

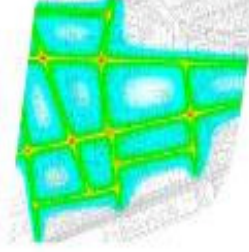
REMEDIATION STRATEGY FORMER GATEACRE SCHOOL:

REC REFERENCE: 44808P2R2









PREPARED FOR:

LIVERPOOL CITY COUNCIL
LIVERPOOL PARTNERSHIP LLP
&
COUNTRYSIDE SIGMA LTD

JULY 2014



QUALITY ASSURANCE

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EXECUTIVE SUMMARY

Site Address	Former Gateacre High School, Liverpool L25 4SA
National Grid Reference	E342221, N388206
Site Area	7.47ha
Background	
<p>Resource and Environmental Consultants Ltd. (REC) have been commissioned by Countryside Sigma Ltd. to prepare a Remediation and Enabling Works Strategy for proposed redevelopment of the former Gateacre School site.</p> <p>The site is being considered for a residential end use with associated car parking and infrastructure.</p>	
Contaminated Land Risk Assessment	
<p>The Tier I Human Health Risk Assessment has identified elevated concentrations of inorganic heavy metals, polycyclic aromatic hydrocarbons (including Naphthalene), hydrocarbon fractions C₈-C₂₁ and volatile organic compounds within the landfill in the west of the site.</p> <p>No contaminant concentrations in the area of the former school building exceeded Tier 1 screening values, however further assessment of the soils around the electricity substation on the eastern site boundary will be required owing to the potential presence of PCBs. Further assessment is required of potential contamination associated with the former school boiler room. Further assessment of the infilled school basements is required due to the potential presence of asbestos within the demolition material.</p> <p>Slightly elevated concentrations of lead, benzo(b/k)fluoranthene and benzo(a)pyrene were recorded in one sample recovered from shallow Made Ground in the Northern Playing Fields area.</p>	
Engineering Requirements	
<p>A programme of enabling works should be implemented as part of the site wide remediation programme to create a development platform that would render the building footprints suitable for the development of proposed low rise residential dwellings.</p>	
Site Remediation & Enabling Works	
<p>The site Remediation Method Statement provides a comprehensive specification for the site remediation and enabling works that are required to negate the identified pollutant linkages and construct a development platform that will be geotechnically suitable for the construction of the proposed low rise residential development. The salient features of the Remediation & Enabling Works Strategy are summarised below:</p> <ul style="list-style-type: none"> ▪ Clearance of all vegetation and removal of invasive plant species; ▪ Excavation of volatile hydrocarbon/naphthalene-impacted soils and chemical validation for potential re-use in low sensitivity areas on site; ▪ Watching brief for any asbestos impacted soils; ▪ Excavation, processing of all surface slabs and hard materials; ▪ Excavation and processing of all deleterious Made Ground in the landfill area; ▪ Replacement of materials in accordance with the REC enabling specification & engineering requirements; ▪ Further assessment of soils surrounding electricity substation on eastern site boundary; 	

- Further assessment of soils associated with former school boiler room;
- Further assessment of infilled school cellar material;
- Validation of materials placement to confirm suitability;
- Restoration of site to required Enabling Works Level; and,
- All works to be undertaken in strict accordance with UK Environmental Permitting and to the satisfaction of the Local Planning Authority.

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Appendix I

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Drawing No 44808p1r0/002 – Historical Exploratory Hole Location Plan
Drawing No 44808p1r0/003 – Exploratory Hole Location Plan
Drawing No 44808p1r0/004 – Depth of Made Ground
Drawing No 44808p1r0/005 – Development Constraints
Drawing No 44808p1r0/006 – Foundation Zoning Plan
Drawing No 44808p1r0/007 – Indicative Cut / Fill Plan
Drawing No 44808p1r0/008 – Historical Features with Exploratory Location Overview
Drawing No 44808p1r0/009 – Proposed Development Plan

Appendix II REC Remediation / Validation Criteria
Appendix III REC Method Compaction Specification
Appendix IV Remediation Excavation Record Template

1.0 INTRODUCTION

Resource and Environmental Consultants Ltd. (REC) has been instructed by Countryside Sigma Ltd. to prepare a Remediation Strategy and Enabling Works Plan for the former Gateacre School Site.

REC has previously been commissioned to undertake a Phase I and II Geo-Environmental Site Investigation at the site to assess the potential risk associated with contaminants within the underlying soil and groundwater. The findings of this investigation are summarised within Section 2 of this report and are presented in detail within the REC Report (44808p1r3) dated July 2014.







A Site Location Plan is presented on Drawing No. 44808p1r0/001 included within Appendix I.

1.1 Report Objectives

The purpose of the Remediation Strategy and Enabling Works plan is to identify and evaluate feasible remedial technologies, and define potential further investigation works needed prior to validate the successful implementation of a site Remediation & Enabling works plan to ensure the safe, cost effective and regulatory compliant redevelopment of the site.







1.2 Scope of Works

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

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

1.3 Previous Works

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

-  Norwest Holst – Ground Investigation, dated February 2005. Project No. F13512;
-  Norwest Holst – Phase 2 Intrusive Land Quality Investigation, dated November 2005. Project No. 13931.
-  Carter Ecological Ltd – Initial Ecological Surveys, dated September 2006;
-  ACS Consulting – Arboricultural Survey and Constraints Plan, dated February 2007. Ref 1516/DR.07;
-  Liverpool City Council – Flood Risk Assessment, dated March 2007; and,
-  Norwest Holst – Ground Investigation, dated October 2007. Project No. F14826.

1.4 Redevelopment Plan

REC understands that Countryside Properties intend to redevelop the site for a proposed low-rise residential end use with associated gardens, driveways, estate roads and adoptable infrastructure. An outline plot layout and highways design has been provided to REC and is reproduced in Appendix III as Drawing No 44808p1r0/009.

1.5 Summary of Parties Involved

Name of Party	Function / Interest
Countryside Sigma	Land Owner / Developer
Resource & Environmental Consultants (REC) Ltd	Geo-Environmental Consultant
Hydrock	Remediation Contractor
Liverpool City Council	Human Health Regulator / Local Planning Authority
Environment Agency	Controlled Waters Regulator

2.0 SITE CHARACTERISTICS

2.1 Site Location and Description

Site Address	Grange Lane, Liverpool L25 4SA
National Grid Reference	E342221, N388206
Site Area	7.47ha

The subject site currently comprises an unoccupied parcel of land. The east of the site is covered by the footprint of the former Gateacre High School (now demolished) and associated hardstanding. The north of the site is occupied by former playing fields. The west of the site is raised by approximately 7m from the east of the site and consists of former playing fields overlying a domestic landfill.

Several areas of the site have been infested by Japanese Knotweed; however this is currently being treated by a third party under instruction from Liverpool City Council.

An electricity substation is present adjacent to the eastern site boundary.

The historical maps show that the site was undeveloped prior to the construction of Gateacre High School circa 1968. The site is then shown to have remained unchanged until the school's recent demolition.

The site exists within a residential area.

2.2 Geology

Superficial drift deposits of fine to medium sand were encountered to a typical depth of less than 1.00m bgl in the eastern sector deepening to circa 5.00m bgl in the remainder of the site.

The site is directly underlain by Triassic Sandstone of the Chester Pebble Beds formation. In the previous site investigations weathered Sandstone was encountered (presumed but unproven bedrock) at depths between 0.20m and 4.90m bgl. Generally the presumed bedrock outcrops at a shallow depth beneath the eastern sector (lower elevation) dipping to the west.

2.3 Hydrogeology and Hydrology

There are no surface water features in the vicinity of the subject site and the site is not located within a currently defined flood risk zone.

There are no groundwater abstractions within 1km radius of the site.

2.4 Soil and Groundwater Condition

No groundwater was encountered during the previous site investigations and is assumed to be at depth within the Chester Pebble Beds..

All soil and groundwater data from previous investigations is presented within the previous Norwest Holst reports (February 2005, November 2005, October 2007) listed in Section 1.3

and REC report 44808p1r3 (July 2014). Soil analysis data from the Norwest Holst phases of investigation was utilised and assessed in REC Report 44808p1r3 and is summarised in the following section.

A Site Plan detailing all previous investigation locations is presented on Drawings 44808p1r0/002 and 44808p1r0/003.

In order to provide an accurate appraisal of the site, it has been divided up into three averaging areas. These are:

- The former landfill in the west of the site;
- The area formerly occupied by the school buildings and associated hardstanding; and,
- The former playing fields in the north of the site not associated with the landfill.

2.5 Summary of Contaminant Distribution

2.5.1 Soils – Landfill Area

A number of Contaminants of Concern (COCs) have been identified which exceed the REC human health screening criteria for a residential use.

Table 2.2 Summary of Exceedances in Landfill Area

Non-Volatile	Volatile
Pathways	
Dermal Contact, Ingestion, Consumption of home grown produce	Inhalation of vapours
<ul style="list-style-type: none"> ■ Arsenic; ■ Chromium (VI); ■ Lead; ■ Nickel; ■ Zinc; ■ Acenaphthylene; ■ Acenaphthene; ■ Phenanthrene; ■ Benzo(a)Anthracene; ■ Chrysene; ■ Benzo(b/k)Fluoranthene; ■ Benzo(a)Pyrene; ■ Indeno(123-cd)Pyrene; ■ Dibenzo(a,h)Anthracene; and, ■ Hydrocarbon fractions aromatic C₁₂-C₁₆ and C₁₆-C₂₁. 	<ul style="list-style-type: none"> ■ Naphthalene; and, ■ Hydrocarbon fractions aliphatic C₈-C₁₀ and aromatic C₁₀-C₁₂.

The results analysis shows that the landfill area has widespread elevated levels of metals and PAHs, particularly with regard to Arsenic (25No. exceedances), Lead (30No. Exceedances), Naphthalene (13No. exceedances) and Benzo(a)pyrene (9No. exceedances).

The results are typical of contaminants of domestic landfill containing ash, clinker and coal tar products.

