hung ceiling was visible and the structure was open to light and weather, reducing its suitability for roosting bats. Some of the windows were boarded and a barge board was present, forming crevices beneath the boarding and the barge board, which may provide roosting opportunities for crevice dwelling bats on an occasional basis. B8 was assessed as having **Low** bat roosting potential but will not be affected by development.	
B9	B9 was a concrete two storey structure with a flat roof. The windows were broken allowing access into the internal structure, where potential roosting features may be present. Some windows were boarded, providing crevices beneath the boards which may provide roosting opportunities for crevice dwelling bats on an occasional basis. In addition, a whole in the concrete wall was located on the western aspect, which may provide access into the internal wall structure for bats. B9 was assessed as having **Low** bat roosting potential.	 

B10	B10 was a red brick structure, with a mono-pitched corrugated metal roof, connected to the disused railway. A crack in the brickwork was visible, which may provide roosting opportunities for crevice dwelling bats on an occasional basis. B10 was assessed as having **Low** bat roosting potential.	
B11	B11 was a single room electricity substation constructed of fibre board walls and roof, with no potential roosting features present. B11 was assessed as having **Negligible** bat roosting potential.	

W1	W1 was present along part of the northern site boundary. It was constructed of concrete and was 3 m high with no potential roosting features present. W1 was assessed as having **Negligible** bat roosting potential.	
W2	W2 was present along part of the northern site boundary. It was constructed of concrete and was 1 m high with no potential roosting features present. W2 was assessed as having **Negligible** bat roosting potential.	

APPENDIX III
POND DESCRIPTIONS AND HSI

DISTANCE FROM SITE	DESCRIPTION	HSI CALCULATION											PHOTOGRAPH
		SI1	SI2	SI3	SI4	SI5	SI6	SI7	SI8	SI9	SI10	S	
Pond 1													
Located on-site within scattered scrub	The pond was located within an area of scattered scrub within the north western corner of the site. The waterbody was boggy with moss and grass present under parts of the waterbody. Numerous young willow trees were growing within the waterbody and bull rush (*Scirpoides holoschoenus*) was present. The surrounding habitat comprised scattered scrub and grassland. HSI score=GOOD	1	1	0.5	0.67	0.4	0.67	1	1	1	0.4	0.72	
Pond 2													
Located approximately 55 m south west of the site	The pond was located adjacent to North Road and is assumed to be for drainage of the road. The waterbody was vast and had a large amount of vegetation growing within the centre of the waterbody. Mallards (*Anas platyrhynchos*) were seen using the waterbody and a large woodland margin was present around the waterbody. HSI score=GOOD	1	0.8	0.9	0.67	0.3	0.67	0.67	1	1	0.9	0.75	
Pond 3													

Located approximately 220 m west of the site.	The waterbody was found to be present with Booston Wood, with duckweed (*Lemnoideae sp.*) present over the water surface. Willow were growing throughout the waterbody, with little aquatic vegetation present. HSI score=AVERAGE	1	1	0.5	0.67	0.2	0.67	1	1	1	0.35	0.66	
Pond 4													
Located approximately 216 m west of the site.	From OS mapping Pond 4 appeared to be multiple ponds, however were found to be joined at the time of survey, forming one large waterbody. The waterbody was surrounded by woodland and waterfowl were present. Fish were also seen to be present within the northern aspect of the pond. The northern aspect of the pond was found to be open with some bull rush stands on the edges of the waterbody but little other aquatic vegetation. southern aspect of the pond was found to be smaller and present within an area of trees, with more aquatic vegetation present. HSI score=AVERAGE	1	0.8	0.9	0.67	0.3	0.67	0.33	1	1	0.4	0.65	

NOTES:
HSI calculation components are detailed below:

SI1	Location
SI2	Pond area
SI3	Pond drying
SI4	Water quality
SI5	Shade
SI6	Fowl
SI7	Fish
SI8	Pond
SI9	Terrestrial habitat
SI10	Macrophytes
S	Score