Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG
01233 646237

Land off Sheppey Way, Iwade, ME9 8GN

Geo-Environmental Investigation

On Behalf of Middlefields Limited

Document Reference: 12775 March 2022

Site: Land off Sheppey Way, Iwade, ME9 8GN

Document Reference No: 12775

Quality Management

Prepared by:	**PJ/JF/JM**
Reviewed by:	**KM**
Authorised by:	**KM**
Date	**March 2022**
Revision	**0**

Table of Contents

Figures

Appendices

1 INTRODUCTION

Ground and Environmental Services Ltd (GES) was commissioned Middlefields Limited (The Client) to undertake a Geo-Environmental Investigation on a proposed redevelopment site at Land off Sheppey Way, Iwade ME9 8GN.

It was understood that the proposed redevelopment of the site would comprise the construction of 14 bungalows and chalet bungalows together with 21 communal car parking spaces and amenity space (See Appendix 1 for Proposed Site Layout Plan).

The principal objectives of the ground investigation were to provide geotechnical recommendations to aid foundation, ground floor slab, pavement and temporary works design for the proposed development.

In addition, contamination testing and a soil gas and groundwater survey were carried out to provide a preliminary assessment of contamination issues based on current Contaminated Land Legislation.

2 SITE LOCATION AND LAYOUT

The site is located in the village of Iwade, in a predominantly rural setting, immediately to the West of Sheppey Way and is centred on approximate ordnance survey grid reference centre: TQ 899 671.

Access to the development site was gained from the East via Sheppey Way and is roughly rectangular in shape.

At the time of the ground investigation, the site appeared to be disused agricultural land.

Features bordering the site are as follows:

- To the North and Northwest, the site is bound by residential buildings
- To the South and West, an access track and agricultural land
- To the East, Sheppey Way.

3 ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey 1:50,000 scale geological map of the area indicates that the geology underlying comprises of soils of the London Clay Formation, with superficial Head deposits anticipated throughout the site.

The geological memoir for the area described these strata as follows:

Head Deposits

Head is poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes. Solifluction is the slow viscous downslope flow of waterlogged soil and other unsorted and unsaturated superficial deposits. The term gelifluction is restricted to the slow flow of fluidized superficial deposits during the thawing of seasonally frozen ground. The flow is initiated by meltwater from thawing ice lenses. Polymict deposit: comprises gravel, sand and clay depending on upslope source and distance from source. Locally with lenses of silt, clay or peat and organic material.

London Clay Formation

The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels.

3.2 GROUNDWATER

Reference to the British Geological Survey 1:50,000 scale Aquifer Designation Dataset, shows the site to be set upon Unproductive Strata, in both the superficial Head deposits, and the underlying London Clay Formation.

Unproductive Strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

The site is not located within a Groundwater Source Protection Zone.

3.3 RADON

Reference to the National Radiological Protection Board's "Radon Atlas of England and Wales" indicated that less than one percent (<1%) of houses within the 5 km square which includes the site have radon concentrations above the action level of 200 Bq/m³. The site is therefore not located within a "Radon Affected Area" and therefore no special measures need be incorporated into buildings.

4 INTRUSIVE INVESTIGATION

4.1 FIELDWORK

The site works were carried out between the 4th February and the 18th February 2022 and comprised the following:

- Window Sampling
- Dynamic Cone Penetrometer Testing
- Soil Gas and Groundwater Level Monitoring

The positions of the above works on the site are indicated on Figure 1, Exploratory Hole Location Plan.

Window Sample Holes

Eight window sample holes (WS1 to WS8) were excavated to depths ranging from 3.0m to 4.0m using a track mounted Premier 110 window sampling rig.

The soils and materials encountered in the holes were logged and representative samples recovered for laboratory analysis. Standard penetration tests were also carried out in the window sample holes using either the split spoon or solid cone attachment as appropriate to the ground conditions encountered.

Window sample holes WS1, WS2, WS3 and WS7 were completed with 35mm diameter groundwater monitoring standpipes installed to the full depth of the test hole, which was 4.0m. Window sample holes WS4, WS5, WS6 and WS8, which were excavated to a depth of 3.0m, were backfilled with arisings and surface coverings made safe. Window sample logs and installation details are presented in Appendix 2.

Dynamic Cone Penetrometer Testing

Eight dynamic cone penetrometer (DCP1 to DCP8) tests were undertaken in the proposed new driveway/car parking areas. The dynamic cone penetrometer (DCP) uses an 8 kg hammer dropping through a height of 575 mm and a 60° cone having a maximum diameter of 20 mm. Penetration depth is recorded after every blow. The DCP is a Penetrometer device used to provide a measure of in situ CBR. Blow count readings were converted to an equivalent CBR, which is displayed in the results tables presented in Appendix 3. The TRRL equation was used to calculate the equivalent CBR value from the DCP results.

Soil Gas and Groundwater Level Monitoring

A soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the window sample hole standpipes installed at the site. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipe for concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2).

The gas and groundwater level monitoring results are presented in Appendix 4.

4.2 GROUNDWATER

Groundwater was generally not recorded during the fieldwork however was recorded as per the table below, as part of the subsequent post-fieldwork monitoring.

WS Ref.	08/02/2022	11/02/2022	18/02/2022
	Depth to Water (mbgl)	Depth to Water (mbgl)	Depth to Water (mbgl)
WS1	2.10	1.90	1.95
WS2	1.70	1.30	2.15
WS3	1.70	1.60	1.75
WS7	1.90	1.80	1.85

It should be noted that groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other causes.

5 LABORATORY TESTING

5.1 GEOTECHNICAL TESTING

The following range of laboratory tests were scheduled, and the results are presented in Appendix 5.

i. Determination of Natural Moisture Content (17 no.).
ii. Determination of Atterberg limits (17 no.).
iii. Determination of Particle Size Distribution (1 no).
iv. Determination of pH (12 No.). See Appendix 6.
v. Determination of water soluble sulphate (12 No.). See Appendix 6.

5.2 ANALYTICAL TESTING

Eight soil samples were selected and scheduled for chemical analysis which was undertaken by DETS Ltd. All soil samples were analysed for a general screening suite of contaminants considered appropriate to the current usage and past history of the site and surrounding area.

Toxic Metals	Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic Cadmium Chromium Lead Mercury Nickel Selenium	Water Soluble Boron Copper Nickel Zinc	Water Soluble Sulphate pH Asbestos	Total Polyaromatic Hydrocarbons (PAH) Mineral oils Total Petroleum Hydrocarbons (TPH)

Two samples were analysed for the presence of Organochlorine Pesticides, considered appropriate based on the site's use as farmland. In addition, a composite sample of arisings was prepared and submitted for analysis in accordance with the Environment Agency's waste acceptance criteria (WAC) for the off-site disposal of soils.

Soil samples were stored in appropriate containers as specified within BS10175. The containers comprised of 1 kg capacity plastic containers with fitted lids.

Where organic compounds were to be determined, inert containers, which prevent loss by absorption, or volatilization, i.e. wide-mouthed amber glass containers, were used.

Samples were stored in appropriately cooled cool boxes and were transported to the laboratory as quickly as possible in order to minimise any potential for chemical and biological changes to take place.

The results of the analytical testing are presented in Appendix 6.

6 GROUND CONDITIONS

This ground investigation found Made Ground over soils typical of superficial Head Deposits.

Made Ground

Made Ground was encountered in all window sampling holes and comprised dark brown sandy to silty clay with fragments of asphalt and red brick. Frequent fine roots were present in all locations.

Head Deposits

Soils typical of Head Deposits were found in all window sampling holes and proven to the base of the holes which terminated at depths ranging between 3.0m and 4.0m.

The soil sequence comprised predominantly soft to firm silty and very silty clay. Within the silty clay soils were gravels comprising hard chalk and coarse to cobble-sized angular and sub-angular flint. Slightly clayey silty sandy gravel was found in WS2, from a depth of 3.6m to the base at 4.0m.

Standard penetration tests carried out within the Head Deposits recorded N values in the range 4 to 26 (soft, firm and very stiff) with the majority of test results being in the range 4 to 9 (soft to firm). See Figure 2 for a plot of SPT vs depth profile and Figure 3 for a plot of SPT N_{60} vs depth profile.

Tactile observations recorded the clays soils as soft to firm becoming firm.

Classification testing on the predominant cohesive soils recorded clay soils of low to intermediate plasticity with plasticity indices in the range 12 to 23% measured. The test results indicated that the soil would have a low to medium shrink/swell potential with the majority classified as low shrink/swell potential.

Particle size distribution testing on the granular soils found in WS2 between 3.6m and 4.0m recorded slight clayey silty sandy gravel with a fine fraction of 20.2% recorded.

Based on the soil descriptions and the in situ and laboratory testing carried out, the following parameters would be considered appropriate for the Head Deposits:

Cohesive (clays with mudstones);

Undrained Shear Strength*	S_u = 35 kN/m^2 at 1.0 m soft, low strength.
	increasing linearly to;
	S_u = 45 kN/m^2 below 1.5 m firm, medium strength

	Very stiff, very high strength.
Coefficient of compressibility*	m_v = 0.28 m^2/MN at 1.0 m increasing to 0.22 m^2/MN at 1.5 m (medium compressibility)
Bulk density	ρ_B = 18 - 19 kN/m^3
Volume Change Potential (VCP)	Low
Permeability	Low
Frost Susceptible	Yes (locally)
CBR	Poor

* Derived from SPT N values

7 ENGINEERING DESIGN

7.1 FOUNDATION DESIGN OPTIONS

At the time of reporting, applied structural loads were unknown. However, it is known that the proposed redevelopment of the site would comprise the construction of 14 bungalows and chalet bungalows. For preliminary foundation design purposes a maximum line load of 60kN/m run has been adopted.

In deliberation of suitable foundation options consideration was given to the geotechnical hazards and risks as presented below:

Geotechnical Hazard	Qualitative Risk & Consequences	Possible Risk Reduction Measures
Existing underground structures such as service runs and old footings.	**Low** Implication for foundation depth and economic feasibility of shallow foundations.	New foundations to be constructed in undisturbed ground or alternatively disturbed ground to be removed and replaced with suitable engineering fill.
Shrinkage/swelling of foundation soils due to action of tree roots.	**Low to Medium** Foundation movement and cracking of brickwork.	Follow NHBC guidance on building near trees for low shrink/swell potential soils
Variations in stiffness of ground below foundation depth that could give rise to unacceptable total and differential settlement.	**Medium** Buildings particularly sensitive to differential settlement. Would result in cracking of superstructure if conventional brickwork or brick cladding.	Calculate likely magnitude of settlement and determine if within acceptable tolerances. Make foundations act as reinforced beams. Include movement joints if and where necessary.

Based upon the ground conditions found consideration has been given to founding the proposed new structures on conventional shallow foundations.

Shallow Strip Foundations

Foundation Depths

Strip footings founded within the Head Deposits will provide a suitable foundation solution for the proposed new structures. A minimum foundation depth of 1.0m is recommended.

Allowable Bearing Pressure and Foundation Sizing

Based on field observations, in situ testing and laboratory test results, a maximum allowable bearing of 80kN/m^2 is recommended for foundations placed at a minimum depth of 1.0m. At a depth of 1.5m a maximum allowable bearing of 100kN/m^2 is recommended for shallow foundations.

Adopting a line load of 60kN/m run minimum foundation widths of 0.75m and 0.6m are recommended for founding depths of 1.0m and 1.5m respectively.

Settlement

The results of the calculations indicated total settlements would be in the order of 25mm for foundations placed at 1.0m and 20mm for foundations placed at 1.5m. Approximately 10% of this settlement would be immediate and therefore 'built out' during construction. The remainder would be long term consolidation settlement.

7.2 GROUND FLOORS

NHBC guidance advises that suspended ground floors should be adopted when the plasticity index (PI) of the founding soils is greater than 10%.

Based upon the results of this ground investigation it is recommended that suspended ground floor slabs are adopted.

7.3 TEMPORARY WORKS

Excavations in excess of 1.2m depth may be required in connection with the proposed development on this site. If there is a requirement for personnel to enter into excavations, then the need for trench side support should be considered for any depth of excavation and, therefore, appropriate equipment should be available on site prior to excavation proceeding. A site specific risk assessment should be carried out where man entry into excavations is required.

The base of foundation excavations should be inspected and any soft loose, organic or otherwise deleterious material at foundation level removed and replaced with lean mix concrete. The soils encountered will be liable to softening/loosening when exposed to surface water infiltration. In order to avoid deterioration of the prepared formation the base of foundations should be blinded with concrete as soon as practical after excavation and particularly if there is delay before placing foundation concrete.

7.4 ROADS/HARDSTANDING

The results of in situ DCP tests indicated CBR values in the range 2 to 25% although below a typical formation level of 0.45m CBR values were generally in the range 4 to 9%.

For preliminary design purposes it is recommended that a CBR value of 4% should be adopted. The soils encountered during this ground investigation are considered frost susceptible therefore road construction should have a minimum of thickness of 450 mm.

7.5 CHEMICAL ATTACK ON BURIED CONCRETE

The results of the chemical testing indicated a concentration of water-soluble sulphate in neutral to slightly alkaline with a range between 6.8 and 7.9 pH units.

In accordance with BRE Special Digest 1 (SD1:2005) entitled 'Concrete in Aggressive Ground' a design sulphate class for the site of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

8 GROUND CONTAMINATION ASSESSMENT

The current guidelines used for this contamination assessment are presented within Appendix 7.

The contaminant concentrations encountered as part of this investigation have been compared against either Land Quality Management Generic Assessment Criteria (LQM GAC) for a residential development, the Chartered Institute of Environmental Health's (CIEH) Suitable for Use Levels (S4USL), or where available against newly published Category 4 Screening Levels (C4SLs) for a Residential (with home-grown produce) end use. Where neither guidelines have limit values, Contaminated Land Exposure Assessment (CLEA) framework guideline limit values have been assessed.

Category 4 Screening Levels (C4SLs) have currently been published for six substances as per the table below.

Substance	Residential (with home-grown produce)	Residential (without home-grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37	40	49	640	79	170
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)Pyrene	5.0	5.3	5.7	77	10	21
Cadmium	22	150	3.9	410	220	880
Chromium VI	21	21	170	49	21	250
Lead	200	310	80	2300	630	1300

All concentrations expressed in mg/kg

This table should be read in conjunction with the Final C4SL R&D Report

8.1 SOIL QUALITY

In terms of any proposed redevelopment of the site, the results of the analysis of the selected soil samples recovered during the site investigation indicated that the concentrations of *metals and metalloids* considered to be potentially toxic to humans were below the respective guideline values in all samples tested.