Elevated aliphatic and aromatic hydrocarbon results were recorded at one location out of 16No. samples tested (WS103 at 3.50m). A sample taken from below this depth within the same borehole (WS103 at 4.70m) returned testing results with all TPH fractions below the laboratory limits of detection, indicating that the hydrocarbon contamination within the landfill area is limited in nature and of low mobility.

Due to the volume of material present, it is not considered viable to remove the landfill soils in their entirety from the site. The proposed remediation required in the landfill area will however break the pollutant linkages identified to human health for volatile pathways and lead to significant betterment at the site with regards to controlled waters. The proposed remediation of the landfill will comprise of two stage; firstly the off site disposal of unsuitable and deleterious materials and secondly, the subsequent bioremediation of the remainder of the soils.

2.5.2 Soils – Former School Area




The results assessment shows that in the area of the former school buildings, no exceedances were recorded with regard to a residential with plant uptake end-use and therefore no further action is required in this regard.

However, further consideration should be given to the potential presence of PCBs within the soils in close proximity to the electricity substation on the eastern site boundary, to the potential for contamination associated with the former school boiler room and to the potential presence of asbestos within the demolition material within the infilled school basements.

2.5.3 Soils – Northern Playing Fields

The results of the direct comparison show that screening values have been exceeded for the following determinants as shown in Table 2.3.

Table 2.3 Summary of Exceedances in Northern Playing Fields Area

Non-Volatile	Volatile
Pathways	
Dermal Contact, Ingestion consumption of home grown produce	Inhalation of vapours
<ul style="list-style-type: none">  Lead;  Benzo(b/k)Fluoranthene; and  Benzo(a)Pyrene; 	

The slightly elevated concentrations of lead, benzo(b/k)fluoranthene and benzo(pyrene) were identified in one sample location (WS111 at 0.40m bgl) at the base of the shallow Made Ground, which was noted in the logs as containing ash.

2.5.4 Groundwater

The results assessment shows widespread leachable metal and PAH contaminant concentrations above the Tier 1 screening values protective of controlled waters within the former landfill area.

The results also show potentially elevated leachable aliphatic and aromatic TPH fractions. This result may however prove erroneous as it was returned by an aggressive NRA leachate test that is known to produce elevated readings. Soils testing on a deeper sample from the same borehole returned TPH results below limits of detection, indicating that leaching of the TPH fractions is not occurring in this case.

2.6 Ground Gases

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 (*Assessing risks posed by hazardous ground gases to buildings*, 2007).

During twelve monitoring visits completed over a ten month period, concentrations of methane up to 14.60%v/v (WS103) and concentrations of carbon dioxide up to 13.4%v/v (WS103) were recorded within the area of historic landfill. However, these concentrations were associated with flow rates of less than 0.1l/hr. Concentrations of methane up to 13.70%v/v and concentrations of carbon dioxide up to 9.20%v/v were also recorded in WS102 with a flow rate of 0.1l/hr. Methane and carbon dioxide are likely to originate from the decomposition of waste matter noted within the Made Ground.

In accordance with the methodology outlined within the CIRIA publication C665, REC have utilised the results of the ground gas monitoring surveys to calculate a Gas Screening Value (GSV) for the proposed development. The maximum GSV recorded for methane was 0.0146l/hr and the maximum for carbon dioxide was 0.0134l/hr.

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area. CIRIA C665 states that the maximum GSV for carbon dioxide and methane is <0.07l/hr for Characteristic Situation 1 and although the GSVs for this site fall into this bracket both methane and carbon dioxide levels have been recorded in excess of 10%. As a precaution it is therefore recommended that Characteristic Situation 3 or Amber 2 (depending on sub-floor constraints) in line with BS8485:2007 is used.

This suggests that the following measures are to be incorporated into any new structures where the landfilled material is retained on site:

- Passive sub-floor ventilation (venting layer can be a clear void or formed using gravel, geo composites, polystyrene void formers etc);
- Reinforced concrete ground bearing foundation raft or cast in-situ suspended slab, both with minimal service penetrations;
- Propriety gas membrane installed to reasonable levels of workmanship;
- Independent validation to confirm appropriate installation of membrane; and,

- All joints and service penetrations to be taped and sealed.

The above assessment is based upon the pre-remediated gas levels, it is considered remedial works comprising the processing and re-engineering of the landfilled area will be required. It is anticipated that this processing will therefore remove biodegradable content within the Made Ground and therefore, the source of the ground gas. Post remediation ground monitoring should be completed and which may show that the site could be reclassified to as Characteristic Situation 1 / 2 or Green / Amber 1, dependent upon the results.

REC recommends that the final scope of any protection measures be agreed with the Local Authority prior to adoption. All protection measures, if adopted, should be validated by a suitably qualified environmental engineer.

2.7 Asbestos Containing Materials

No asbestos was detected in soil samples tested during the previous site investigations. Asbestos was removed from the school building as part of the demolition process by Asbestos Control & Treatment Ltd with APEC Environmental also involved in the Air Monitoring.

Although all asbestos was removed from the structure, it cannot be discounted that Asbestos Containing Materials (ACMs) may be present in the infilled cellars under the footprint of the former school. This should be investigated further during the enabling works, with all work carried out in accordance with the guidance set out in CIRIA C733.

2.8 Japanese Knotweed

A number of small Japanese Knotweed stands were observed in the vicinity of the former tennis courts in the southern sector of the site; however this is currently being treated by a third party instructed by Liverpool City Council. The Japanese Knotweed will need to be fully certified by Liverpool City Council's sub-contractor as to its eradication.

2.9 Geotechnical Considerations

2.9.1 Clean Cover System

A clean 'Cover System' will need to be constructed in all proposed residential gardens and landscaped areas in the Landfill Area in accordance with the REC Specification outlined below:

- Uniform 450mm of chemically validated sub-soil clay (cover) to be placed within all residential gardens and areas of soft landscaping. The clay is proposed to limit the potential for the mobilisation of leachable contaminants;
- 150mm layer of chemically validated topsoil to be placed within all residential gardens and areas of soft landscaping; and,
- The cover system is to be independently validated to confirm the required depth of suitable topsoil / subsoil has been installed.

The Made Ground has been identified to be geotechnically unsuitable for retention in garden areas in the Northern Playing Field Area and the Former School Area. This should be

removed to 600mm or to a natural stratum and made up to finished levels using topsoil and subsoil as detailed above with a minimum of 150mm topsoil.

The materials to be used within the clean cover system must meet the chemical requirements listed in the Remediation Targets included in Appendix II. Chemical validation of the cover system materials will be undertaken prior to placement, with subsequent depth validation following the installation of the cover system by a series of hand pits in all landscaped areas.

The cover system validation reports will be issued as the development progresses, with a final cover system report encompassing the entire development to be issued following completion.

2.9.2 Foundations

Significant thicknesses of Made Ground have been identified in the western sector of the site and basements of an unknown depth are known to exist in the east associated with the former school.

It is considered that subject to removal and subsequent re-engineering / processing of all landfilled material and historical basements, ground conditions should allow for a combination of shallow strip supported by Vibro Stone Columns, mass trench fill foundations with a small number of piled foundations in the event of soft spots, high walls or groundwater.

2.10 Identified Development Constraints

The following potential development constraints have been identified:

- Former landfill;
- The presence of below ground relict structures and foundations including infilled cellars under the footprint of the former school;
- Deep Made Ground deposits associated with the western landfilled area;
- Stands of Japanese Knotweed; and
- Site levels for development.

A Site Plan detailing historical structures at the site is presented on Drawing No. 44808p1r0/008.

A detailed Materials Management Plan (MMP) will need to be completed in accordance with CL:AIRE COP, when reusing materials on site.

3.0 REMEDIAL OBJECTIVES

3.1 Relevant Pollutant Linkage Objectives

The aim of the remedial work at the subject site is to voluntarily manage the environmental risks and environmental liabilities associated with the former use of the site. Based on current site data, the primary objective of the remedial work is to mitigate the hydrocarbons, metals and PAH concentrations identified in the soil associated with the landfill in the west of the site to enable a residential end-use and to gain betterment for the site for controlled waters. This objective will be achieved by breaking the following pollutant linkages:

- Direct contact / Ingestion;
- Inhalation of indoor air pathways;
- Explosion and asphyxiation, and,
- Vertical migration of mobile contaminants.

3.2 Further Investigation Objectives

Further potential contaminants have been identified in the site investigation report (44808p1r3), the assessment of which will require further investigation in conjunction with the initial site works. These are:

- PCBs in soil adjacent to electricity substation on eastern site boundary;
- Contaminants associated with former school boiler room; and,
- Asbestos associated with demolition material in infilled cellars of former school.

3.3 Management Objectives

The management objectives for the site are to produce a remediation strategy that can be agreed with key stakeholders to enable a residential end-use for the site.

3.4 Technical Objectives

The technical remediation objectives for the site are to provide a remedial approach that will address the identified active pollutant linkages at the site and to enable a residential end-use for the site.

3.4 Site Remediation Criteria

The site Remediation Criteria are:

- To reduce identified contaminant concentrations of soils to the human health screening criteria defined REC Detailed Contaminated Land Assessment (44808p1r3);
- To reduce identified mobile contaminant concentrations of soils with regard to controlled waters (44808p1r3);
- To permanently break the identified pollutant linkages such that exposure pathways detailed above in Section 3.1 are inactive; and
- To assess the further potential contamination identified in report 44808p1r3 as detailed in Section 3.2 above.

4.0 REMEDIATION TECHNOLOGY

Taking into account the site-specific conditions including the nature of the identified impacts, the geology and the objectives of the remediation, the most appropriate soil remedial technologies are considered to be a cover system to address metal and PAH impacts and excavation coupled with off site disposal of unsuitable materials and bioremediation of the volatile petroleum hydrocarbon and naphthalene impacted soils within the area of the former landfill.

It is considered that these technologies and methodologies will address the identified active pollutant linkages in the following manner:

Contaminants of Concern

Metals, PAHs, low-volatility Hydrocarbon (petroleum range) Compounds

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

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

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

Volatile Petroleum Range Hydrocarbons and Naphthalene

The primary exposure pathway associated with volatile petroleum range hydrocarbon fractions and Naphthalene is:

- Volatilisation from the soil source to indoor air spaces and subsequent inhalation by future on-site residents; and,
- Migration of mobile contaminants into controlled waters.

Due to the volume of material present, it is not considered viable to remove the landfill soils in their entirety from the site. The proposed remediation required in the landfill area will however break the pollutant linkages identified to human health for volatile pathways and lead to significant betterment at the site with regards to controlled waters.

The proposed remediation of the landfill will comprise of two stage; firstly the off site disposal of unsuitable and deleterious materials and secondly, the subsequent bioremediation of the remainder of the soils. All Made Ground within the former landfill will require excavation in its entirety and following excavation, excavated materials will be sorted, with the unsuitable material disposal off-site. The remainder of soils will be subject of treatment by means of bioremediation in windrows of the identified hydrocarbon contaminated soil is considered to be an appropriate remedial technique to address the identified impacts. This remedial approach addresses the driving pollutant linkage by removing the source. Soils will be considered to be suitably remediated as and when laboratory validation testing demonstrates that the soil concentrations are below the remediation criteria for both human health and controlled waters.

5.0 SITE REMEDIATION & ENABLING WORKS

5.1 Overview

A summary of the proposed site enabling / remediation works, associated management activities and validation protocols are presented in detail later within Section 5.2; the salient features of which are presented below:

The outline strategy for the site remediation and enabling works will comprise:

- Implementing the works with appropriate consultancy supervision so that the works can be fully validated, together with verification reporting, to the satisfaction of the Local Planning Authority (LPA);
- General site clearance and legislatively compliant disposal of all surface vegetation, breaking out, excavation and removal of all slabs, hard-standing and buried structures to the base of the Made Ground;
- The further assessment of the soils adjacent to the electricity substation of the eastern site boundary, the soils beneath the former school boiler room and the infill material in the former school cellars.
- Excavation /and ex-situ treatment of volatile hydrocarbon and Naphthalene-impacted soils;
- Excavation and removal of all previously unidentified materials deemed to be either a potential risk to the identified receptors or the built environment;
- The confirmation of successful treatment and eradication of invasive plant species (namely Japanese Knotweed) by third party contractors;
- Breaking out and subsequent crushing / processing of all surface and sub-surface structures including foundations, redundant drains and any further buried obstacles (where present);
- Processing aggregates in accordance with the Engineer's Specification with requisite validation testing;
- The processing of the landfilled material to remove non suitable (wire/tyres etc.) and degradable material;
- The regrading of site levels including the reengineering of the processed landfill material and installation of retaining structures;
- The winning of topsoil from the northern playing field area for reuse within the development;
- Removal and disposal of any perched water from within excavations (if required);
- Management of all works so as to ensure that no environmental nuisance is created through dust emissions, noise or vibration levels;
- Ensure that all works are completed in a manner so as not to create any structural risk to the adjacent highways;

- Implement all temporary works as necessary to support excavations throughout the duration of the works;
- Inspection of all works by a qualified Geo-Environmental Engineer to confirm the suitability of material for re-use and to confirm the findings of the REC report;
- Importation of inert and geotechnically stable fill if required – finished levels are still to be determined. Laboratory testing of all imported material to confirm chemical and geotechnical suitability for use, in accordance with the testing schedule presented within the Remediation Strategy;
- Provide suitable development platform to facilitate the construction of the proposed roadways, drainage infrastructure, pavements and areas of hard-standing; to be delivered in accordance with the Engineers Specification;
- Provide and place a 600mm thick soft cover system to all landscaped areas within the area of the former landfill;
- Remove Made Ground in landscaped areas in Northern Playing Fields Area and the Former School area to 600mm or natural ground and make up to finished levels as above with a minimum 150mm topsoil;
- Removal of all soil wastes deemed unsuitable for use from site in accordance with UK Waste Management Legislation and in accordance with the UK Landfill Directive; and,
- Development of a comprehensive validation report to document the successful completion of the aforementioned works.




A Site Plan detailing the depth of Made Ground across the site is presented on Drawing No. 44808p1r0/004.

5.2 Remediation / Enabling Works

The rationale detailed below provides a synopsis of the proposed site enabling / remediation works required to produce the suitable platform for the construction of the proposed residential development. This is intended to demonstrate that the proposed activities are to be undertaken in full compliance with the relevant regulatory controls.

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 overleaf:

Table 5.1 – Enabling Works Schedule

EW1	Pre-Commencement Works
	Implementing the works with appropriate consultancy supervision so that the works can be fully validated, along with validation reporting to the satisfaction of the Local Planning Authority (LPA).
	Validation Requirements: Provide documented evidence to confirm acceptance of proposed methodologies.
EW2	Site Clearance Operations
	General site clearance & provision of welfare, offices and site security.
	Validation Requirements: Any disposal of materials of site (including vegetation) should be completed in accordance with UK Waste Management Legislation.
EW3	Further Investigation
	In conjunction with EW2, the following works will be carried out as recommended in REC report 44808p1r3. <ul style="list-style-type: none">  Assessment of soils adjacent to electricity substation on eastern site boundary for potential PCB impact.  Assessment of potential contamination associated with former school boiler room.  Assessment of potential asbestos within demolition material in infilled cellars, with due regard of CIRIA C733.
	Validation Requirements Following the assessments, REC Ltd will produce an interim validation report.
EW4	Excavation of Deleterious and Geotechnically Unsuitable Materials in the Landfill Area
	Deleterious and geotechnically unsuitable materials have been identified within the landfill area in the west of the site. All Made Ground materials within the former landfill will require excavation in its entirety and during excavation; the natural surface will be screened using a Photo Ionisation Detector to determine when it will be necessary to cease excavation.
	In addition, samples will then be taken on a 25m grid from the base and sides of the void and submitted to the laboratory for analysis as detailed in Table 5.2 for Speciated PAH and Banded TPH to demonstrate that all soils left in-situ are suitable for use. The excavated materials will be sorted, with the unsuitable material disposal off-site

	<p>in accordance with UK Waste Management Legislation. The remaining material will then be subjected to EW5 works below.</p> <p>Validation Requirements:</p> <p>The processed material will require visual inspection prior to being placed in the bioremediation treatment area. Upon the excavation, the resulting void will undergo validation testing of the soils for TPH and PAHs to be compared to the site specific remedial target values.</p> <p>Areas will require appropriate geotechnical testing to demonstrate that the backfill material meets the required engineered standard.</p>
EW5	<p>Excavation, Bio-remediation and Validation of Volatile Hydrocarbon/Naphthalene-impacted areas in the west of the site</p> <p>Rationale:</p> <p>The human health risk assessment within the REC report has determined that the Made Ground soils in of the former landfill area pose an unacceptable risk to end users of the development via inhalation of volatile petroleum hydrocarbon vapours and naphthalene contamination. In order to break this pollutant linkage by means of source removal it is proposed that these soils are subjected to bioremediation.</p> <p>All processed soils from the landfill should be transferred to an engineering treatment area (i.e. hard-standing or visqueen area with drainage systems to contain leachate that may originate from the soils). Soils should be screened for coarse materials and nutrients added, constructed into windrows, covered, and turned appropriately during the treatment period and validation soil samples collected at a frequency of one sample every 250m³.</p> <p>Soils may be reinstated to excavation areas provided that the measured concentrations are below remediation criteria.</p> <p>Validation Requirements:</p> <p>Following bioremediation chemical testing of bioremediated material should be undertaken for the confirmation that no remedial targets (Appendix II) for volatile hydrocarbons are exceeded and that soils are suitable for use within the site. Completing these exercises will help to demonstrate that the soil and groundwater remaining at the site will pose no unacceptable risk to the controlled water receptor.</p>
EW6	<p>Removal of Perched Water</p> <p>Rationale:</p> <p>Any (perched) waters encountered within the formation of earthworks excavations will be assessed and disposed of in a controlled and legislatively compliant manner.</p> <p>Validation Requirements:</p> <p>To be confirmed following assessment of results.</p>

EW7	<p>Excavation, Breaking and Processing of all Sub-Surface Structures Including the infilled basements of the former school building</p> <p>Rationale:</p> <p>All known major obstructions/foundations apart from live services are to be removed to the base of Made Ground. The basements of the former floor slabs are known to be present within the former footprint.</p> <p>In these areas all artificially hard materials will be broken out and crushed. Stockpiles will be made, validation testing undertaken, and site won material reused on site where required.</p> <p>It is proposed that the full depth of Made Ground is to be excavated, turned and processed beneath all former building footprints and external areas.</p> <p>Any obstructions/foundations/structures not previously encountered within the remainder of the site will be removed to the base of Made ground. Where any very loose or soft material is present at the base of excavations, removal of material will continue, and any material excavated will be re-engineered to a suitable specification to minimise the risk of future settlement.</p> <p>Validation Requirements:</p> <p>Site-won arisings will require chemical testing to demonstrate that they are suitable for use with the proposed development platform.</p> <p>Areas will require appropriate geotechnical testing to demonstrate that the backfill material meets the required engineered standard.</p>
EW8	<p>Backfill for Remedial Excavations</p> <p>Rationale:</p> <p>On completion of the site enabling / remediation works as described above all excavations beneath the proposed buildings and gardens will be backfilled with a suitable material that conforms to the engineer's specification for construction within that sector of the site.</p> <p>Materials to be placed beneath proposed adoptable roads will be compacted to a Method Compaction Specification in accordance with Section 6 of the Highways Design Manual and the REC specification.</p> <p>Validation Requirements:</p> <p>Confirmation that the material is chemically and geotechnically suitable for re-use.</p>

EW9	<p>Provision of Sub-Soil in Landfill Area</p> <p>Rationale:</p> <p>Subsoil will be sourced onsite where possible but if volumes prove insufficient a chemically suitable subsoil forming clay material (450mm) will be imported for use within all garden and landscaped areas.</p> <p>Validation Requirements:</p> <p>Sub-soil will require testing in line with the schedule present within Section 5.5.</p> <p>The garden and landscaped areas will require depth validation to satisfy the requirement of the Council Mortgage Lenders (CML) in order to demonstrate that the appropriate thickness has been provided.</p>
EW10	<p>Provision of Top-Soil in Landfill Area</p> <p>Rationale:</p> <p>It will be necessary to provide a chemically suitable top-soil forming material (150mm) for use within all garden and landscaped areas to be placed on top of the 450mm of validated sub-soil. This may be site-won from the northern playing field section of the site and/or imported.</p> <p>Validation Requirements:</p> <p>Top-soil will require testing in line with the schedule present within Section 5.5.</p> <p>The garden and landscaped areas will require depth validation to satisfy the requirement of CML in order to demonstrate that the appropriate thickness has been provided.</p>
EW11	<p>Provision of Garden/Soft Landscaping Material in Areas Outside Landfill Area</p> <p>Made Ground has been identified in the Northern Playing Fields Area and the Former School Area. Where this affects soft landscaping/garden areas, it should be removed to 600mm below ground level or natural ground and made up with clean validated material as per sections EW9 and EW10 utilising a minimum of 150mm topsoil. It is not a requirement outside the Landfill Area for the subsoil to be clay.</p>

5.3 Materials Management & Legislation Compliance

All operations as outlined in detailed within the Enabling Works Rationale summarised within Section 5.2 (above) will be subject to regulation using a 'Materials Management Plan' (MMP) to be created in accordance with Version 2 of the CL:AIRE Definition of Waste - Industry Code of Practice. The aforementioned MMP should be created with due consideration to all proposed remediation and enabling works operations prescribed within this document and will be undertaken by a Qualified Person and a signed declaration submitted to the EA prior to reuse of materials on the site.