Organic contamination across the site was low and concentrations which may be considered to pose an unacceptable risk to human health should any viable pathway exist were not encountered.

Concentrations of organochlorine pesticides were generally below the detection limit of the analytical method used.

Asbestos contamination was not encountered within any of the soil samples analysed.

A comprehensive description of the soil quality as measured as part of the intrusive site investigation is given below.

8.1.1 Toxic Metals

Concentrations of toxic metals arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc were all below their respective soil guidance values for either a residential development under the CLEA/LQM GAC guidelines and the C4SL guideline values for residential (with home-grown produce) where appropriate in all soil samples tested.

8.1.2 Phytotoxic Metals

Concentrations of phytotoxic metals copper, zinc and nickel were compared against the maximum permissible concentration in the Sewage Sludge (Use in Agriculture) Regulations 1989.

Concentrations of copper, nickel, and zinc were found to be below the maximum permissible concentration for use on soils for the relevant pH level in all of the analysed soil samples.

8.1.3 Organic Compounds

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of total PAH were significantly below the inert waste acceptance criteria of 100 mg/kg as detailed in the Landfill (England and Wales) (Amended) Regulations 2004 in all of the samples tested.

Benzo(a)pyrene (B(a)P)

All B(a)P concentrations were below the C4SL guideline limit value of 5.0 mg/kg for a residential (with home-grown produce) end use.

All other speciated PAH compounds were also below their respective guideline values.

Total Petroleum Hydrocarbons

Concentrations of TPH were low and were significantly below the inert waste acceptance criteria of 500 mg/kg as detailed within the Landfill (England and Wales) Regulations 2004 and also within the UK Water Industry Research (UKWIR) in all soil samples tested.

Generic Assessment Criteria (GAC) for total petroleum hydrocarbons according to both their molecular weight and chemical structure and also for a range of soil organic matter (SOM) content values have been derived using CLEA software. The LQM CIEH GACs are presented according to their soil organic matter content and proposed end use of the land.

Comparison of the measured TPH data with the worst-case scenario constituent compounds and their GAC limit values was made to provide a conservative assessment of the organic contamination. The maximum TPH concentration recorded on site during the site investigation was 19 mg/kg within WS8 (0.3 m) comprising 11 mg/kg within the C21-C35 range which is significantly below the absolute worst-case relevant GAC limits for C21-C35 aromatic compounds of 1100 mg/kg.

The TPH concentrations recorded on site within WS8, and hence the other locations across the site, were therefore below the relevant GAC limit for their respective range and would therefore not be considered to pose a significant risk of significant harm to human health.

Pesticides

Concentrations of Organochlorine Pesticides were generally below the detection limit of the analytical method used. DDE was detected in a trace amount of 0.05 mg/kg. Concentrations of DDD and DDT were below the limit of detection for the analytical method used. No limit values are set in the UK for organochlorine pesticides in soils, however the concentrations detected within the near surface soils on site are considered to be low when compared with limit values set by EU countries, notably the Netherlands, which have a limit value of 2.3 mg/kg for DDE, 34 mg/kg for DDD and 1.7 mg/kg for DDT, in soils.

8.1.4 Inorganic Compounds

Concentrations of water-soluble sulphate close to surface were found to range from below the analytical detection limit of 10 mg/l to 63 mg/l (as SO_4) within the analysed soil samples. The pH values were very slightly acidic to neutral with values ranging between 6.8 and 7.8 units.

8.1.5 Asbestos

Asbestos screening of the soil samples did not identify any Asbestos Containing Material (ACM).

8.2 SOIL GAS

Three gas monitoring visits were undertaken between the 8th February and the 18th February 2022.

During the visits, a soil vapour survey was undertaken which comprised the monitoring of the atmosphere within the installed Window Sample Hole standpipes. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipes for concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2).

For determining the gas protection measures which may be required in low rise buildings with a beam and block floor there is published guidance from the NHBC for use on

residential developments which utilises a traffic light system of classification. For larger buildings the guidance in CIRIA 665 and BS8485 is used.

Reference has also been made to the British Standard Code of Practice BS8485:2015, *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* and regard has been given to the recommendations presented therein. The processes set out in BS8485 represent good practice and is based on the CIRIA C665 document.

In addition CIRIA document C735, *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* has also been referenced.

The results obtained from the short-term soil gas monitoring undertaken indicated that slightly elevated concentrations of soil gas *were present* in the soils underlying the site. The soil gas results are attached at Appendix 4.

The results obtained from the soil gas survey undertaken indicated that elevated carbon dioxide concentrations were recorded within the void of WS2 during the second and third monitoring periods which was in excess the action level of 5%. It should be noted that the remaining voids did not indicate elevated carbon dioxide concentrations during the monitoring visits.

Methane concentrations were below the action level of 1% at all locations.

Measurement of gas flow indicated a maximum gas flow rate of 0.1 l/hr.

9 CONTAMINATION RISK ASSESSMENT

This risk assessment has been undertaken with due regard to the advice relating to groundwater as provided in the Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", the advice provided in the Contaminated Land (England) Regulations 2000, and the associated statutory guidance. The guidance defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- significant harm is being caused or there is a significant possibility of such harm being caused; or

- pollution of controlled water is being or is likely to be caused.

This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, that is a linkage between a contaminant and a receptor by means of a pathway.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination. This risk assessment is based on the proposed construction of 14 bungalows and chalet bungalows together with 21 communal car parking spaces and amenity space.

The significance of the risks to the receptors/targets identified is based on an evaluation of the potential pathways between the contaminant source and receptors based on a residential with plant uptake end use of the site.

Potential receptors/targets at the site and in the area in which the site is located include:

- future users and the public;
- construction/maintenance workers;
- groundwater resources;
- underground services in and around the site;
- planting in areas of private gardens and soft landscaping;

9.1 CONTAMINANT SOURCES

The following general potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current and Historic Site Use	Near surface in-fill/ reworked material of unknown origin.	PAH, Metals, ACM
	Farmland	Pesticides
	Near surface made ground of unknown origin.	Ground Gases (Methane and Carbon Dioxide)
Current and Historic Surrounding Land Use	Farmland	Pesticides

No visual or olfactory evidence of organic contamination was noted during the intrusive investigation.

The analytical testing of soils retrieved as part of the intrusive investigation did not generally reveal any significantly elevated contaminant concentrations present above their respective guideline values. The risks associated with these contaminants are discussed below.

9.2 RISK TO HUMAN HEALTH

Toxic Metals

Concentrations of toxic metals arsenic, cadmium, chromium, lead, mercury, nickel, selenium, and zinc were all below their respective soil guidance values for a residential (with plant uptake) end use in all samples tested in this site investigation, therefore the risks to human health from these contaminants is considered to be low.

Organic Compounds

Concentrations of the organic compounds total PAH and total TPH, were low across the site and would therefore not be considered to pose a significant risk of significant harm to human health.

Concentrations of Organochlorine Pesticides were low across the site and would therefore not be considered to pose a significant risk of significant harm to human health.

Inorganic Compounds

Asbestos containing material (ACM) was not encountered at the site. Therefore the risk to human health is considered low.

On the balance of the toxicological risks posed by the ground contamination encountered as part of the intrusive investigation undertaken by GES, it is considered that the potential risks to site workers and future occupants could be adequately controlled as follows:

Site Workers

- Provision of appropriate personal protective equipment and hygiene facilities.
- Good working practice in line with current legislation when safely handling and disposing of asbestos material.
- Provision of appropriate dust suppression, to minimise the generation of potentially contaminated suspended particulates during site works.

Future Occupants

Elevated levels of contaminants which could pose a risk to future occupants have not been encountered in the soils recovered as part of the intrusive site investigation.

9.3 RISKS TO WATER RESOURCES

The geology underlying the site comprises the London Clay Formation overlain by superficial Head Deposits, both of which are designated as Unproductive Strata. The site is not situated within a Groundwater Source Protection Zone.

Significant levels of potentially soluble and therefore mobile organic contaminant sources were not measured on site within the samples tested. In the absence of any significant potential contaminative source, it is therefore considered the risks to groundwater and surface water resources are low.

9.4 RISKS TO PLANTS

The concentrations of potentially phytotoxic metals copper, zinc and nickel were all below their respective maximum permissible concentrations used in the Sewage Sludge (Use in Agriculture) Regulations 1989 for their relevant soil pH.

Furthermore, there are no signs of phytotoxic stress in any of the vegetation noted across the site.

Therefore, the risk to plants is considered low. Should additional growth media be required this may need to be imported and its suitability confirmed by means of some validation testing.

9.5 RISKS TO BUILDINGS & SERVICES

The risks to buried services from organic contamination such as TPH, which can degrade/permeate plastics and other polymer materials used to supply potable water is considered to be negligible.

Based on current guidance, the need to protect incoming water supplies, e.g. by the use of barrier pipes, is unlikely given the contaminant levels encountered as part of this investigation however it is always advisable that confirmation from utility suppliers should be sought.

9.6 GAS RISK ASSESSMENT

The levels of soil gas underlying the site have been monitored as part of a short-term soil gas monitoring programme carried out across the site between 8th February and 18th February 2022. The results obtained from the soil gas survey indicate that slightly elevated levels of soil gas, which may require gas protection measures to be incorporated into the development, are present on site. No significantly elevated gas flow rates were recorded during the monitoring.

The highest carbon dioxide concentration encountered on site during this current investigation was measured in WS2 at 7.5% which is in excess of the relevant guideline limits of 5%. No significantly elevated methane concentrations were recorded with all concentrations being below the detection limit of the gas analyser.

Measurement of gas emission rates indicates that no significant gas flows are present. The maximum gas flow rate measured on site was 0.1 l/hr which was measured using the GA5000 built-in flow meter.

Based on BS 8485:2015, we have assessed the site based on the gas monitoring undertaken as part of the site investigation in order to calculate a Characteristic Gas Situation (CS).

Based on the worst-case gas characteristic situation, the worst-case implied CS derived by combining the maximum observed concentrations from different gas monitoring standpipes during any monitoring event and a worst-case flow rate of 2.0 l/h are as follows.

Flow Rate (l/h)	CH4 (%)	CO2 (%)	GSV – CH4 (l/h)	GSV – CO2 (l/h)	Implied CH4 CS	Implied CO2 CS
2.0	0.1	7.5	0.001	0.15	1	1

On the basis of the measurements in the table above, the GSV is taken to be 0.15 l/h, which is the worst case for methane and carbon dioxide. A GSV of 0.15 l/h lies within the GSV values for **CS2** (0.07 to <0.7 l/h) which has a low hazard potential.

BS 8485:2015 enables the minimum level gas protection (score) for the site or zones to be determined based on the determined CS and the type of proposed building. Given the proposed end use of the site, a high-risk Type A building has been used for calculating the appropriate gas protection score.

Given that the site has an implied CS2, the minimum gas protection score required for a Type A building is 3.5, which means that gas protection measures would be required as part of the proposed development based on current gas concentrations.

9.7 WASTE DISPOSAL

Although no suspected asbestos containing materials were observed during the site investigation, should any suspected asbestos materials be encountered later on, it should be disposed of to a suitably licensed waste facility. Where dismantling of asbestos is required this should be done by a suitably qualified person or persons. All certification and waste transfer documentation should be retained by the client.

Should an excess volume of soil be required to be disposed of off-site then a waste classification may be required. For a waste classification to be undertaken, materials may need to be subjected to leachate testing which would give an indication to the soluble component of contaminants and, therefore those most toxic to the environment in the waste. The classification will then allow the appropriate disposal pathway to a suitably licensed disposal facility to be determined.

Waste acceptance criteria (WAC) leachate testing was carried out on a composite soil sample from the site. The results are attached at Appendix 6 and show that levels in excess of the inert limit values were not noted within the composite samples of soils. As a preliminary waste assessment and based on the results of materials tested to date, it is considered that the majority of any surplus soils requiring off-site disposal would be classified as EWC 17 05 04 non-hazardous and acceptable at a waste facility licenced to accept inert material.

10 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a system diagram identifying contaminant sources, routes of exposure (pathways), and which receptors are affected by contaminants moving along those pathways.

The model is produced to identify the zones of the site with different potential contaminations characteristics (e.g. whether contaminants in the soil are likely to be on the surface or at depth, distributed over an entire area or in localised 'hot spots').

The conceptual site model presented in the table below is based on the findings of the site investigation undertaken.

Source	Pollutant		Pathway	Hazard		Receptor	Observations/ Recommendations	Assessed Risk
Contaminated ground	Metals, organic (hydrocarbons) could be present	➔	Direct contact, ingestion, inhalation.	Health risks including skin irritation.	➔	Humans: site workers	Normal health and safety precautions. No significantly elevated contaminant concentrations encountered.	Low.
			Surface run off.	Lateral movement to surface watercourses.	➔	Aquatic resources, ecology and subsequent users including humans.	Significant contamination not encountered on site and there are no surface water courses in immediate vicinity of the site.	Low
			Leaching/ Dispersion.	Downward migration to groundwater.	➔	Aquatic resources – Groundwater, abstraction wells) / surface waters.	Significant mobile contamination not present in soils.	Low
			Uptake by plants.	Phytotoxic effects.	➔	Soft landscaped areas / plants.	Significant contamination not present in soils.	Low
			Direct contact	Aggressive chemical attack	➔	Building structures and services	It is considered that protection of services is unlikely to be required on this site however confirmation advice should be sought from Statutory Providers.	Low

Source	Pollutant		Pathway	Hazard		Receptor	Observations/ Recommendations	Assessed Risk
Liquid contaminant sources	Diesel, Petrol and Oils.	➔	Direct contact; ingestion, inhalation.	Health risks including skin irritation. Lateral and vertical migration of contaminants.	➔	Humans: site workers. Groundwater and surface water.	The intrusive ground investigation proved no significant contamination, and no liquid contamination sources were identified on site.	Low
Asbestos	Asbestos fibres within made ground and waste on site	➔	Inhalation.	Health risks including asbestosis, mesothelioma, and lung cancer.	➔	Humans: site workers and future occupants.	Asbestos has not been identified on site. Appropriate PPE should be worn during site works.	Low
Landfill, madeground,	Ground Gases (CO_2, CH_4)		Inhalation and ingress into buildings	Asphyxiation and explosions		Buildings/humans/ future site users	Slightly elevated ground gases have been noted on site. Gas protection measures are recommended in new development.	Low, following installation of gas protection measures as recommended in this report.
Redundant Waste, Demolition Waste			Dermal Contact/ingestion. Potential for migration via surface water run-off	Health Risks		Humans: Site workers	Any unwanted waste on site is to be removed from site during site preparatory works and disposed of in accordance with current legislation. Normal health and safety precautions.	Low

11 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation, intrusive works and subsequent data assessment, the following conclusions and recommendations have been drawn in respect of the site known as Land off Sheppey Way, Iwade, ME9 8GN.