5.4 Post Remediation Constraints

Post remediation constraints for the site will include:

- Gas protection measures are required in building design. In its current configuration, the area of deep Made Ground would be classified as CS3 / Amber 2 with the remainder of the landholding being CS1 / Green. Following the remediation of the landfilled area, further monitoring may show a reduction in this area's classification;
- Sub surface concrete should be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (AC EC) Ac-1s in accordance with recommendations provided in BRE Special Digest 1 (2005);
- Preliminary assessment would suggest that barrier pipe would be suitable for use within the proposed residential development.
- Topsoil to be site-won from the northern playing field area and/or supplied by the developer, with appropriate quality checks;
- Placement of clean sub-soil and topsoil in gardens and soft landscaped areas of Landfill Area must be a minimum of 600mm;
- Made Ground to be removed from garden and soft landscaped areas in Northern Playing Field Area and Former School Area to 600mm below ground level or to natural ground and made up with clean validated material as above;
- Foundation strategies should take into account the properties of the strata left in-situ; and,
- Disposal of arisings for services and foundation trenches, if required.

Consultations will have to be completed with the Local Authority to enable the satisfactory discharge of planning conditions associated with the planning consent for the site.

5.5 Validation Sampling Protocol

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

Soil samples destined for chemical analysis will be collected at regular intervals in appropriate sampling containers. All samples will subsequently be stored in cooled boxes

prior to submission to Scientific Analysis Laboratories (SAL) for analysis in accordance with their UKAS and MCERTS accreditation where applicable.

All samples will be collected using appropriate PPE and sampling equipment that will be cleaned at each sampling location.

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

Where materials are found to contain concentrations of potential contaminants at levels in excess of the site specific screening criteria (as detailed within Appendix II), REC 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 5.2 (below).

Table 5.2 – Specification of Materials Validation Laboratory Analysis

Material Use	Testing Frequency	Suite of Analysis
Imported materials	1 Sample Per 1000m ³	A / B / C / D
Site won/imported Sub-Soil (450mm garden cover)	1 Sample Per 250m ³	A / B / C / D
Topsoil Cover	1 sample per 50m ³	A / B / C / D
Treated hydrocarbon/naphthalene impacted material	1 Sample Per 200m ³	E / F

Notes – Table 5.2

Suites of Analysis

A) Speciated PAH

B) Banded TPH (C5-C35)

C) Asbestos (ID)

D) CLEA Inorganic

E) Speciated PAH, Banded TPH and VOCs

F) PID Headspace Analysis

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

6.0 ENVIRONMENTAL MONITORING AND VALIDATION

6.1 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;
- The strategy for each day's work will be agreed with the REC Consultant, who will be in attendance as required, prior to the commencement of the works. REC 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;
 - Ensure that any loads which 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 REC site engineer.
- All material imported and removed from site will have Duty of Care / Consignment Notes, copies of which will be retained on-site by the Site Manager;
- Materials directly reusable will be incorporated into the earthworks, subject to operational conditions and phasing of excavations, in which case they will be stockpiled prior to final placement.

7.0 DETAILED WORKING METHODOLOGIES – ACM IMPACTED SOIL

This section has been included within the Remediation Strategy in the event that Asbestos Containing Material (ACM) is identified within the Made Ground soils during a phase of supplementary investigation. These working methodologies should also be adopted in the event that during the earthworks, visual cement bonded ACM is encountered in the Made Ground.

It will be necessary to develop and document all proposed working methodologies to be adopted by all people involved with the proposed handling of soil matrices where Asbestos Containing Material (ACM) has been identified.

At this time, a detailed programme of proposed enabling works and construction phase activities has not been provided to REC, therefore it will be necessary to develop addendums to this document to accurately describe the proposed work process and demonstrate that no risk associated with airborne fibre release has been created.

Pre-Commencement Works

Prior to the commencement of works the following activities will be undertaken:

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

Control, Monitoring and Reporting of General Aerial Emissions; Dusts and Particulates

Damping Down of Soils – Mitigate Particulate (Dust) Emission

During the excavation of soils outlined within the detailed working methodologies, soils will be regularly damped down using water to control the generation of dust. REC will determine the best form of dust suppression to be used when a detailed programme has been issued.

In extreme circumstances when soils are found to be visually impacted by ACM products known to contain loose fibres such as pipe lagging as an added contingency PVA may also be added to water sprayed onto these soils to assist in damping down and suppression of airborne particulates. For the avoidance of doubt, this is not considered to be an eventuality during the site enabling works.

With respect to the works outlined within the detailed works methodologies, REC's extensive experience of similar works confirmed that damping down of soil arisings is an extremely effective control measure.

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 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 (<5mph) during civil excavation works to reduce the potential to generate dust;

Personal Protective Equipment (PPE)

In accordance with the HSE Guidance Note EM6 (non-licensed asbestos works), REC 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 - these are difficult to cover properly;
- Wear the overall legs over footwear. Tucking them in lets dust into footwear; and
- 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 removed from works area.

7.1 Monitoring of Local Weather Conditions

An on-site weather station could be used to monitor prevailing wind directions and weather conditions and daily/weekly weather reports will also be monitored. Works will be carefully planned taking into account weather conditions (max wind speed of 10m/s) and prevailing wind directions. Should adverse weather conditions be encountered and/or the above measures prove insufficient to ensure satisfactory dust control the works generating dust will be suspended until conditions improve.

The use of real time on-site weather monitoring is a useful tool in assessing the risk associated with the generation of particulate emissions and can also be used to demonstrate to any interested parties (such as the HSE) that a high level of diligence is being employed when dealing with hazardous substances such as ACM.

Visual monitoring of aerial emissions shall be carried out by site staff supervising materials handling operations. Visual monitoring will also be undertaken by the site manager or supervisor, at least twice per day, at the site boundary situated downwind of the engineering operations, and shall be recorded in the site diary.

7.2 Asbestos Air Monitoring

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 2006;

- 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’; and,
- HSE Guidance Note HSG247 ‘Asbestos: The licensed contractors’ guide’.

Air Monitoring Procedures

Air monitoring for asbestos fibres will be undertaken in three distinct forms as follows:

- Boundary;
- Working Area; and,
- Personal.

Boundary Monitoring

Boundary monitoring will comprise a series of static air monitoring pumps located along the boundary down-wind of the active working area. This will allow for a comprehensive assessment of the presence of any airborne fibres which may be transported to the site’s boundary.

Depending upon the wind direction, the placement of the static monitoring points may vary daily, which will allow for a proactive monitoring assessment. The wind direction will be relayed at the start of the working day to REC Asbestos from the onsite Resident Engineer.

The use of Dust Deposition Gauges at the site boundary to monitor PM10 (Particulate Matter 10 micron) emissions from the site will also be implemented. The use of such monitoring apparatus will assist in the assessment of off-site dust emissions and ensure that should any statutory nuisance complaints arise, the Client / Principal Contractor are able to demonstrate that they have not been negligent in their legislative obligations for the works.

Working Area

A series of static air monitoring pumps will be clustered both upwind, downwind and crosswind of the active working area, which will be defined by the Resident Engineer at the start of each monitoring occasion.

Personal Monitoring

Personal monitoring pumps will be worn by selective ground workers involved within the active working area. The monitoring will be undertaken in accordance with the method statement highlighted within Section 2.0.

Results

Once the monitoring has been analysed by the onsite UKAS accredited laboratory, the results will be delivered to the Resident Engineer who will then follow the correct site procedure.

REC has derived this monitoring protocol based on a nuisance risk, not a health risk, this is a critical point when using Environment Agency Technical Guidance Document M17 –

Monitoring of particulate matter in ambient air around waste facilities, which is the source of protocol rationale.

Paragraph 4.3.2 of M17 states, 'No statutory or official air quality criterion for dust annoyance has been set in the UK, however in England and Wales a custom practice limit of 200mg/m²/day is used for measurement with dust depositional gauges.' It also states 'In the absence of any other criteria, this unofficial guidance has been widely used in environmental assessment.'

Based on this guidance REC will undertake its assessment of the nuisance level of particulates against a limit of 200mg/m²/day.

Sectional 5.3.4 of M17 states 'Short duration sampling programmes are unlikely to give data representative of general conditions' As a result REC proposes that the monitoring will be undertaken in two week periods over the duration of the ACM removal works.

Section 5.5.3 of M17 states '...there are no hard-and-fast rules on the number of sampling stations...' With this in mind REC proposes to install 2 directional depositional dust gauges at locations highlighted within this report.