Geotechnical

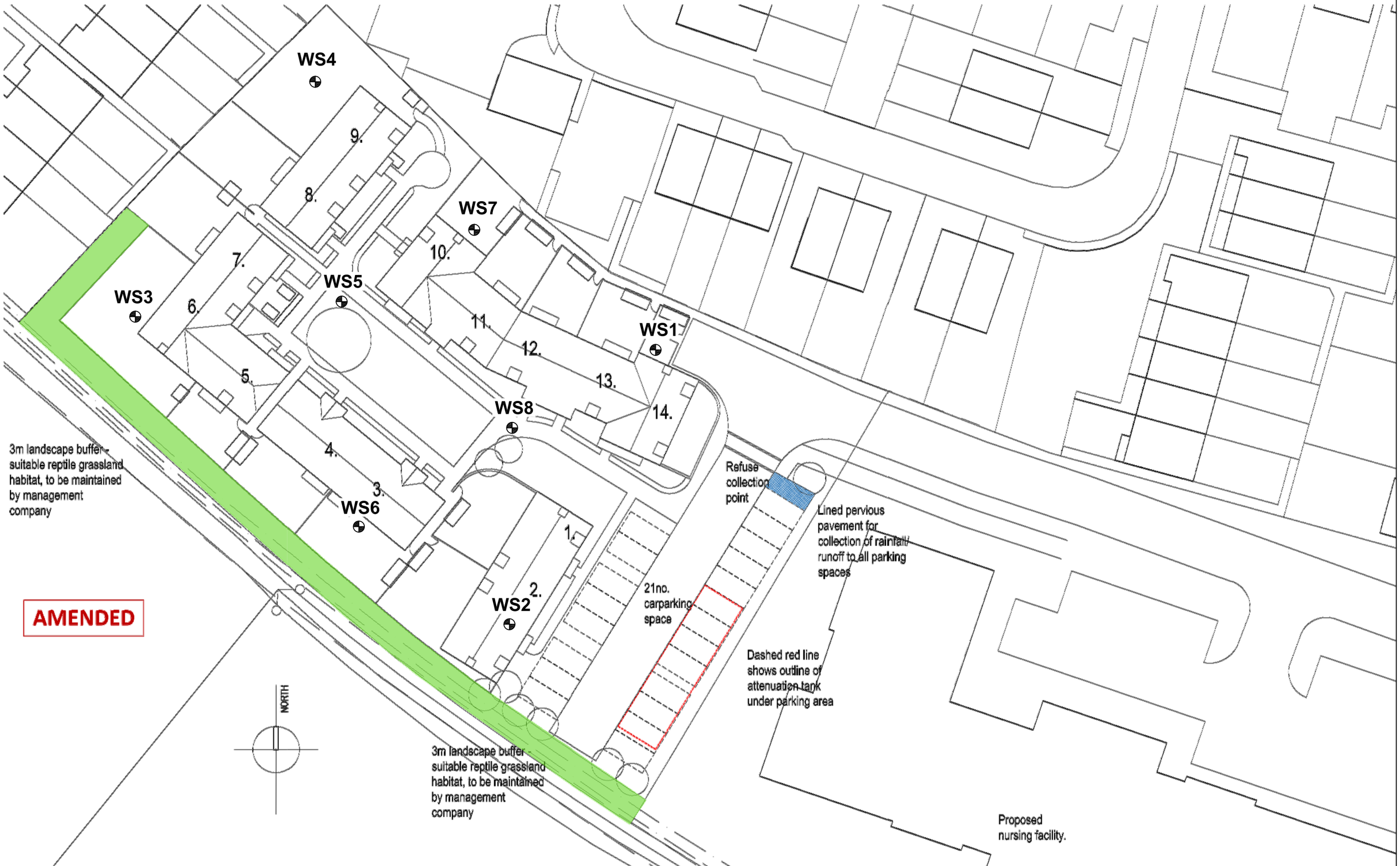
- The ground investigation found soils typical of Head Deposits beneath a surface layer of Made Ground.
- The proposed development was understood to comprises the construction of low rise bungalows and chalet bungalows. For preliminary foundation design purposes, a maximum line load of 60kN/m run was adopted.
- The Head Deposits was identified as a suitable founding stratum.
- Based on field observations an allowable bearing pressure of 80kN/m² is recommended for foundations placed at a minimum depth of 1.0m and an allowable bearing pressure of 100kN/m^2 was recommended for foundations placed at a minimum foundation depth of 1.5m.
- It was therefore recommended that minimum foundation widths of 0.75m and 0.6m are adopted for house foundations placed at depths of 1.0m and 1.5m respectively.
- The results of the settlement calculations predicted total settlements would be 25mm and 20mm for foundations placed at 1.0m and 1.5m respectively.
- Suspended ground floor slabs were recommended.
- For preliminary design purposes it is recommended that a CBR value of 4% should be adopted.
- In accordance with BRE Special Digest 1 (SD1) a design sulphate class for the site of DS-1 and a class of AC-1 is recommended.

Environmental

- The site is located above Unproductive Strata in both the London Clay Formation and overlying superficial Head Deposit. The site is not located within an Environment Agency defined groundwater Source Protection Zone.
- Concentrations of toxic and phytotoxic metals were low and below their respective guidelines in all of the soil samples analysed on site and therefore are not considered to pose a significant risk to human health.
- Concentrations of PAH and TPH were all below the relevant SGVs and therefore are not considered likely to pose a significant risk to human health.

- Concentrations of Organochlorine Pesticides were low, with concentrations below the limit values for soils as set by the Netherlands, in the absence of any UK limit values.
- The risk to flora on site is considered to be low given the absence of significant phytotoxic contamination and the health and vigour of the plants currently on site.
- Asbestos containing material was not detected within soil samples retrieved from the site and no sources of asbestos have been identified therefore the risks to human health from asbestos are considered to be low. Good working practice should be adhered to, along with appropriate PPE, in line with current legislation when undertaking any works on site.
- The risks posed to workers involved in any future redevelopment of the site are not considered significant providing standard health and hygiene practices are adopted.
- Based on low concentrations of organic contaminants found across the site, it is unlikely that any new services, in particular potable water, will require protection, however it is advisable to seek service provider confirmation of this.
- Based on gas monitoring results, the site has been given a classification of CS2 which has a low hazard potential and therefore gas protection measures will need to be incorporated into any new buildings constructed on the site. Alternatively, three further gas monitoring visits could be undertaken to verify the initial findings in this report.
- The risks to groundwater in the underlying unproductive clay strata is considered to be low due to the lack of any significant mobile organic contamination.
- The majority of any surplus soil material to be removed off site is likely to be classified as non-hazardous and may be acceptable at a facility licensed to accept inert waste.

Based on the principles and definitions outlined under section 57 of the Environment Act 1995, the site would not be considered to be “Contaminated Land” based on its proposed residential redevelopment with plant uptake end use following implementation of the above recommended remedial measures.



WS - Window Sample	DP - Dynamic Probe
BH - Borehole	GM - Gas Monitoring Standpipe
TP - Trial Pit	SP - Soakage Pit
HDTP - Hand Dug Trial Pit	PT - Percolation Test
DCP - Dynamic Cone Penetration Test	S - Sample Location
HA - Hand Auger	(I) - Installation

Site: Land off Sheppey Way, Iwade	Client: Middlefields Ltd	Drawn: PJ	Rev.:	Unit 2 Montpelier Business Park, Dencora Way, Ashford, Kent TN23 4FG Tel: 01233 646 237
Title: Figure 1 Exploratory Hole Location Plan	Project: 12775	Date: 02/2022	Scale:	

Figure 2: Land off Sheppey Way, Iwade
SPT N-Depth Profile

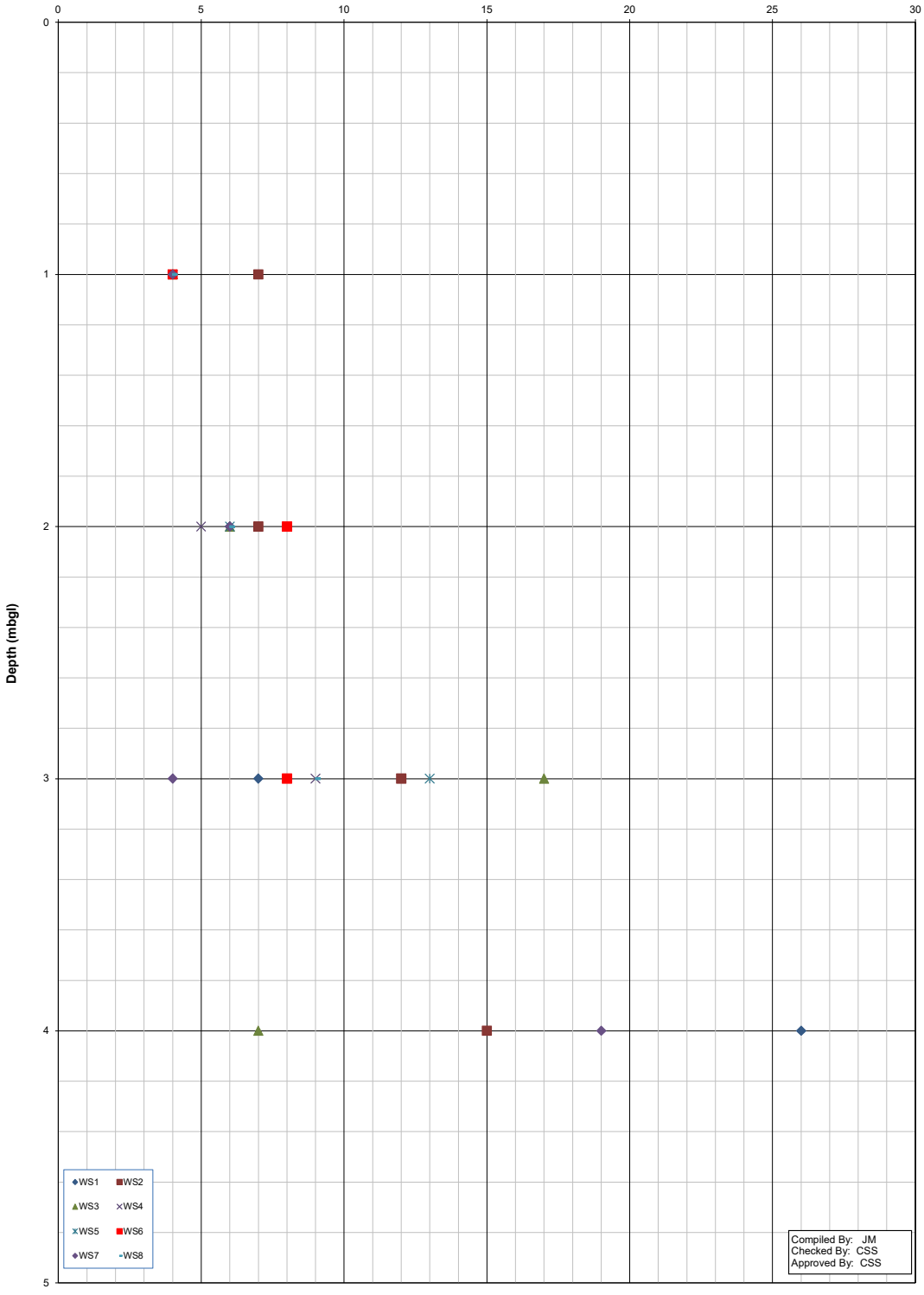
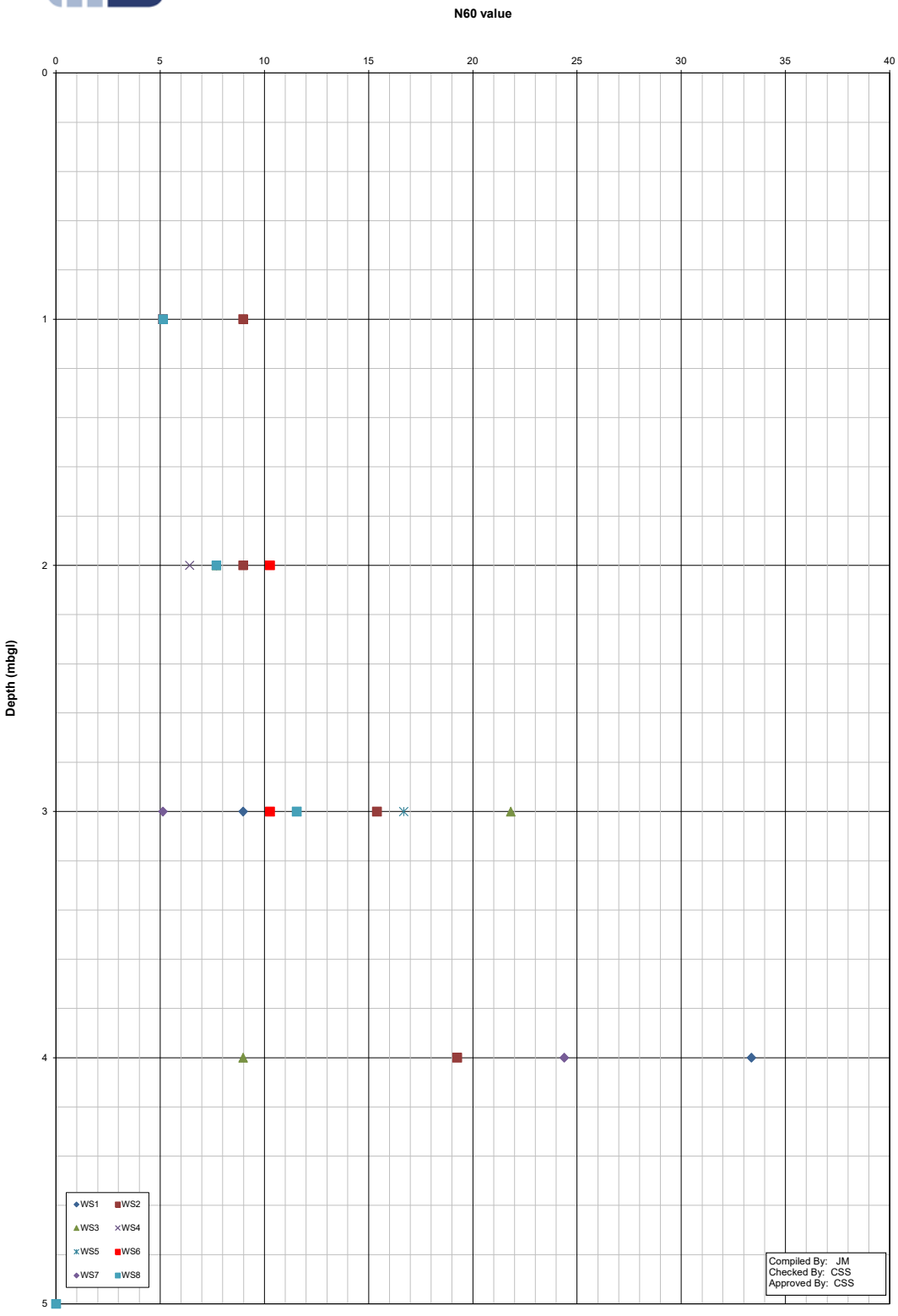
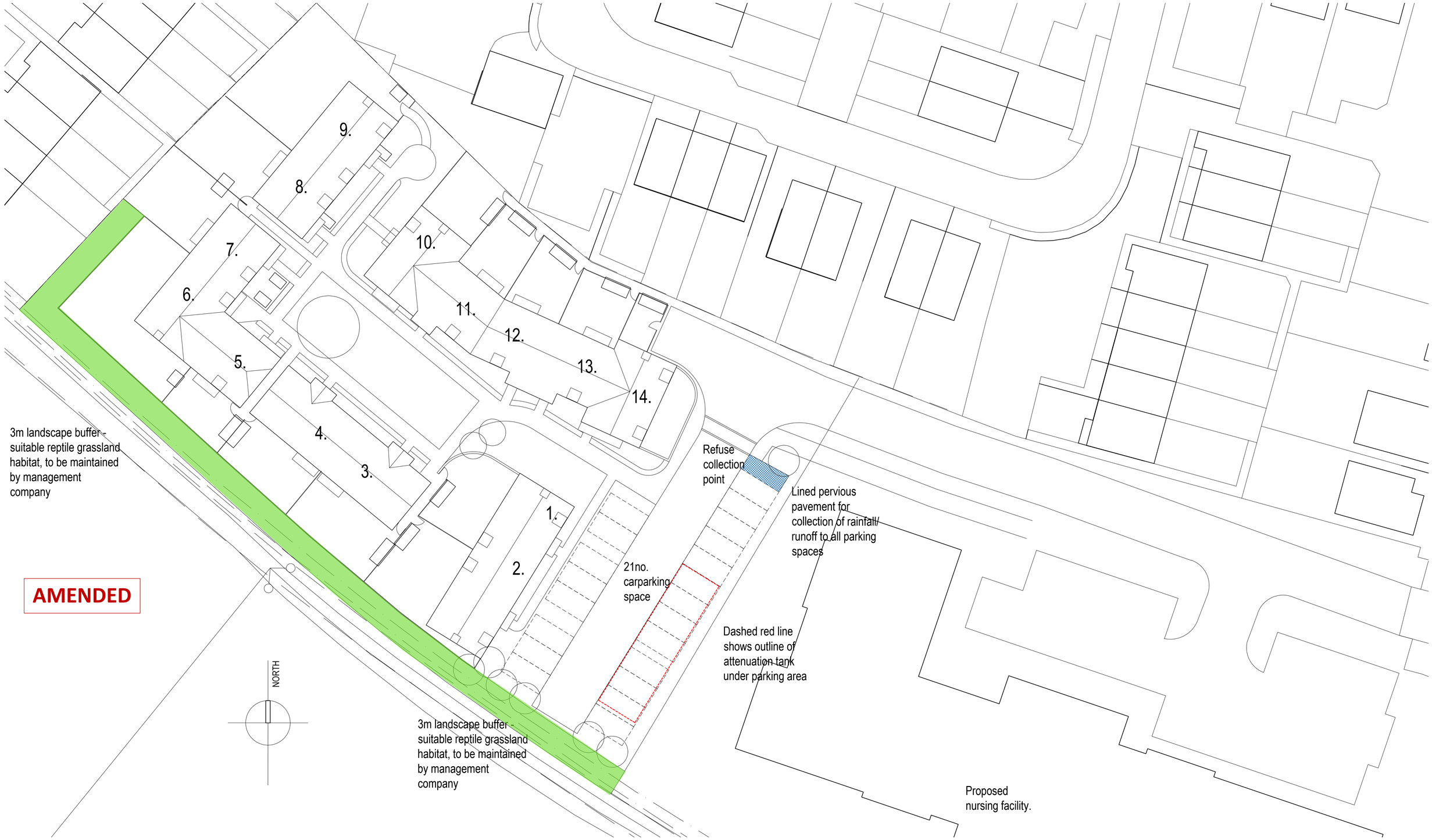