8.0 RECORD KEEPING & VERIFICATION

8.1 Record Keeping

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

- Detailed daily site diary including material movements;
- **Asbestos Containing Materials (ACM) (if required)** – sampling register, testing results, photographs, details of locations where ACM is identified (drawings), consignment notes relating to any ACM that is disposed of off-site and, certificates of any air monitoring undertaken;
- **Hydrocarbon Impacted Soils** – sampling register, testing results, photographs, details of locations of hydrocarbon impacted soils (drawings), details of hotspot removals, details of dates when bioremediation is undertaken and 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 the Remediation Excavation Record, the template of which is attached at Appendix IV. This record will remain on site and will be completed by the REC on-site engineer during the course of the remediation and site enabling works.

8.2 Verification

The records listed above will then be compiled into a Validation Report produced by REC Ltd 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. REC will also prepare an as built development drawing clearly detailing the materials present on-site to be cross referenced with the supporting validation documentation.

The Validation Report will include the following:

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

9.0 CONTINGENCY PLAN

9.1 Previously Unidentified Contaminants

Should any significantly impacted material be encountered during the development, then it should 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 should be undertaken to determine whether it can be retained on-site as part of the Material Management Operations or whether it should be disposed 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.

APPENDIX I
GLOSSARY

GLOSSARY

TERMS

MMP	Material Management Plan
MM	Material Movement
FFL	Finished Floor Level
COP	Code of Practice
AST	Above ground Storage Tank
UST	Underground Storage Tank
EA	Environment Agency
CSM	Conceptual Site Model
GL	Ground Level
D	Not Detected
NR	Not Recorded
BSI	British Standards Institute
BGS	British Geological Survey
CLEA	Contaminated Land Exposure Assessment
SGV	Soil Guideline Value
GAC	General Assessment Criteria
CIEH	Chartered Institute of Environmental Health
PID	Photo Ionisation Detector
CIRIA	Construction Industry Research Association
GSV	Gas Screening Value
EQS	Environmental Quality Standard
DWS	Drinking Water Standard
PAH	Poly Aromatic Hydrocarbon
TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)
VOC	Volatile Organic Compound
SVOC	Semi Volatile Organic Compound
SPT	Standard Penetration Test
VCCs	Vibro Concrete Columns
QA	Quality Assurance

UNITS

m	Metres
km	Kilometres
%	Percent
%v/v	Percent volume in air
mb	Milli Bars (atmospheric pressure)
l/hr	Litres per hour
µg/l	Micrograms per Litre (parts per billion)
ppb	Parts Per Billion
mg/kg	Milligrams per kilogram (parts per million)
ppm	Parts Per Million
mg/m ³	Milligram per metre cubed
m bgl	Metres Below Ground Level
m bcl	Metre Below Cover Level
mAOD	Metres Above Ordnance Datum (sea level)
kN/m ²	Kilo Newtons per metre squared
µm	Micro meter

**APPENDIX II
LIMITATIONS**

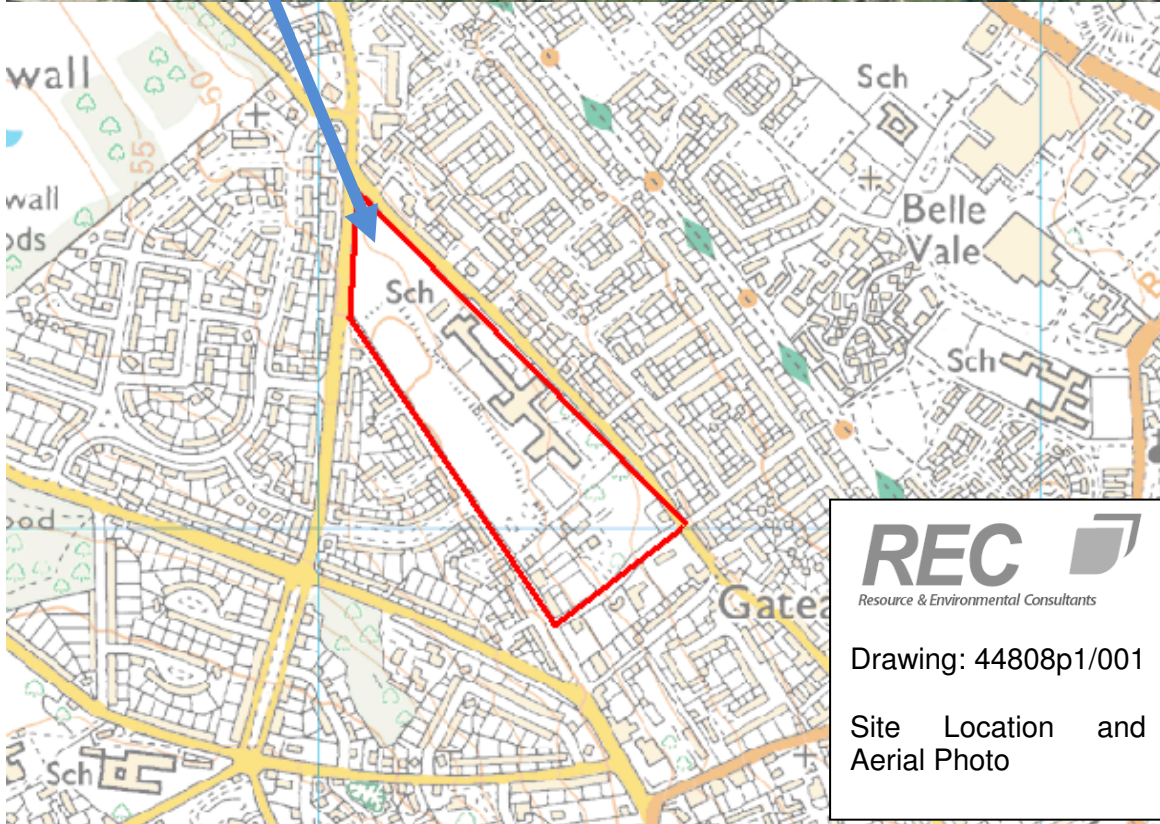
Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client.
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. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
5. 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.
6. REC 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 REC 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 REC in this connection without their explicit written agreement there to by REC.

**APPENDIX III
DRAWINGS**



Site Location



REC
Resource & Environmental Consultants

Drawing: 44808p1/001

Site Location and
Aerial Photo

Key

- BH1

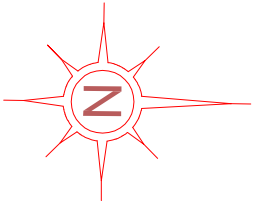
Approximate Borehole Location Undertaken by Northwest Holst (2004)
- BH1

Approximate Borehole Location Undertaken by Northwest Holst (2005)
- TP1

Approximate Trial Pit Location Undertaken by Northwest Holst (2005)
- TP22

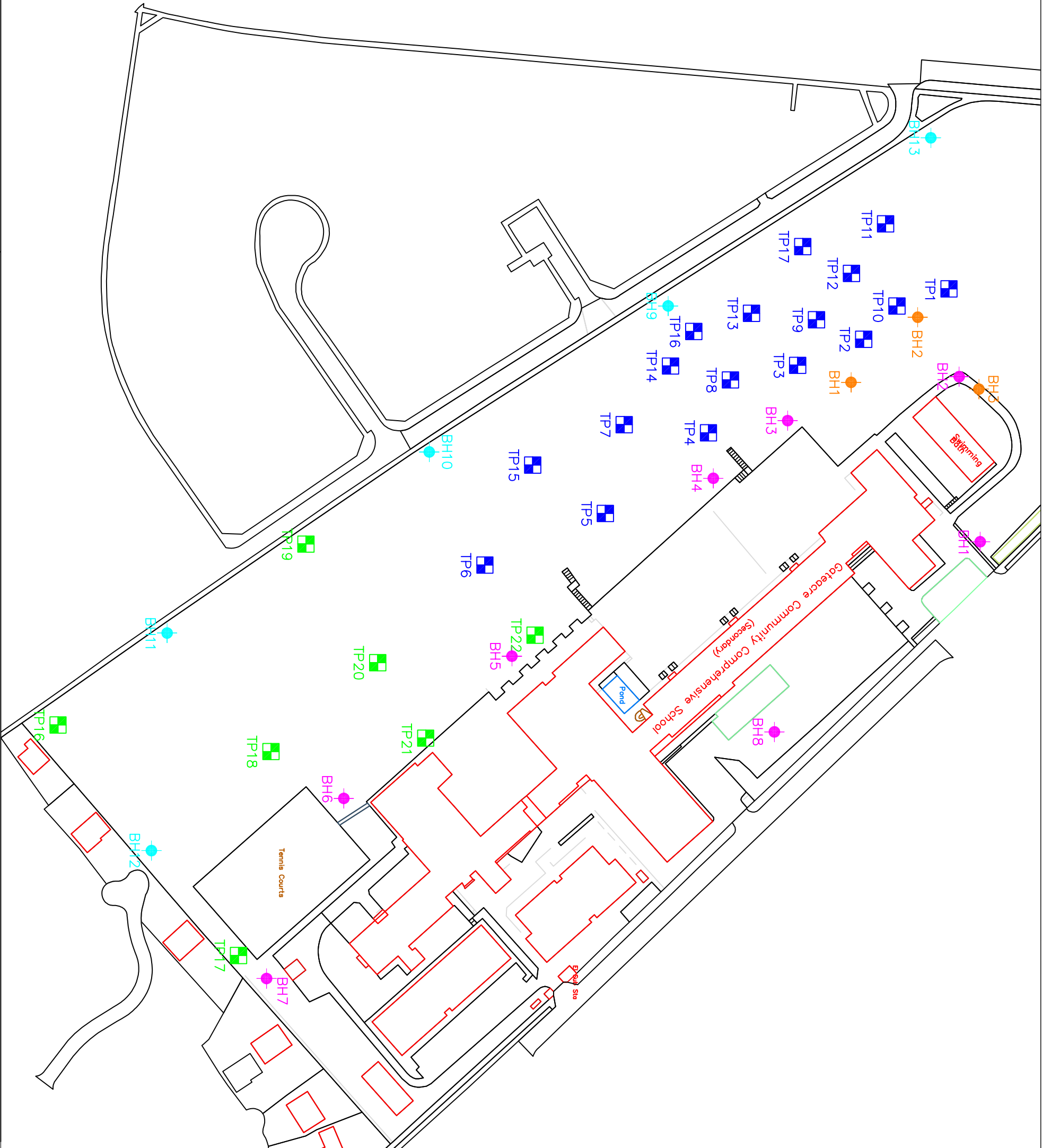
Approximate Trial Pit Location Undertaken by Northwest Holst (2007)
- BH10

Approximate Borehole Location Undertaken by Northwest Holst (2007)



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Job Title: Gateacre High School, Liverpool

Client: Countryside Properties

Job No: 44808

Drawn by: K.Doolan

Approved by: R.Paul

Scale: 1:2000 @ A3

DATE: 15-04-14

Notes:

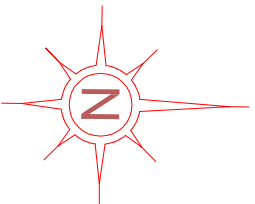
Drawing Title: 44808p1r0-002 Historical Exploratory Hole Location Plan

Key

- WS101
- Approximate Window Sample
Probehole Location
- TP101
- Approximate Trial Pit
Location

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Job Title:

Gateacre High
School, Liverpool

Client:

Countryside Properties

Job No: 44808

Drawn by: R. Willoughby

Approved by: R.Paul

Scale: 1:2000 @ A3

29-04-13

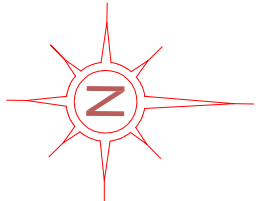
Notes:

Drawing Title:

44808p1r0-003
Exploratory Hole
Location Plan

Key


- No MADE GROUND
- MADE GROUND 0.00–0.49m
- MADE GROUND 0.50–0.99m
- MADE GROUND 1.00–1.99m
- MADE GROUND 2.00m+



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Client:

Countryside Properties

Job No: 44808

29-04-13

Drawn by: R. Wlloughby

Approved by: S. Howard

Scale: 1:2000 @ A3

Notes:

Drawing Title:

44808p1r0-004
Depth of Made Ground Plan

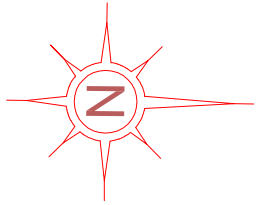
Key



Area of Historic Landfill, risk of total & differential settlement, chemically impacted ground and ground gas generated risks.

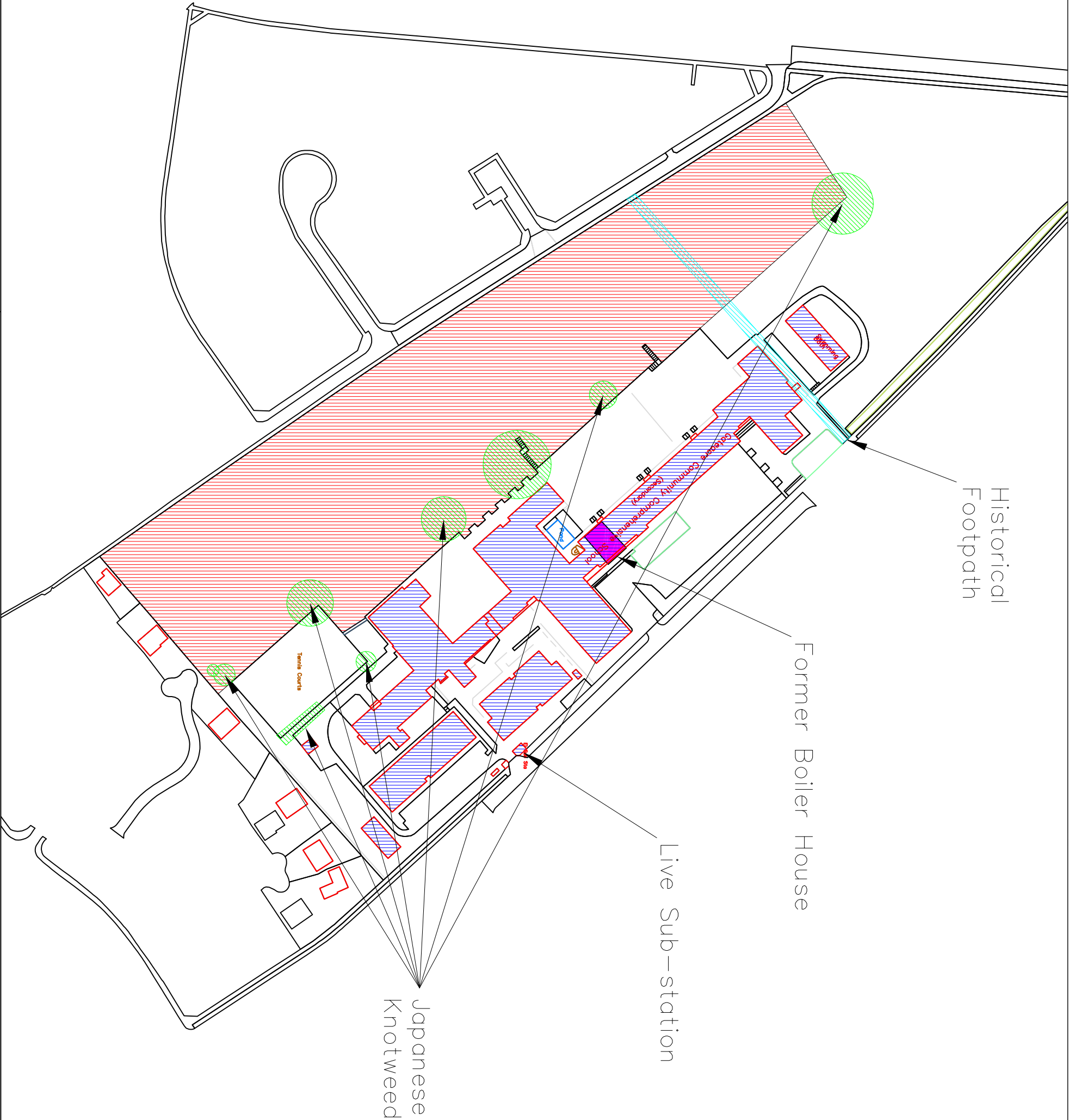


Area of Gateacre High School, significant depths of Made Ground due to presence of unknown quantity of basements and infill.



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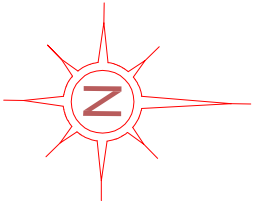
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Key

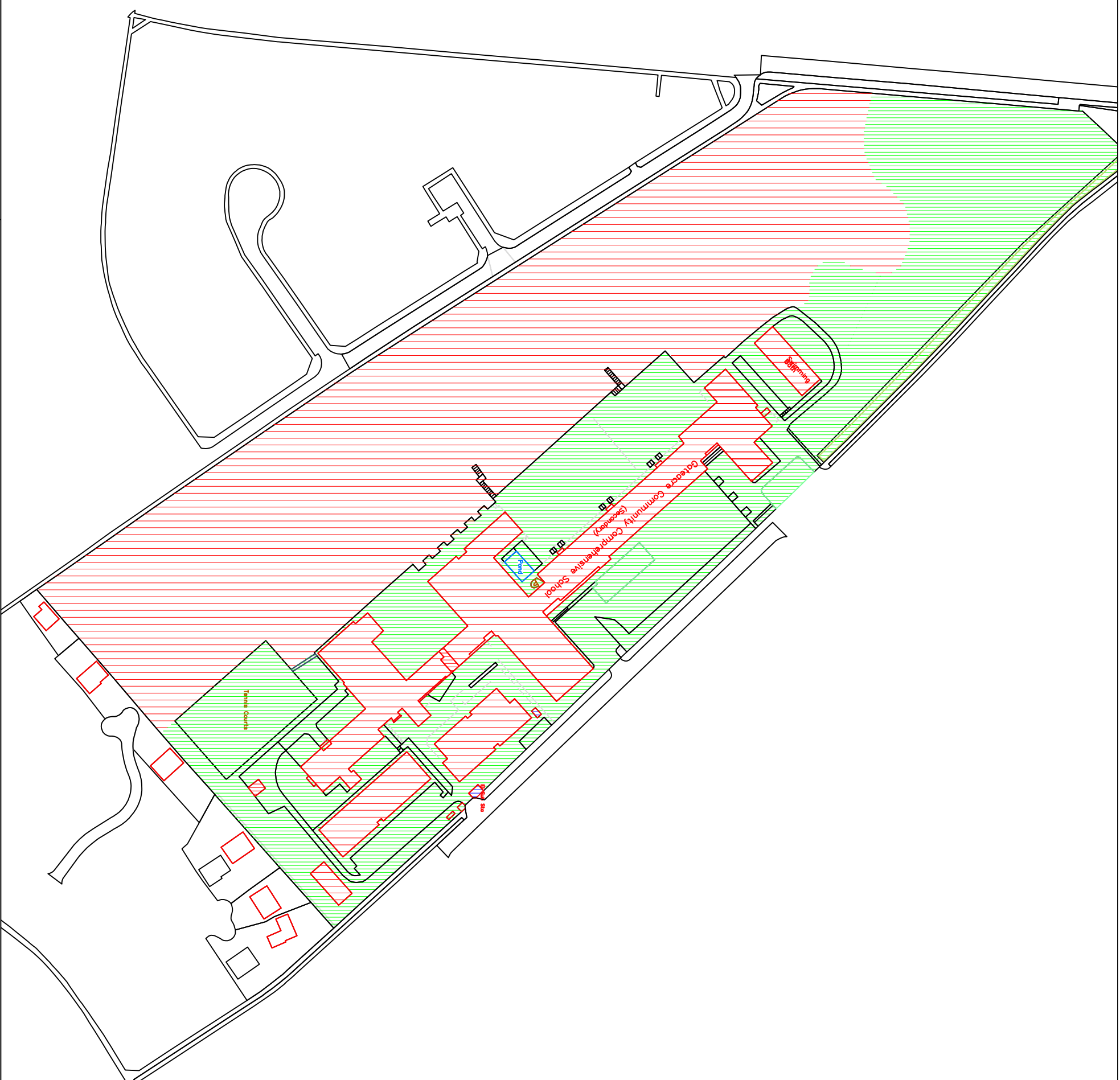
Excavation & Re-engineering of ground using vibro-replacement stone columns supporting shallow strip foundations

Standard Strip footings.