Figure 3: Land off Sheppey Way, Iwade
N60-Depth Profile



APPENDIX 1

PROPOSED SITE LAYOUT PLAN



AMENDED

Rev.	Description	Int.	Date
A	Updates following comments from		
	planning officer	HW	Jan 2020
B	Landscape/ reptile buffer amended	HW	March20

Client
HUME PLANNING

Job Title
PROPOSED RETIREMENT COTTAGES AT IWADE

CDP Architecture Ltd
22-23 North Lane,Canterbury
Kent,CT2 7EE
Tel: 01227 458181 Fax: 01227 451543
info@thinkcdp.com www.thinkcdp.com

1:200 scale bar
0m 4.0m 8.0m 12.0m 16.0m
CDP original printed to scale. Prints from PDF's could distort

Drawing Title
PROPOSED SITE PLAN

Scale @ A1	1:200
Drawn	MW
Date	AUG 2019
Checked	

STATUS

Preliminary/Comment	
Planning	■
Building Regulations	
Tender	
Construction	
As built	

766 : P02 B

A1

APPENDIX 2

WINDOW SAMPLE LOGS AND INSTALLATION DETAILS

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
Tel: 01233 646237

Window
Sampler Log No. WS1
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Support Used:None
_Backfill: 35mm Standpipe

Project Name: Land off Sheppy Way
Project Location: Iwade
Client: Middlefields Ltd

Job No: 12775

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:02/04/2022
Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.60)
0.50		TUB				-0.60		0.60
					MADEGROUND: Light brown slightly sandy silty clay with rare fragments of Asphalt.			(0.20)
						-0.80		0.80
0.90- 1.00		D			Dry firm light brown slightly sandy, very silty CLAY with occasional fine roots.			(0.20)
			SN=4	1,1/1,1,1,1		-1.00		1.00
					Dry soft to firm light brown slightly sandy, very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.50- 1.60		D						
					...from 1.50 becoming very silty and firm			
1.90- 2.00		D						(2.00)
			SN=6	1,1/2,1,1,2				
					...from 2.00 to 3.00 Rare chalk gravels			
2.50- 2.70		D						
			SN=7	1,1/1,2,2,2		-3.00		3.00
					Dry firm light orange with light grey mottling silty CLAY with occasional coarse sub angular flints.			
								(1.00)
3.60- 3.80		D						
			SN=26	3,10/11,7,4,4		-4.00		4.00

End of W/S 4.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:25
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

Hole ID. WS1

Installation Details & Readings

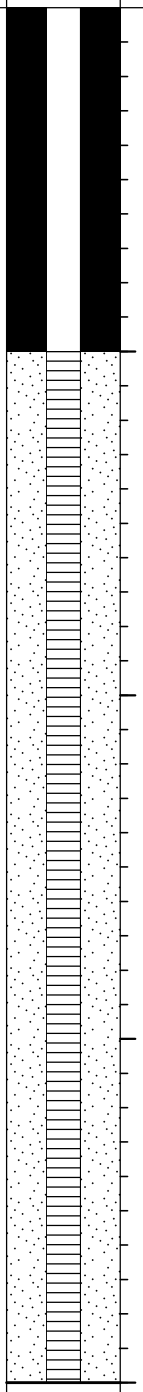
Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:4/2/2022 Date Completed:4/2/2022

Installation Date : 4/2/2022
Depth to TOP Response Zone : 1 (m)
Installation Type : SP
Depth to BASE Response Zone : 4 (m)

Installation Diagram

Depth Related Remarks (Elevation)



1 (-1.00)

End of Hole 4.00 m

(-4.00)

Compiled By: JM	Checked By: CSS
Scale:	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 9/2/22

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS2
Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:02/04/2022 Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.55)
0.50		TUB				-0.55		0.55
					Dry firm light brown slightly sandy, very silty CLAY with occasional fine roots.			(0.45)
0.90- 1.00		D	SN=7	1,1/2,1,2,2		-1.00		1.00
					Dry firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.50- 1.60		D						
1.90- 2.00		D	SN=7	1,1/1,2,2,2				(2.00)
2.50- 2.70		D						
			SN=12	1,2/2,2,2,6		-3.00		3.00
					Wet to moist firm light tan, silty CLAY with occasional to frequent coarse up to cobble sized angular to sub angular flints.			(0.60)
3.60- 3.80		D				-3.60		3.60
					Wet medium dense light tan silty clayey GRAVEL. Coarse up to cobble sized angular flint.			(0.40)
			CN=15	3,2/3,4,4,4		-4.00		4.00
					End of W/S 4.00 m (Thickness of basal layer not proven)			

Remarks:

Logged By: JM	Checked By: CSS
Scale: 1:25	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

Hole ID. WS2

Installation Details & Readings

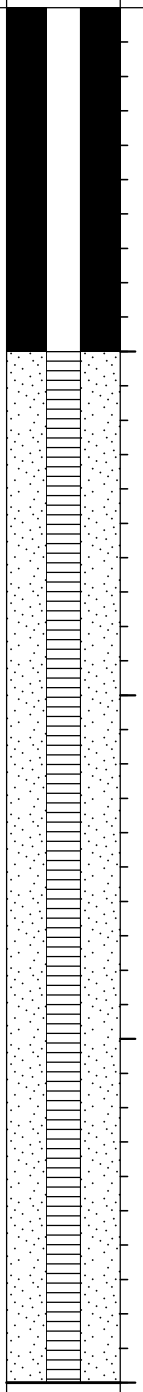
Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:4/2/2022 Date Completed:4/2/2022

Installation Date : 4/2/2022
Depth to TOP Response Zone : 1 (m)
Installation Type : SP
Depth to BASE Response Zone : 4 (m)

Installation Diagram

Depth Related Remarks (Elevation)



1 (-1.00)

End of Hole 4.00 m

(-4.00)

Compiled By: JM	Checked By: CSS
Scale:	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 9/2/22

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS3
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Support Used:None
_Backfill: 35mm Standpipe

Project Name: Land off Sheppy Way
Project Location: Iwade
Client: Middlefields Ltd

Job No: 12775

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:02/04/2022
Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.35		TUB			MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.40)
						-0.40		0.40
					Dry firm light brown very silty CLAY with occasional fine roots.			(0.60)
0.90- 1.00		D	SN=4	1,1/1,1,1,1		-1.00		1.00
1.50- 1.60		D			Dry soft to firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.90- 2.00		D	SN=6	1,1/1,1,2,2				(2.00)
2.50- 2.70		D						
			CN=17	1,2/2,5,5,5		-3.00		3.00
					Wet to moist loose light tan silty CLAY with occasional to frequent coarse up to cobble sized angular to sub angular flints.			(1.00)
3.60- 3.80		D						
			CN=7	3,4/2,2,1,2		-4.00		4.00

End of W/S 4.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:25
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

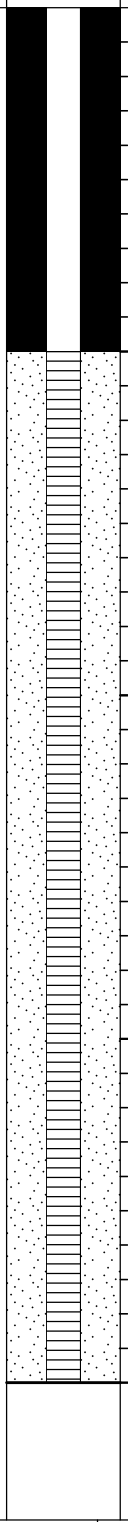
Hole ID. WS3

Installation Details & Readings

Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:4/2/2022 Date Completed:4/2/2022

Installation Date : 4/2/2022
Depth to TOP Response Zone : 1 (m)
Installation Type : SP
Depth to BASE Response Zone : 4 (m)



Depth Related Remarks (Elevation)	
1	(-1.00)
End of Hole 4.00 m	
	(-4.00)

Compiled By:	Checked By:
JM	CSS
Scale:	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 9/2/22

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS4
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Support Used:None
_Backfill: Arisings

Project Name: Land off Sheppy Way
Project Location: Iwade
Client: Middlefields Ltd

Job No: 12775

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:02/04/2022
Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30		TUB			MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.45)
						-0.45		0.45
					Dry firm light brown silty CLAY with occasional fine roots.			(0.55)
0.90- 1.00		D	SN=4	1,1/1,1,1,1		-1.00		1.00
1.50- 1.60		D			Dry soft to firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.90- 2.00		D	SN=5	1,1/1,1,1,2				(2.00)
2.50- 2.70		D						
			SN=9	1,2/2,2,2,3		-3.00		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:25
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS5
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Support Used:None
_Backfill: Arisings

Project Name: Land off Sheppy Way
Project Location: Iwade
Client: Middlefields Ltd

Job No: 12775

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:02/04/2022
Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30		TUB			MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.40)
						-0.40		0.40
					Dry firm light brown slightly sandy silty CLAY with occasional fine roots.			(0.60)
0.90- 1.00		D	SN=4	1,1/1,1,1,1		-1.00		1.00
1.50- 1.60		D			Dry soft to firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.90- 2.00		D	SN=6	1,1/1,1,2,2				(2.00)
2.50- 2.70		D						
			SN=13	1,1/2,2,4,5		-3.00		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:25
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS6
Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: Arisings	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:02/04/2022 Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30		TUB			MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.50)
						-0.50		0.50
					Dry firm light brown very silty CLAY with occasional fine roots.			(0.50)
0.90- 1.00		D	SN=4	1,1/1,1,1,1		-1.00		1.00
					Dry soft to firm light brown silty CLAY with occasional fine to medium sub rounded chalk gravels.			(1.00)
1.50- 1.60		D						
1.90- 2.00		D	SN=8	1,1/1,2,3,2		-2.00		2.00
					Dry firm light orange with light grey mottling silty CLAY with occasional coarse sub angular flints.			(1.00)
2.50- 2.70		D						
			SN=8	1,1/2,2,2,2		-3.00		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:	Logged By: JM	Checked By: CSS
	Scale: 1:25	Approved By:
	FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited

Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS7

Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:02/04/2022 Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.30)
0.30		TUB				-0.30		0.30
					Dry firm light brown slightly sandy, very silty CLAY with occasional fine roots.			(0.70)
0.90- 1.00		D	SN=4	1,0/1,1,1,1		-1.00		1.00
					Dry firm light orange with light grey mottling, very silty CLAY with occasional coarse sub angular flints.			
1.50- 1.60		D						
1.90- 2.00		D	SN=6	1,1/1,1,2,2				(2.00)
2.50- 2.70		D						
			CN=4	1,1/1,1,1,1	...from 2.80 Occasional Coarse sub angular flint	-3.00		3.00
					Dry soft to firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			(1.00)
3.60- 3.80		D						
			CN=19	3,4/6,6,4,3		-4.00		4.00

End of W/S 4.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By:	Checked By:
JM	CSS
Scale: 1:25	Approved By:
FIG No.	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG
T: 01233 646237

Hole ID. WS7

Installation Details & Readings

Sheet: 1 of 1

Equipment & Methods. Premier Compact 110 _Support Used:None _Backfill: 35mm Standpipe	Project Name: Land off Sheppy Way Project Location: Iwade Client: Middlefields Ltd	Job No: 12775
Co-ordinates: E: N:	Ground Level (m):	Date Started:4/2/2022 Date Completed:4/2/2022

Installation Date : 4/2/2022
Depth to TOP Response Zone : 1 (m)
Installation Type : SP
Depth to BASE Response Zone : 4 (m)

Installation Diagram	Depth Related Remarks (Elevation)
	1 (-1.00)
	End of Hole 4.00 m
	(-4.00)

Compiled By:	Checked By:
JM	CSS
Scale:	Approved By:
	FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG PIEZO/STANDPIPE LOG LOGS.GPJ GSG-AGS3-STD TEMPLATE.GDT 9/2/22

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park Tel: 01233 646237
Dencora Way, Ashford
Kent TN23 4FG

Window
Sampler Log No. WS8
Sheet: 1 of 1

Equipment & Methods.
Premier Compact 110
_Support Used:None
_Backfill: Arisings

Project Name: Land off Sheppy Way
Project Location: Iwade
Client: Middlefields Ltd

Job No: 12775

Co-ordinates:
E:
N:

Ground Level (m):

Date Started:02/04/2022
Date Completed:02/04/2022

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADEGROUND: Dark brown slightly sandy silty clay with frequent to occasional fragments of asphalt and rare red brick. Fine roots throughout.			(0.35)
						-0.35		0.35
0.50		TUB			Dry firm light brown very silty CLAY with occasional fine roots.			(0.65)
0.90- 1.00		D	SN=4	1,1/1,1,1,1		-1.00		1.00
1.50- 1.60		D			Dry soft to firm light brown very silty CLAY with occasional fine to medium sub rounded chalk gravels.			
1.90- 2.00		D	SN=6	1,1/1,1,2,2				(2.00)
2.50- 2.70		D						
			SN=3	1,2/1,2,3,3		-3.00		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: JM
Checked By: CSS
Scale: 1:25
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

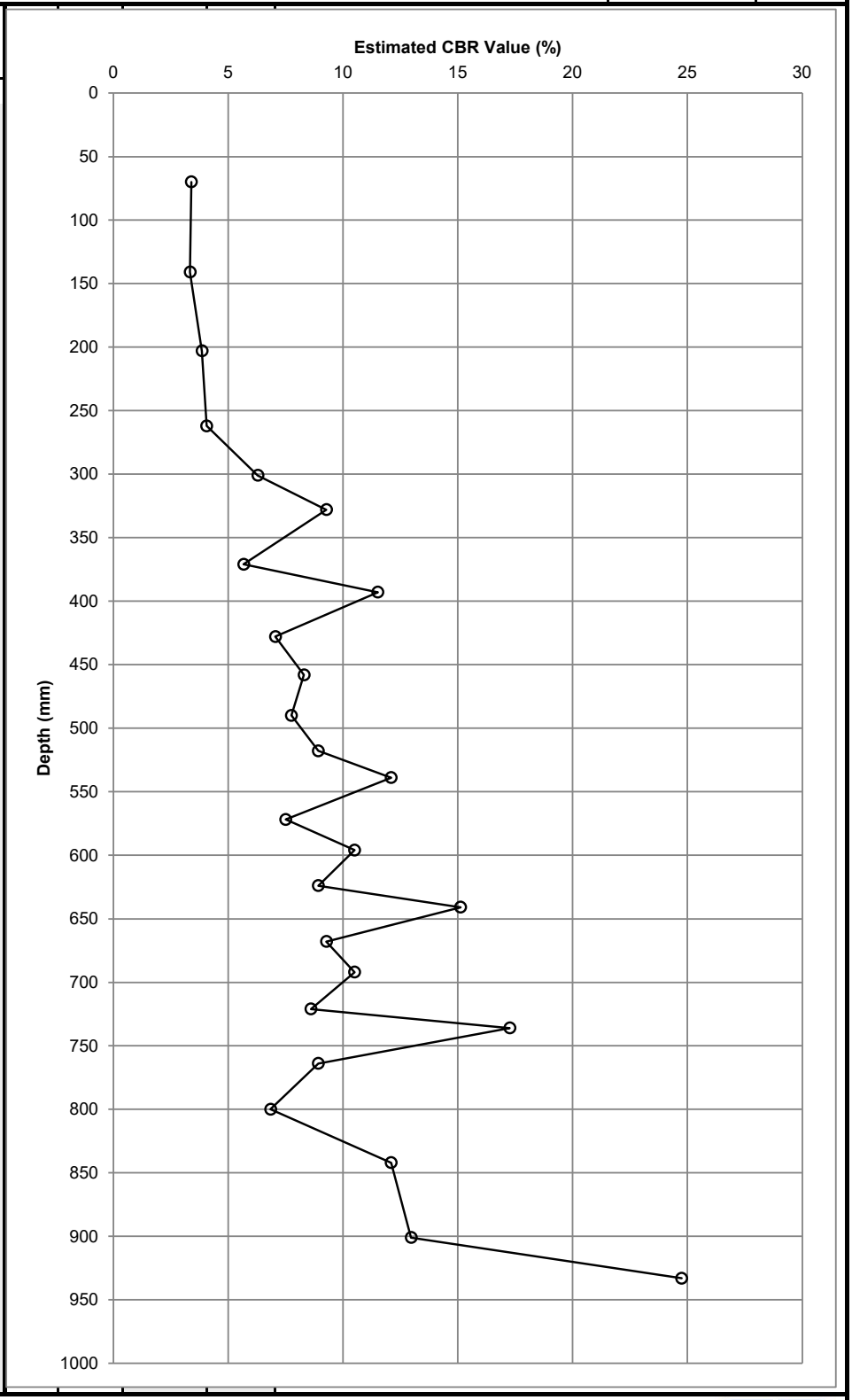
APPENDIX 3

DYNAMIC CONE PENETROMETER TEST RESULTS

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP1
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	40

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	70	70	3
2	141	71	3
3	203	62	4
4	262	59	4
5	301	39	6
6	328	27	9
7	371	43	6
8	393	22	12
9	428	35	7
10	458	30	8
11	490	32	8
12	518	28	9
13	539	21	12
14	572	33	7
15	596	24	10
16	624	28	9
17	641	17	15
18	668	27	9
19	692	24	10
20	721	29	9
21	736	15	17
22	764	28	9
23	800	36	7
25	842	21	12
28	901	20	13
31	933	11	25



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

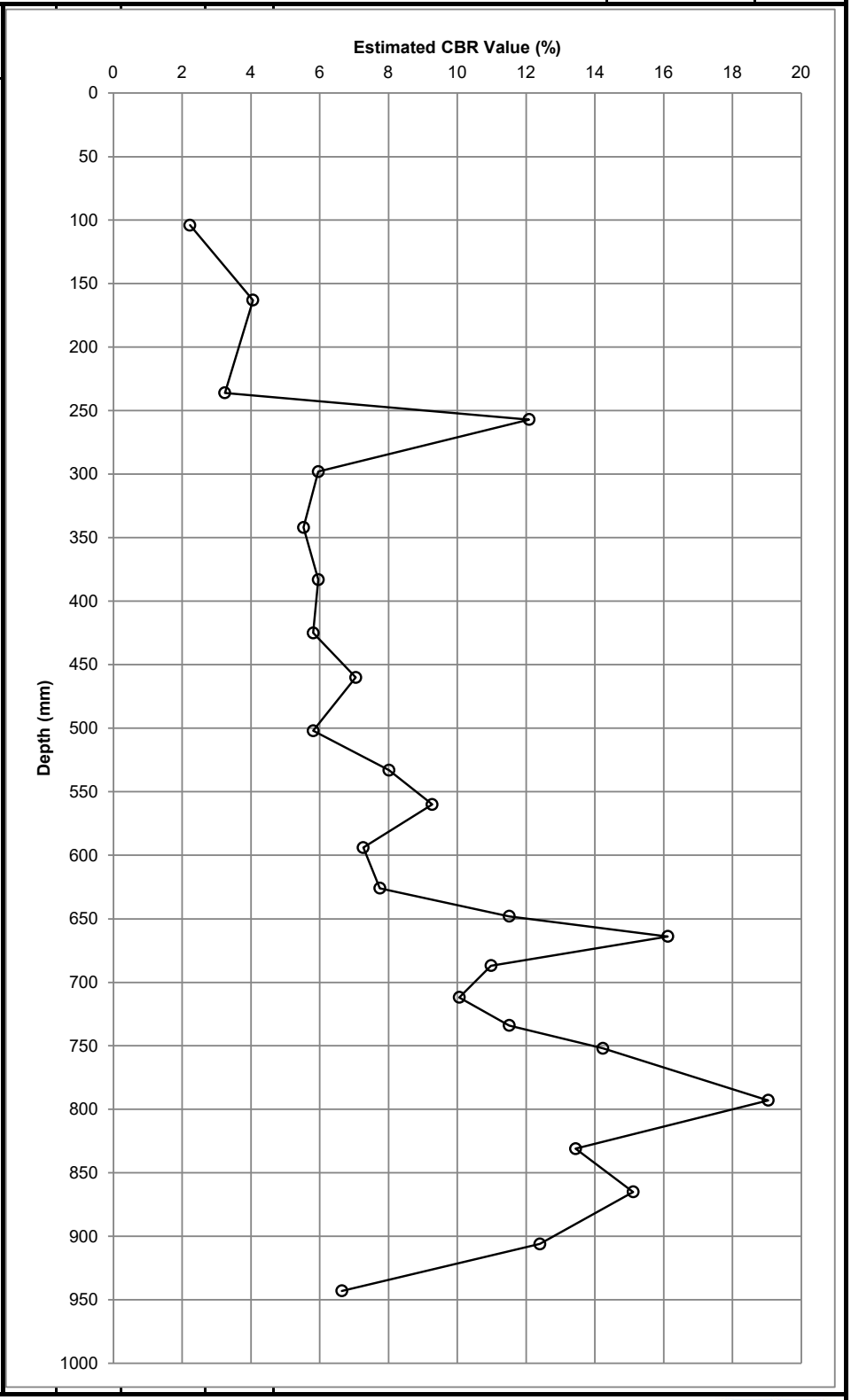
Tested By: CSS **Approved By: CSS**

Checked By: PAD

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP2
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	28

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	104	104	2
2	163	59	4
3	236	73	3
4	257	21	12
5	298	41	6
6	342	44	6
7	383	41	6
8	425	42	6
9	460	35	7
10	502	42	6
11	533	31	8
12	560	27	9
13	594	34	7
14	626	32	8
15	648	22	12
16	664	16	16
17	687	23	11
18	712	25	10
19	734	22	12
20	752	18	14
23	793	14	19
25	831	19	13
27	865	17	15
29	906	21	12
30	943	37	7



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

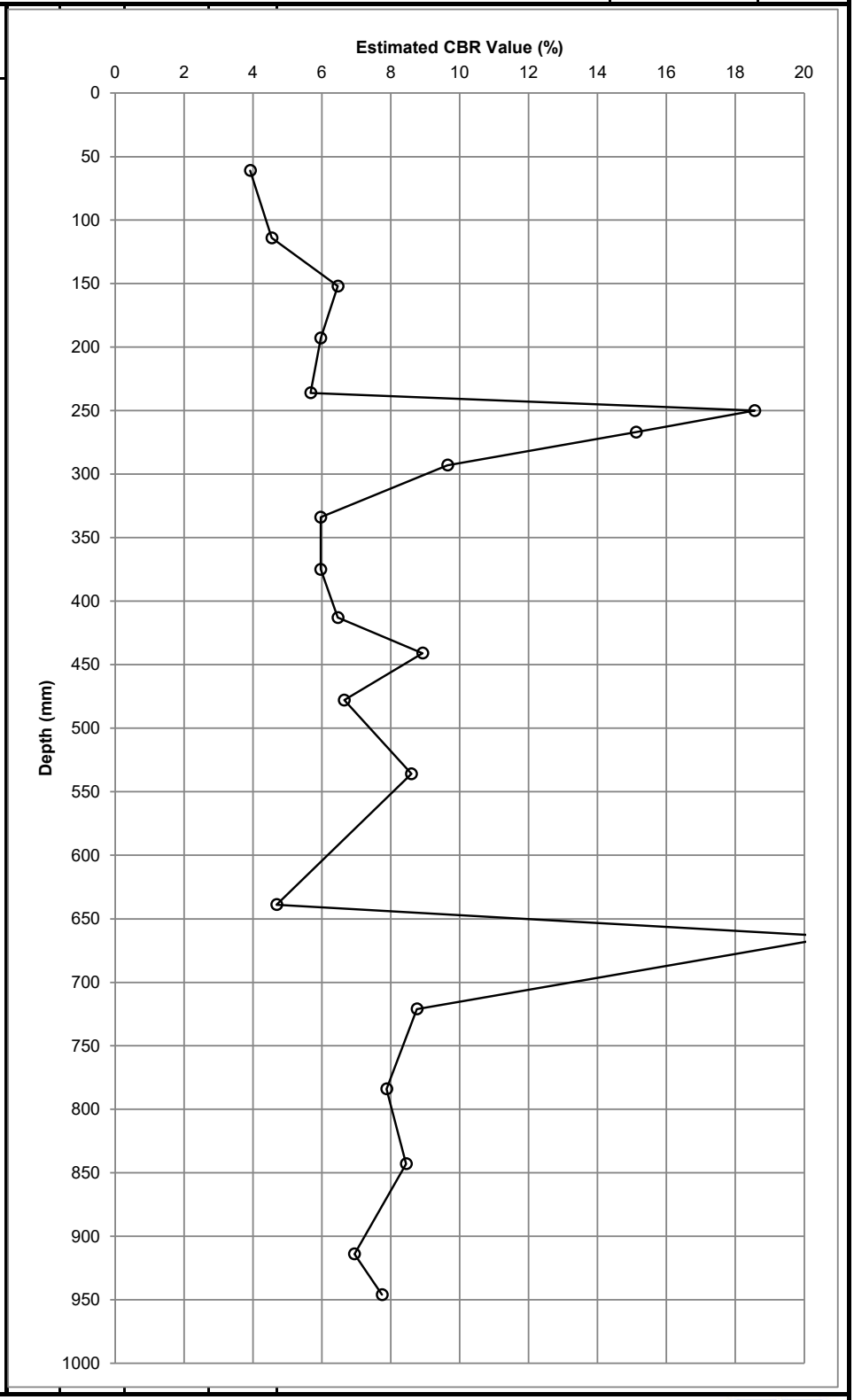
Tested By: JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP3
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	27