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Website: www.recltd.co.uk

Job Title:

Gateacre High
School, Liverpool

Client:

Country-side Properties

Job No: 44808

Drawn by: R. Willoughby

Approved by: S. Howard

Scale: 1:2000 @ A3

DATE: 29-04-13

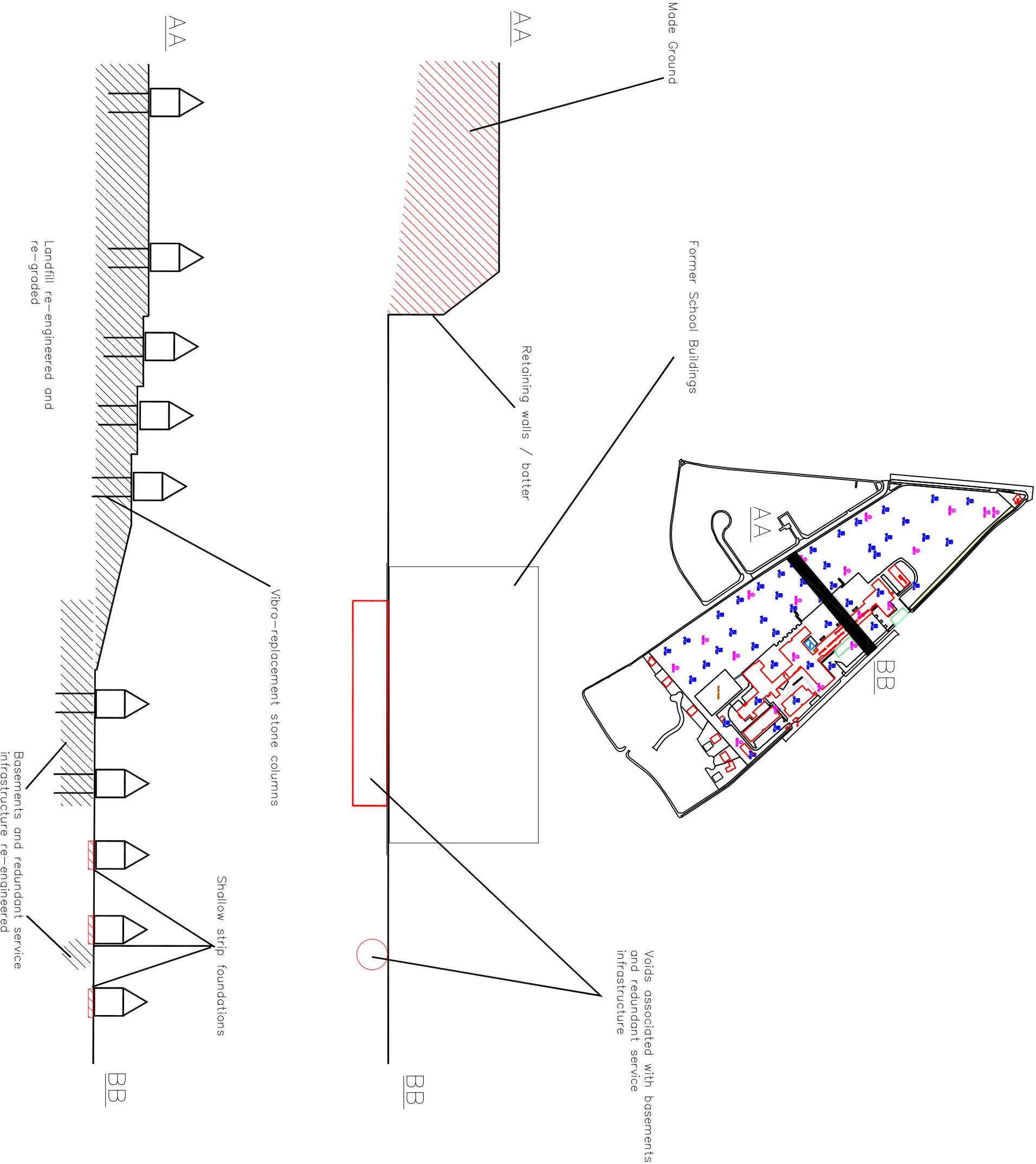
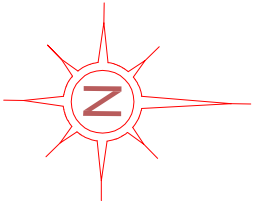
Notes:

Drawing Title:

44808p1r0-006
Foundation Schedule
Plan

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Key

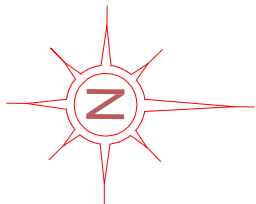
WS101
Approximate Window Sample
Probehole Location

TP101
Approximate Trial Pit
Location

Area of Historic Landfill, risk of
total & differential settlement,
chemically impacted ground and
ground gas generated risks.

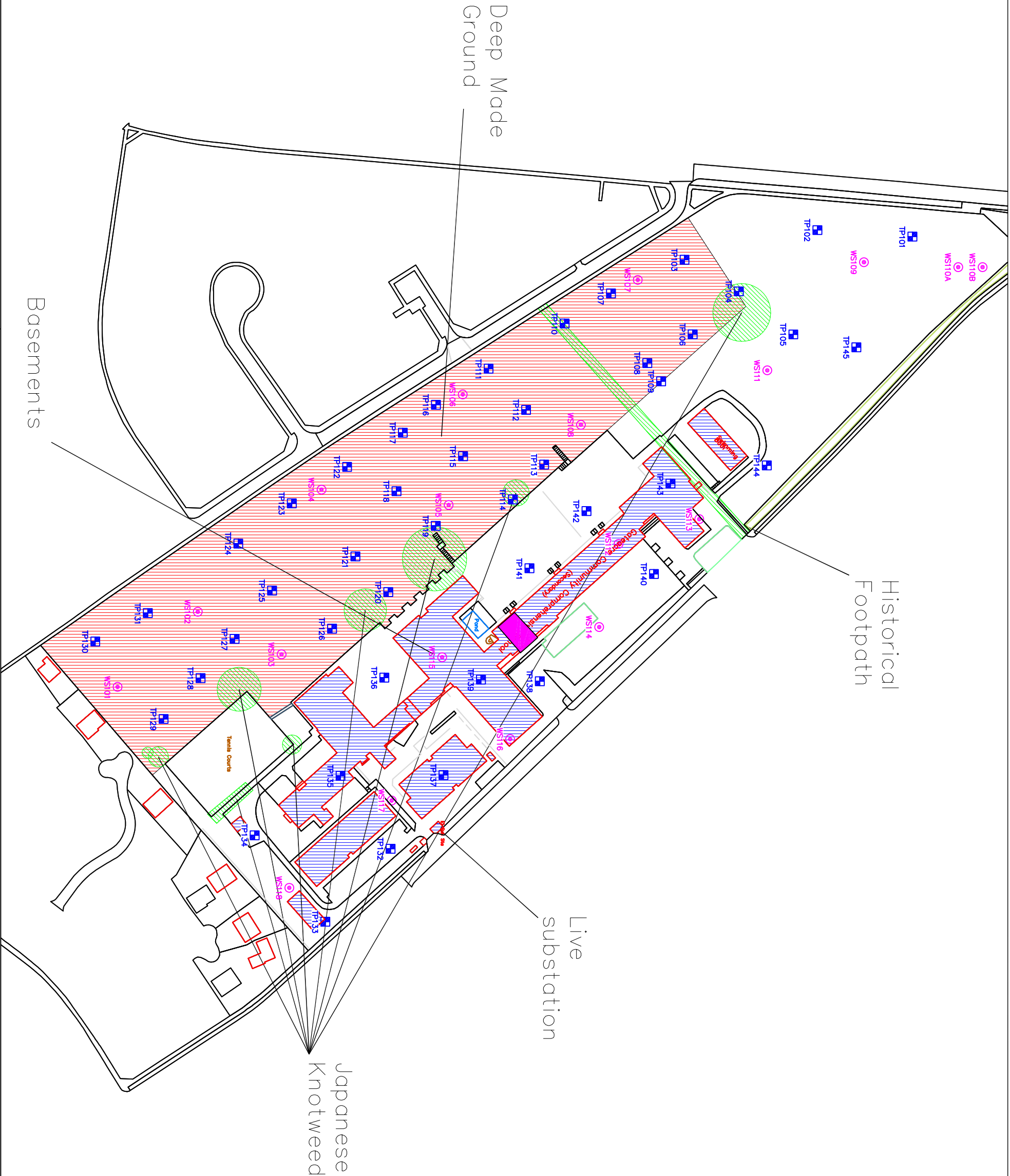
Area of Gateacre High School,
significant depths of Made
Ground due to presence of
unknown quantity of basements
and infill.

Former Boiler House



The client must not amend any
drawing, design or other intellectual
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of the amendments being made, REC
Ltd. shall not be liable for any damage
and/or losses occurring as a result of
the amended drawing, design or
intellectual property.