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	61	61	4
2	114	53	5
3	152	38	6
4	193	41	6
5	236	43	6
6	250	14	19
7	267	17	15
8	293	26	10
9	334	41	6
10	375	41	6
11	413	38	6
12	441	28	9
13	478	37	7
15	536	29	9
17	639	52	5
19	664	12.5	21
21	721	28.5	9
23	784	31.5	8
25	843	30	8
27	914	36	7
28	946	32	8



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

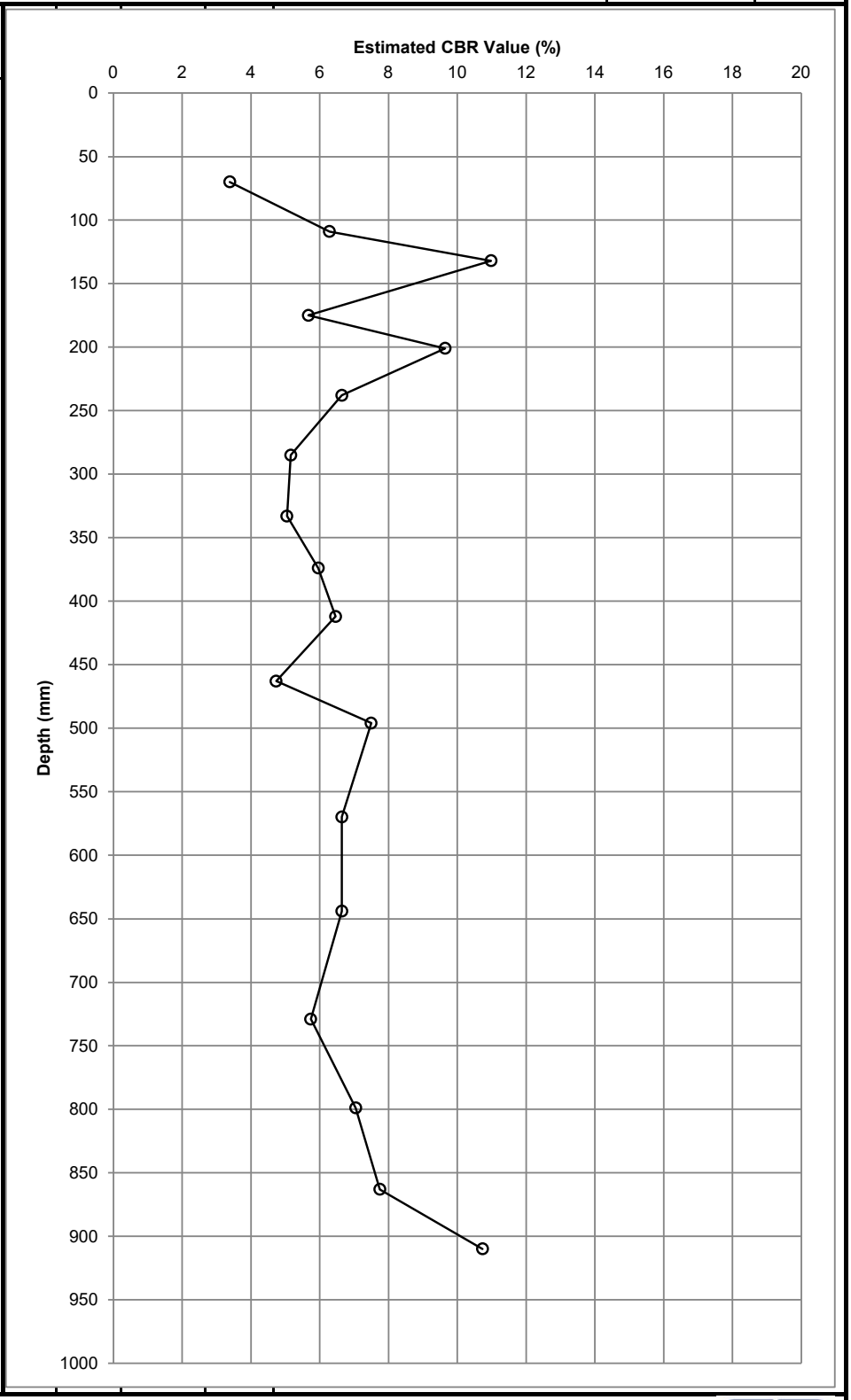
Tested By: JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP4
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	48

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	70	70	3
2	109	39	6
3	132	23	11
4	175	43	6
5	201	26	10
6	238	37	7
7	285	47	5
8	333	48	5
9	374	41	6
10	412	38	6
11	463	51	5
12	496	33	7
14	570	37	7
16	644	37	7
18	729	43	6
20	799	35	7
22	863	32	8
24	910	23.5	11



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

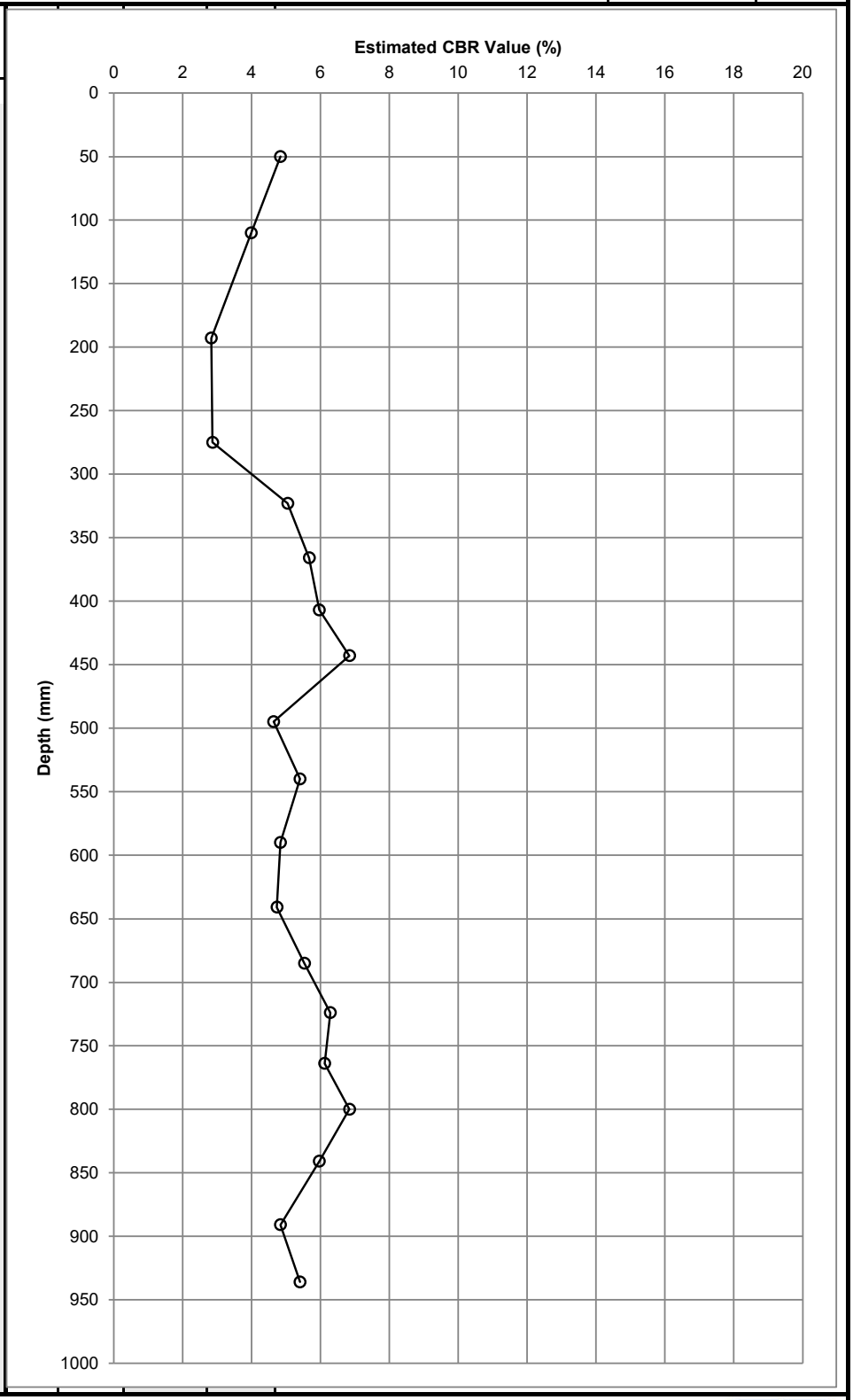
Tested By: JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP5
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	18

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	50	50	5
2	110	60	4
3	193	83	3
4	275	82	3
5	323	48	5
6	366	43	6
7	407	41	6
8	443	36	7
9	495	52	5
10	540	45	5
11	590	50	5
12	641	51	5
13	685	44	6
14	724	39	6
15	764	40	6
16	800	36	7
17	841	41	6
18	891	50	5
19	936	45	5



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

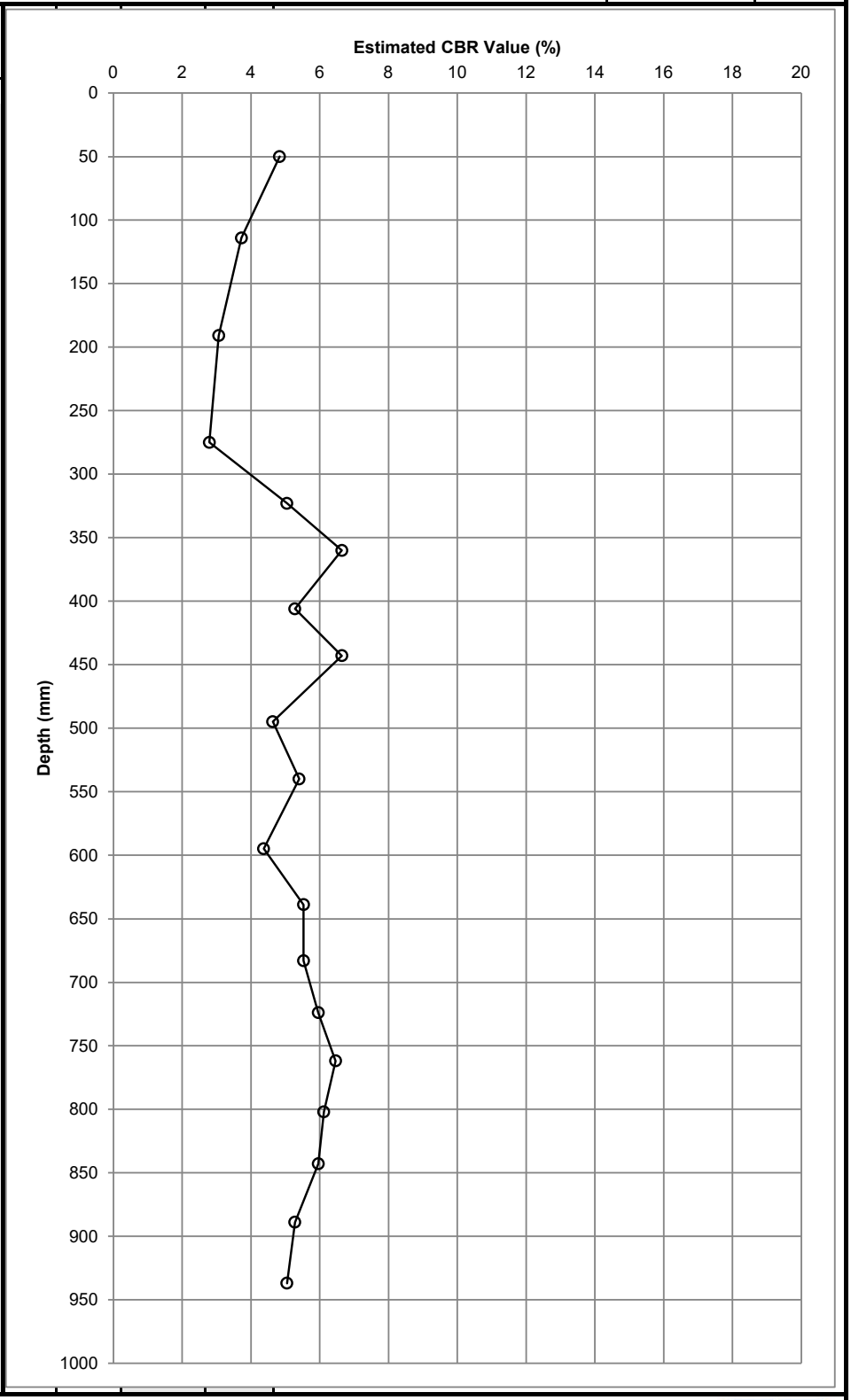
Tested By: JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP6
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	18

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	50	50	5
2	114	64	4
3	191	77	3
4	275	84	3
5	323	48	5
6	360	37	7
7	406	46	5
8	443	37	7
9	495	52	5
10	540	45	5
11	595	55	4
12	639	44	6
13	683	44	6
14	724	41	6
15	762	38	6
16	802	40	6
17	843	41	6
18	889	46	5
19	937	48	5



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

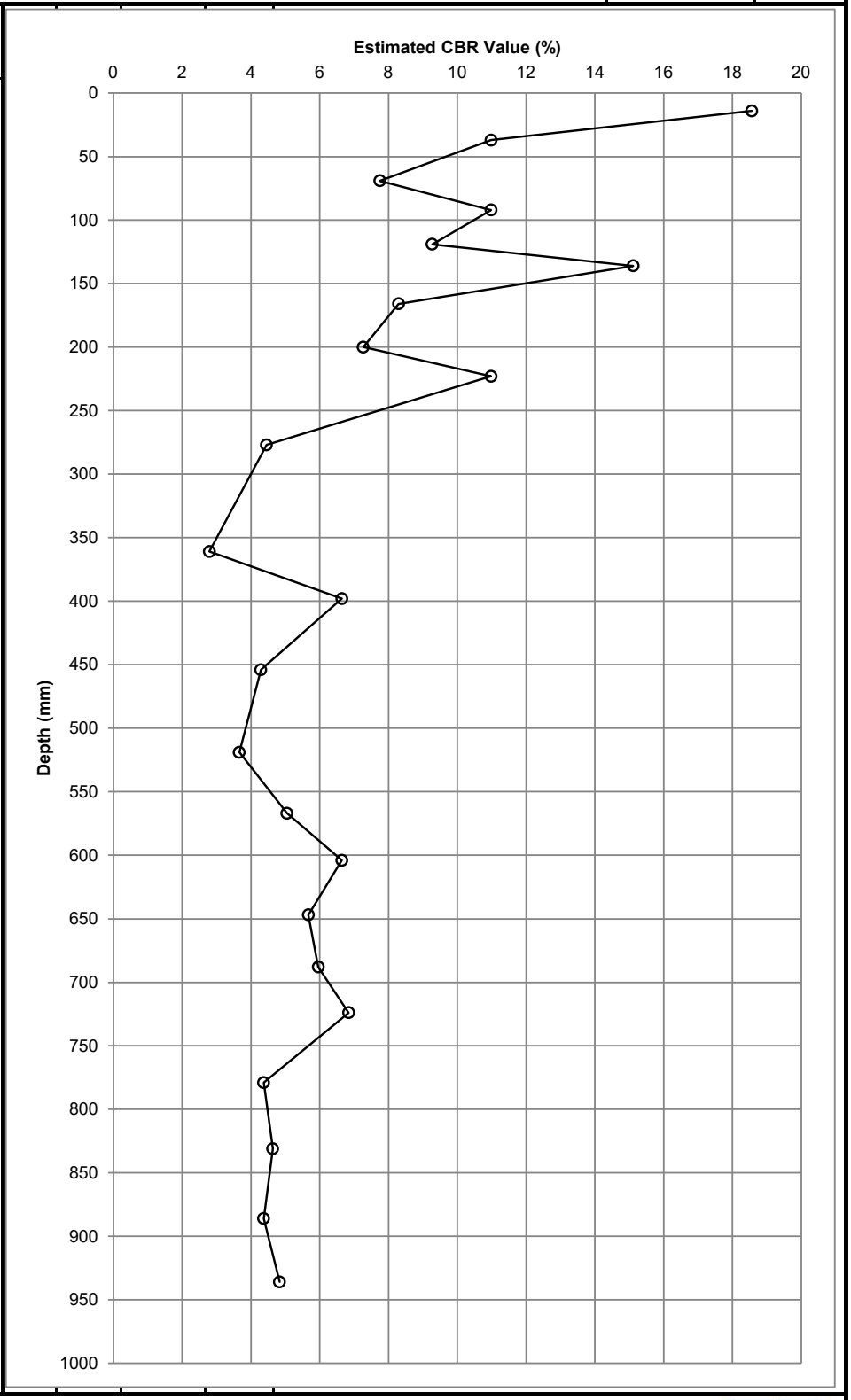
Tested By: JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP7
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	24

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	14	14	19
2	37	23	11
3	69	32	8
4	92	23	11
5	119	27	9
6	136	17	15
7	166	30	8
8	200	34	7
9	223	23	11
10	277	54	4
11	361	84	3
12	398	37	7
13	454	56	4
14	519	65	4
15	567	48	5
16	604	37	7
17	647	43	6
18	688	41	6
19	724	36	7
20	779	55	4
21	831	52	5
22	886	55	4
23	936	50	5



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

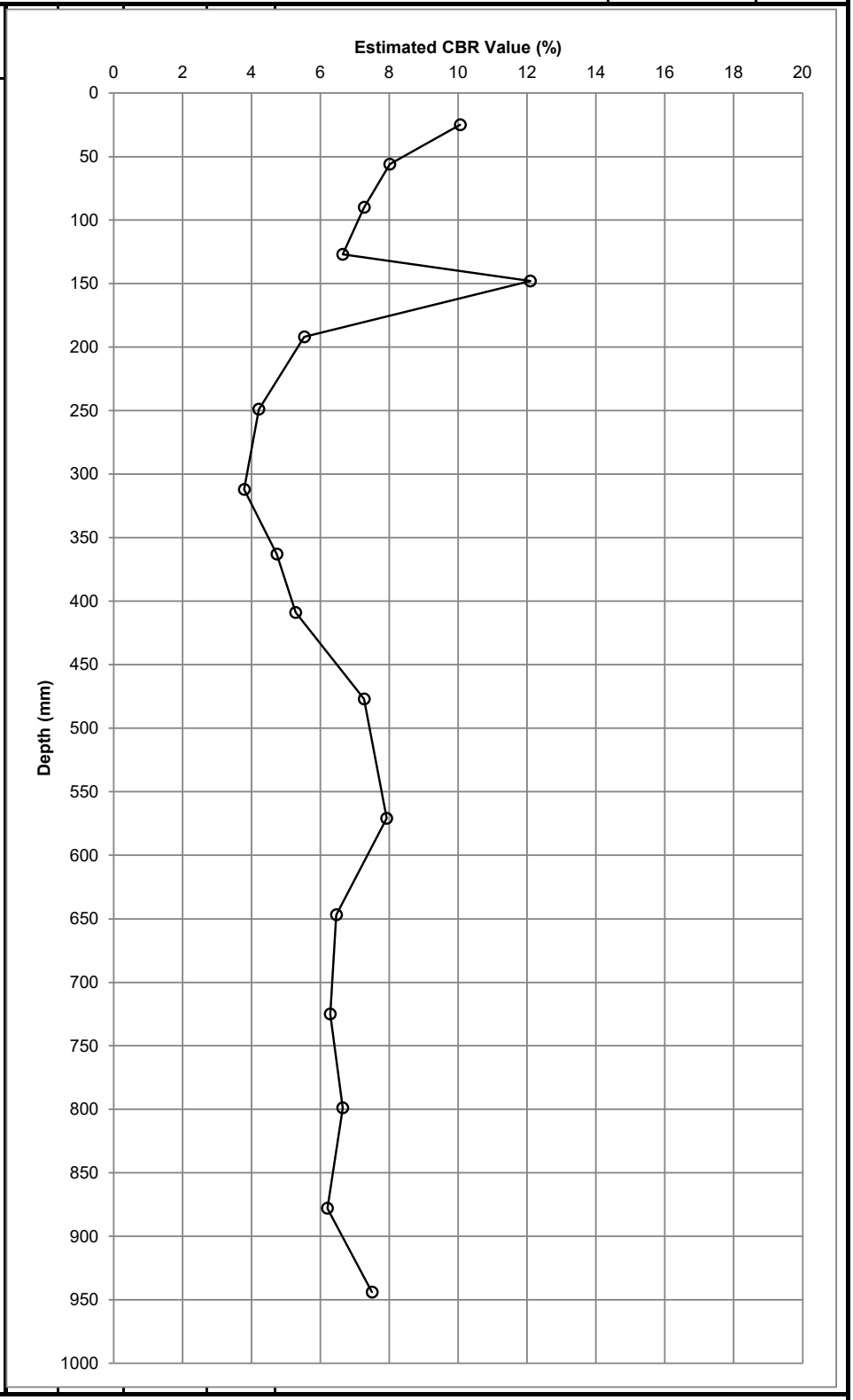
Tested By :JF **Approved By:**

Checked By:

DYNAMIC CONE PENETROMETER TEST RESULTS

		Test No	DCP8
		Date:	11-Feb
Project Name:	**Land off Sheppey Way, Iwade**	**Project No:**	12775
Client Name:	**Middlefields Ltd**	**Zero Reading**	23

No. of Blows	Depth (mm)	Penetration mm/blow	Est CBR (%)
0	0		
1	25	25	10
2	56	31	8
3	90	34	7
4	127	37	7
5	148	21	12
6	192	44	6
7	249	57	4
8	312	63	4
9	363	51	5
10	409	46	5
12	477	34	7
15	571	31	8
17	647	38	6
19	725	39	6
21	799	37	7
23	878	39.5	6
25	944	33	7



GROUND AND ENVIRONMENTAL SERVICES LIMITED
Ground Investigation and Environmental Consultants

Tested By: JF **Approved By:**

Checked By:

APPENDIX 4

SOIL GAS AND GROUNDWATER LEVEL MONITORING RESULTS

SOIL GAS SURVEY

Project:	Land off Sheppey Way			Date:	08/02/2022				Equipment Used:		GA 5000/Dipmeter	
Location:	Iwade			Weather:	Cloudy, 5/8 cover							
Job No.	12775			Temp:	12°C							

Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
WS1	12:22	18.5	1.3	0	0	0		-0.2		2.1		Barometric Pressure (mb)
WS2	12:14	17.5	2.4	0	0	0		-0.1		1.7	Time	
WS3	12:06	16.0	3.7	0	0	0		-0.1		1.7	12:05	1027
WS7	12:11	17.6	2.4	0	0	0		-0.2		1.9		
											Datum:	

Tested by: JF

Checked by: CSS

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

Gas	Accuracy			Range
	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

SOIL GAS SURVEY

Project:	11			Date:	11/02/2022				Equipment Used:	GA 5000/Dipmeter		
Location:	Iwade			Weather:	Sunny, 1/8 cloud cover							
Job No.	12775			Temp:	13°C							

Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
WS1	13:16	19.1	1	0						1.9		Barometric Pressure (mb)
WS2	12:58	9.3	7.4	0.2						1.3	Time	
WS3	13:08	17.0	4.2	0						1.6	12:55	1033
WS7	13:22	17.8	2.6	0						1.8		
											Datum:	

Tested by: JF

Checked by: CSS

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

Gas	Accuracy			Range
	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

SOIL GAS SURVEY

Project:	Land off Sheppey Way			Date:	18/02/2022				Equipment Used:	GA 5000/Dipmeter		
Location:	Iwade			Weather:	Windy, cloudy, 7/8 cover							
Job No.	12775			Temp:	11°C							

Monitoring Point No.	Time	O2 (% v/v)	CO2 (% v/v)	CH4 (% v/v)	H2S (PPM)	CO (PPM)	PID (PPM)	Flow (l/hr)	Differential Pressure (mbar)	Water (mbgl)	Site Observations/ Comments	
WS1	10:13	20	0..2	0.1				0.1		1.95		Barometric Pressure (mb)
WS2	10:20	9.9	7.5	0				0		2.05	Time	
WS3	10:31	17.2	4.2	0				0		1.75	10:10	988
WS7	10:35	18.6	2.5	0				0		1.85		
											Datum:	

Tested by: JF

Checked by: CSS

mbgl = metres below ground level

Ground and Environmental Services Limited

Accuracy and range of Gas Analyser 5000 (GA5000)

Gas	Accuracy			Range
	Gas Concentrations			
	0-5%	5-15%	0-FS	
CH_4	+/-0.5%	+/-3%		0-70% to specification, 0-100% reading
CO_2	+/-0.5%	+/-3%		0-40% to specification, 0-100% reading
O_2	+/-1%	+/-1%		0-25%
CO			+/-10%FS	0-500ppm
H_2S			+/-10%FS	0-200ppm
B.P.	+/- 5 mBar			700-1200 mBar
Flow:				

Notes:

CH4: methane in percent volume per volume (% v/v)

CO2: carbon dioxide in %v/v

O2: oxygen in % v/v

H2S: hydrogen sulphide in part per million (ppm)

CO: carbon monoxide in ppm

B.P.: Barometric pressure in mBar

Flow: Gas flow in litre per hour (l/h)

APPENDIX 5

LABORATORY TEST RESULTS

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

www.genvs.com
E: info@genvs.com
T: 01233 646237

Site: Iwade

Project No: 12775

Client: Middlefields Ltd

Date 10/02/2022

Date Received: 07/02/2022

Date Tested: 09/02/2022

Test Results

Location ID	Depth (m)	MC (%)	LL (%)	PL (%)	PI (%)	% passing 425 µm sieve	Classification	Sample type
WS 1	0.9-1.0	23	40	20	20	98	CI	D
WS 1	1.5-1.6	22	36	20	16	95	CI	D
WS 1	2.5-2.7	22	38	18	20	95	CI	D
WS 2	1.5-1.6	20	31	19	12	95	CL	D
WS 3	0.9-1.0	20	35	20	15	98	CL/CI	D
WS 3	1.5-1.6	23	34	21	13	95	CL	D
WS 4	0.9-1.0	23	41	21	20	98	CI	D
WS 4	2.5-2.7	22	41	18	23	95	CI	D
WS 5	0.9-1.0	23	37	22	15	98	CI	D
WS 5	1.5-1.6	21	35	18	17	95	CL/CI	D
WS 6	0.9-1.0	20	33	21	12	98	CL	D
WS 6	2.5-2.7	32	81	29	52	95	CV	D
WS 7	0.9-1.0	24	37	21	16	98	CI	D
WS 7	1.5-1.6	23	36	19	17	95	CI	D
WS 7	3.6-3.8	22	39	18	21	95	CI	D
WS 8	0.9-1.0	22	37	21	16	98	CI	D
WS 8	2.5-2.6	24	38	20	18	95	CI	D