Schedule

Cole	@ 710sqft x 16
Langford	@ 893sqft x 16
Ashop	@1075sqft x 15
Dunham	@1165sqft x 20
Rockingham	@1238sqft x 25
Saytridge	@1249sqft x 08
Can	@1235sqft x 10
Rubrie	@1288sqft x 11
The Galsion	@1380sqft x 17
The Mellon	@1442sqft x 06
The Cannock	@1543sqft x 09
The Rufford	@1623sqft x 10
The Hetherton	@1695sqft x 11
The Rushall	@1753sqft x 05
New type	@2245sqft x 03
New type	@2254sqft x 06
New type	@2282sqft x 02
New type	@2362sqft x 04
New type	@2435sqft x 02

Total

Area	197
	19.5acres
	10.10 UPR
	145.87 sqft/acre

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APPENDIX IV
REC REMEDIATION / VALIDATION CRITERIA

Former Gateacre School – Remediation Targets

Determinand	Units	GAC	C4SL	Pathway
Arsenic	mg/kg	32 ⁽ⁱ⁾	37	1
Cadmium	mg/kg	10 ⁽ⁱⁱ⁾	26	5
Chromium (VI)	mg/kg	4.3 ⁽ⁱⁱⁱ⁾	21	1
Lead	mg/kg	-	200	1
Mercury	mg/kg	11 ⁽ⁱ⁾	-	2
Nickel	mg/kg	130 ⁽ⁱ⁾	-	1
Selenium	mg/kg	350 ⁽ⁱ⁾	-	1, 5
Copper	mg/kg	2330 ⁽ⁱⁱⁱ⁾	-	1, 5
Zinc	mg/kg	3750 ⁽ⁱⁱⁱ⁾	-	5
Cyanide - Total	mg/kg	791 ⁽ⁱⁱⁱ⁾	-	1
Asbestos	-	N.D. ^(iv)	-	2
Phenols - Total.	mg/kg	210 ⁽ⁱⁱⁱ⁾	-	5
Benzene	mg/kg	0.33 ⁽ⁱ⁾	0.87	2, 5
Toluene	mg/kg	610 ⁽ⁱ⁾	-	2, 5
Ethylbenzene	mg/kg	350 ⁽ⁱ⁾	-	2, 5
o-xylene	mg/kg	250 ⁽ⁱ⁾	-	2, 5
m-xylene	mg/kg	240 ⁽ⁱ⁾	-	2, 5
p-xylene	mg/kg	230 ⁽ⁱ⁾	-	2, 5
Naphthalene	mg/kg	1.5 ⁽ⁱⁱⁱ⁾	-	2
Acenaphthylene	mg/kg	170 ⁽ⁱⁱⁱ⁾	-	3
Acenaphthene	mg/kg	210 ⁽ⁱⁱⁱ⁾	-	1
Fluorene	mg/kg	160 ⁽ⁱⁱⁱ⁾	-	1
Phenanthrene	mg/kg	92 ⁽ⁱⁱⁱ⁾	-	3
Anthracene	mg/kg	2300 ⁽ⁱⁱⁱ⁾	-	3
Fluoranthene	mg/kg	260 ⁽ⁱⁱⁱ⁾	-	3
Pyrene	mg/kg	560 ⁽ⁱⁱⁱ⁾	-	3
Benzo(a)Anthracene	mg/kg	3.1 ⁽ⁱⁱⁱ⁾	-	3
Chrysene	mg/kg	6 ⁽ⁱⁱⁱ⁾	-	3
Benzo(b/k)Fluoranthene	mg/kg	5.6 ⁽ⁱⁱⁱ⁾	-	3
Benzo(a)Pyrene	mg/kg	0.83 ⁽ⁱⁱⁱ⁾	5	3
Indeno(123-cd)Pyrene	mg/kg	3.2 ⁽ⁱⁱⁱ⁾	-	3
Dibenzo(a,h)Anthracene	mg/kg	0.76 ⁽ⁱⁱⁱ⁾	-	3
Benzo(ghi)Perylene	mg/kg	44	-	3
TPH C ₅ -C ₆ (aliphatic)*	mg/kg	30 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₆ -C ₈ (aliphatic)*	mg/kg	73 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₈ -C ₁₀ (aliphatic)*	mg/kg	19 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₁₀ -C ₁₂ (aliphatic)*	mg/kg	93 ⁽ⁱⁱⁱ⁾	-	1
TPH C ₁₂ -C ₁₆ (aliphatic)*	mg/kg	740 ⁽ⁱⁱⁱ⁾	-	1
TPH C ₁₆ -C ₃₅ (aliphatic)*	mg/kg	45000 ⁽ⁱⁱ⁾	-	1
TPH C ₅ -C ₇ (aromatic)*	mg/kg	65 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₇ -C ₈ (aromatic)*	mg/kg	120 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₈ -C ₁₀ (aromatic)*	mg/kg	27 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₁₀ -C ₁₂ (aromatic)*	mg/kg	69 ⁽ⁱⁱⁱ⁾	-	2
TPH C ₁₂ -C ₁₆ (aromatic)*	mg/kg	140 ⁽ⁱⁱⁱ⁾	-	1
TPH C ₁₆ -C ₂₁ (aromatic)*	mg/kg	250 ⁽ⁱⁱⁱ⁾	-	1
TPH C ₂₁ -C ₃₅ (aromatic)*	mg/kg	890 ⁽ⁱⁱⁱ⁾	-	1

Notes

Pathway: 1 = Soil Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact & Ingestion, 4 = Dust Inhalation 5 = Consumption of home-grown produce and attached soils

Abbreviations: GAC = General Assessment Criteria, C4SL = Category 4 Screening Level, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance.

GAC Tier 1 Origin

(i) 2009 Soil Guideline Value (SGV);

(ii) LQM/CIEH Generic Assessment Criteria for 1% Soil Organic Matter (SOM);
(iii) CLEA 1.06 Derived Value;
(iv) N.D = Not Detected

APPENDIX V
REC REMEDIATION EXCAVATION RECORD

REMEDATION EXCAVATION RECORD

Contract Reference No. and Title	
Location of Excavation (co-ordinates/grid ref/plot no./other)	
Date of Excavation: Started / Completed	
STAGE 1 – Justification / purpose of Excavation	
STAGE 2 – Brief description of excavation to be carried out:	
Volume of Material Excavated:	Destination of Excavated Material:
Photos Taken of Excavation:	Method of Validation:
Date Validation carried out:	Validation Details:
STAGE 3 – Backfill Instructions:	
Date Backfilled:	
Other Notes:	

APPENDIX VI
REC COMPACTION SPECIFICATION

REC LTD GEOTECHNICAL EARTHWORKS SPECIFICATION

It is proposed to regrade the site to form a working platform to the required working level in accordance with the proposed formation levels drawing to be submitted separately. This work will include, but not necessarily be limited to, the following elements.

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

LOCALLY WON FILL MATERIAL

It is proposed regrade 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 site will be predominantly granular in matrixes. Because of the long term settlement associated with even well compacted cohesive soils due to elevated pore water pressures, it is essential that the cut and fill process is well controlled.

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 November 2005; and,
- Soils for Civil Engineering Purposes, BS1377, 1999.

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 other of the following general classifications as defined in Table 6/1 of the Specification for Highway Works.

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

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.

GENERAL REQUIREMENTS

The contractor shall employ only plant and working methods which are suited to the materials to be handled and traversed. He 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.

Land Use	Compaction Methodology
Building Structure Footprint	-
Adopted Highways	Method Compaction – Highways Design Manual Series 600
Estate Roads	End Product Specification - Highways Design Manual Series 600
Car Park	Compaction to achieve CBR of 5%
Gardens, POS & Other External Areas	Compaction to achieve CBR of 5%

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

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 when sufficient spreading and compaction. Plant is operating at the place of deposition to ensure compliance with Clause 612 of the Highways specification.

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 require3d to be deposited separately shall be excavated separately without contamination by other classes of material.

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

The Contractor shall ensure that he does not adversely affect the stability of excavations or fills by his methods of stockpiling materials, use of plant or sitting 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 2.0m; 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:

- (i) arranging the rapid removal of water:
 - (a) shed on to the earthworks
 - (b) entering the earthworks from any source
- (ii) provide where necessary temporary watercourses, drains, pumping and the like:
- (iii) discharge accumulated water and groundwater into the permanent outfalls of the drainage system where practicable
- (iv) provide adequate means for trapping silt on temporary systems discharging into permanent drainage systems.

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

Where materials are designated either Class U1B or Class U2 (according to the Highways Specification), 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.

CONSTRUCTION OF FILLS - HIGHWAYS

All fills shall be constructed:

- (i) in the locations as shown in the contract drawings to the lines and levels stated therein;
- (ii) of classes of material complying with this specification;
- (iii) by deposition, as soon as practicable after excavation, in layers to meet the compaction requirements as required for each Class of material as specified.
- (iv) 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:

- (i) The base is sound and stable by excavating and removing any topsoil as soft subsoil.
 - (ii) Base layers are not exposed until the fill layer is ready for placement.
 - (iii) Un-compacted material on the side slopes of previously backfilled zones shall be removed and benches of between 1.0m and 1.5m 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 1.0m and 1.5m in height.

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

Temporary slopes within compacted and un-compacted backfill shall be formed at gradients which ensure stability.

COMPACTION OF FILLS – Adopted Highways, Estate Roads & Car Park

The Contractor shall carry out compaction upon the materials which 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 which requires 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 to 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 compactive effort is being compacted.

If the results of field tests show densities which indicate the state of the compaction to be inadequate, and if this is due to failure on 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 Highway specification for definition of plant to be used in accordance with this specified works.

The Contractor will be responsible for assessing the Class of Fill in accordance with Table 6/1 of the Highways Specification. Table 6/4 of the Highways Specification 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.

EARTHWORKS MATERIALS 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 following:

Test	Test Method				
Liquid and plastic limits	BS1377: Part 2				
Grading	BS1377: Part 2				
Uniformity Co-efficient	Calculated from grading curve				
Moisture content	BS1377: Part 2				
Organic Matter (maximum 2.5% total organic content)	BS1377: Part 3				
Water soluble sulphate	TRL Report 447 test No 1				
Total sulphate content	TRL Report 447 Test No 4				
EARTHWORK INSITU 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 of 3%)</td><td>BS1377: Part 9</td></tr></table>	Test	Test Method	Plate load tests (equivalent CBR of 3%)	BS1377: Part 9	Clause 632 (BS1377: Part 4)
	Test	Test Method			
	Plate load tests (equivalent CBR of 3%)	BS1377: Part 9			
DISPOSAL OF MATERIALS The contractor shall be responsible for the safe disposal of any excess of unsuitable material found on the Site. Multi Point Moisture Condition Value (MCV) (to assess optimum moisture content)					
Proctor compaction testing	BS1377: Part 4				

During the construction of the fill the testing outlined above shall be undertaken at on suitable frequency of fill or when the source of the fill changes. The results of this work shall be submitted to the Consulting Engineer for approval.