Tested by: STP Checked by: CSS Approved by: CSS

Ground and Environmental Services Limited
Unit 2 Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

www.genvs.com
E: info@genvs.com
T: 01233 646237

Site: Iwade **Project No:** 12775

Client: Middlefields Ltd **Date** 10/02/2022

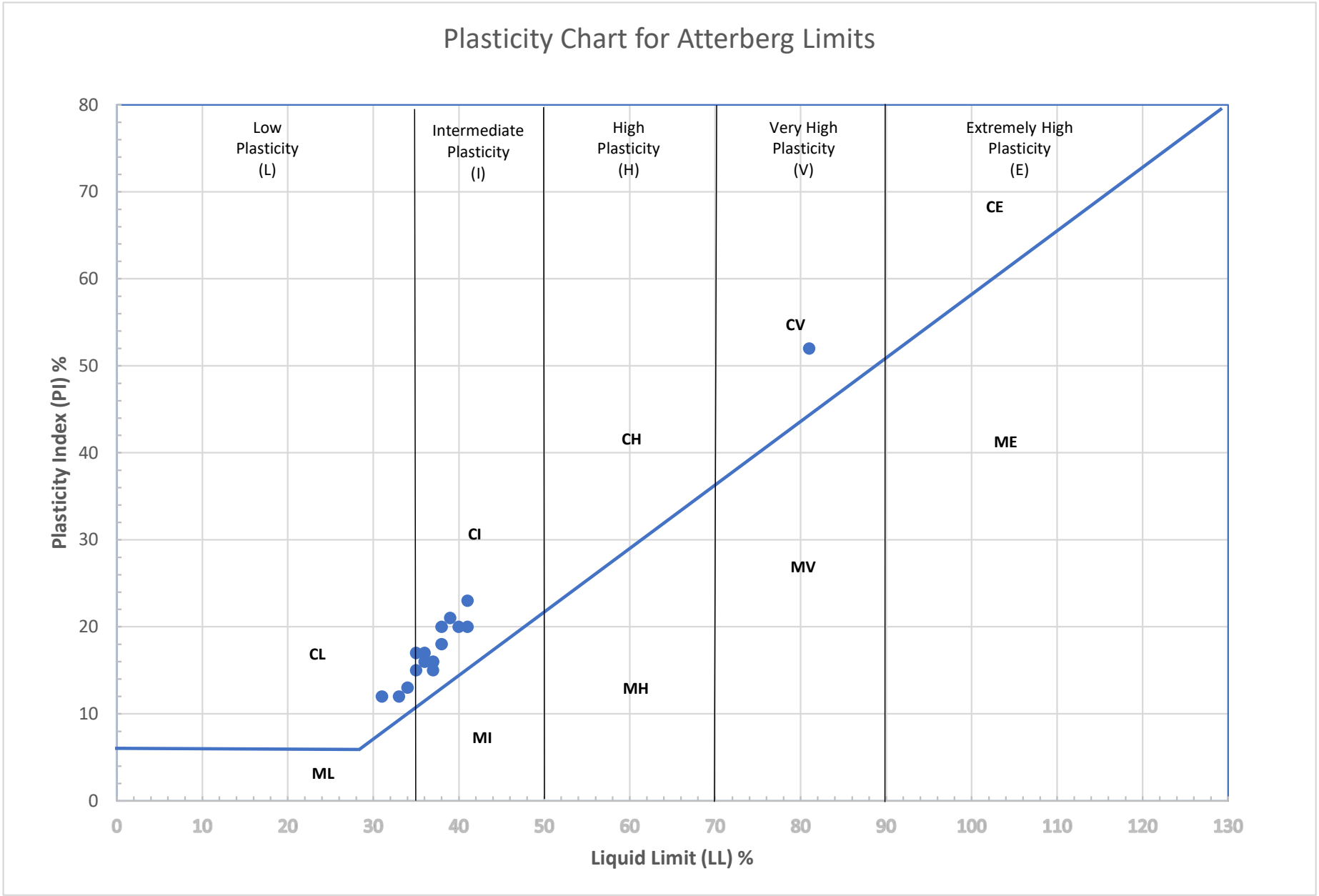
Date Received: 07/02/2022

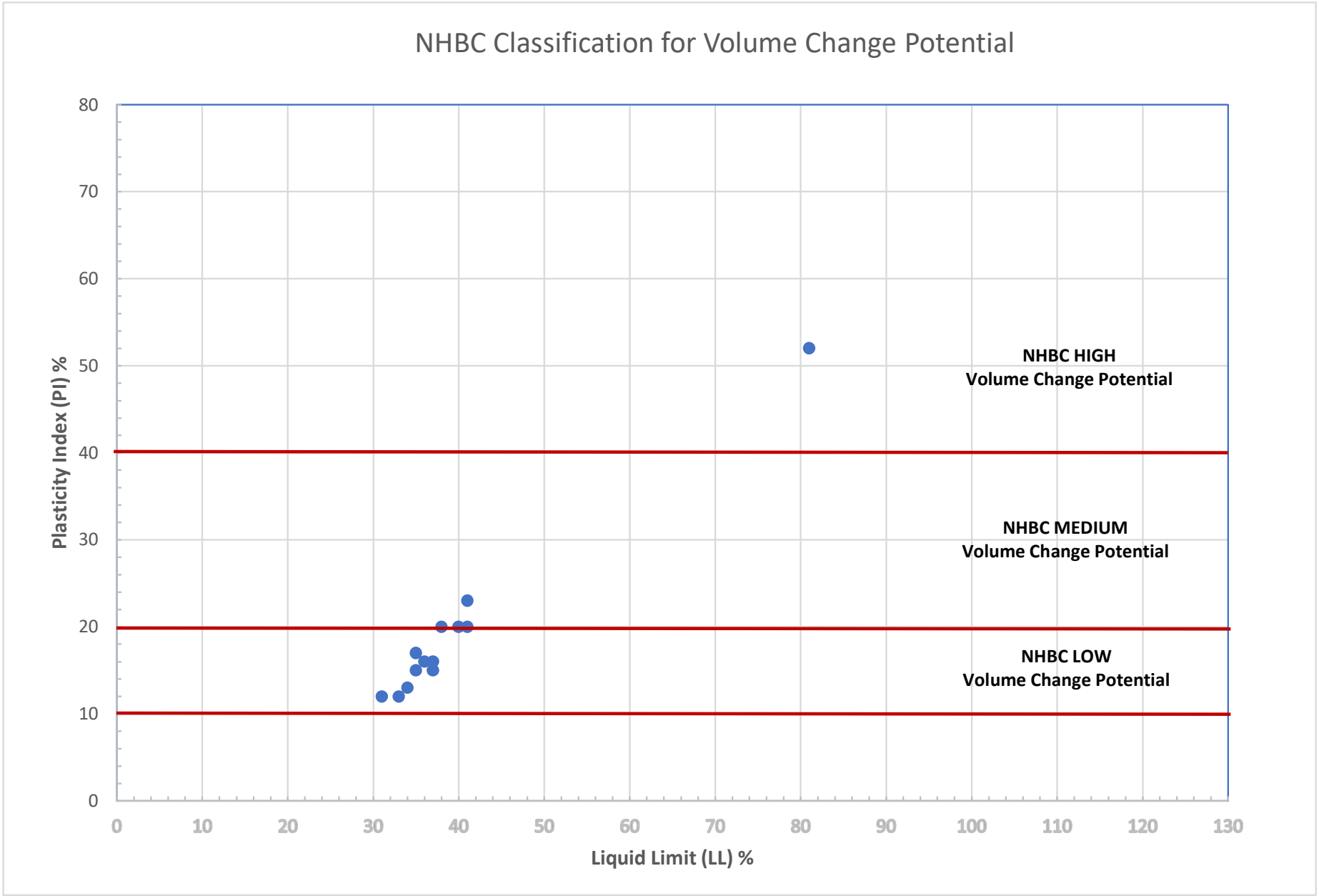
Date Tested: 09/02/2022

Visual Descriptions

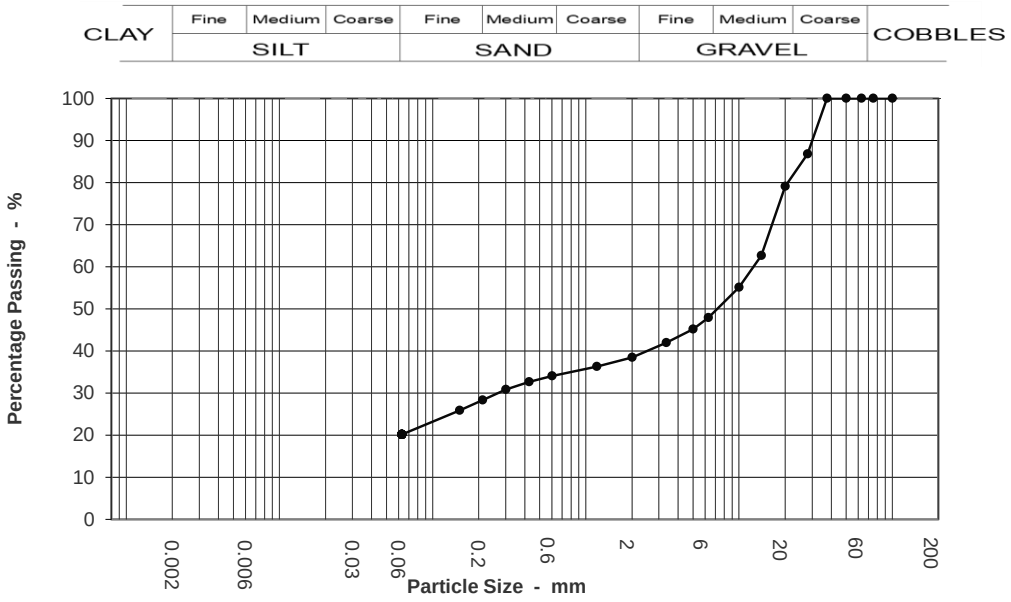
Location ID	Depth	Description
WS 1	0.9-1.0	Brown silty CLAY
WS 1	1.5-1.6	Brown very silty CLAY with occasional gravel
WS 1	2.5-2.7	Brown very silty CLAY with occasional gravel
WS 2	1.5-1.6	Brown very silty CLAY with occasional gravel
WS 3	0.9-1.0	Brown very silty CLAY
WS 3	1.5-1.6	Brown very silty CLAY with occasional gravel
WS 4	0.9-1.0	Brown silty CLAY
WS 4	2.5-2.7	Brown silty CLAY with occasional gravel
WS 5	0.9-1.0	Brown silty CLAY
WS 5	1.5-1.6	Brown very silty CLAY with occasional gravel
WS 6	0.9-1.0	Brown very silty CLAY
WS 6	2.5-2.7	Light orange with light grey silty CLAY with occasional gravel
WS 7	0.9-1.0	Brown very silty CLAY
WS 7	1.5-1.6	Brown very silty CLAY with occasional gravel
WS 7	3.6-3.8	Brown very silty CLAY with occasional gravel
WS 8	0.9-1.0	Brown very silty CLAY
WS 8	2.5-2.6	Brown very silty CLAY with occasional gravel

Tested by: STP Checked by: CSS Approved by: CSS


Plasticity Chart for Atterberg Limits
Low Plasticity (L)
Intermediate Plasticity (I)
High Plasticity (H)
Very High Plasticity (V)
Extremely High Plasticity (E)
CE
CV
CH
ME
CI
MV
CL
MH
MI
ML
Plasticity Index (PI) %
Liquid Limit (LL) %
0
10
20
30
40
50
60
70
80
90
100
110
120
130


NHBC Classification for Volume Change Potential
Plasticity Index (PI) %
Liquid Limit (LL) %
0
10
20
30
40
50
60
70
80
90
100
110
120
130
NHBC HIGH
Volume Change Potential
NHBC MEDIUM
Volume Change Potential
NHBC LOW
Volume Change Potential

	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Job Ref	12775
		Borehole / Pit No	WS 2
Project	Iwade	Sample No	
		Depth	3.6-3.8 m
Soil Description	Light tan silty sandy fine to coarse GRAVEL with some clay content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	87		
20	79		
14	63		
10	55		
6.3	48		
5	45		
3.35	42		
2	38		
1.18	36		
0.6	34		
0.425	33		
0.3	31		
0.212	28		
0.15	26		
0.063	20		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	61.5
Sand	18.3
Silt & Clay	20.2

Grading Analysis	
D100	37.50
D60	12.590
D10	
Uniformity Coefficient	N/A

Operator	Checked	Approved	Remarks
STP	CSS	CSS	

APPENDIX 6

ANALYTICAL TEST RESULTS

John Finch
Ground & Environmental Services Ltd
Unit 2
Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 22-01101

Site Reference:	Iwade
Project / Job Ref:	12775
Order No:	GES/4693.12775
Sample Receipt Date:	07/02/2022
Sample Scheduled Date:	07/02/2022
Report Issue Number:	1
Reporting Date:	11/02/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

For Topsoil and WAC analysis the expanded uncertainty measurement should be considered while evaluating results against compliance values.

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22	04/02/22	04/02/22
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Iwade	**TP / BH No**	WS 1	WS 2	WS 3	WS 4	WS 5
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: GES/4693.12775	**Depth (m)**	0.50	0.50	0.35	0.30	0.30
Reporting Date: 11/02/2022	**DETS Sample No**	585129	585130	585131	585132	585133

Determinand	Unit	RL	Accreditation					
Stone Content	%	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	6.9	7.2	7.8	7.2	7.1
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	< 10	63	12	< 10	< 10
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.06	0.01	< 0.01	< 0.01
Organic Matter (SOM)	%	< 0.1	MCERTS	0.7	0.7	3.1	3.4	1.9
Arsenic (As)	mg/kg	< 2	MCERTS	8	10	11	10	10
Barium (Ba)	mg/kg	< 2.5	MCERTS	67	80	128	115	112
Beryllium (Be)	mg/kg	< 0.5	MCERTS	0.7	0.9	0.6	0.6	0.6
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	0.7	0.6	0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	23	28	22	22	21
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	12	17	38	39	35
Lead (Pb)	mg/kg	< 3	MCERTS	11	13	83	80	96
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19	22	17	16	14
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	36	42	33	33	30
Zinc (Zn)	mg/kg	< 3	MCERTS	44	52	80	77	74
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22	04/02/22	
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Iwade	**TP / BH No**	WS 6	WS 7	WS 8	WAC	
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: GES/4693.12775	**Depth (m)**	0.30	0.30	0.30	None Supplied	
Reporting Date: 11/02/2022	**DETS Sample No**	585134	585135	585136	585137	

Determinand	Unit	RL	Accreditation					
Stone Content	%	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected		
pH	pH Units	N/a	MCERTS	7.3	7.4	6.8		
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	< 10	< 10	< 10		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01	< 0.01		
Organic Matter (SOM)	%	< 0.1	MCERTS	3	2.4	1.9		
Arsenic (As)	mg/kg	< 2	MCERTS	9	9	10		
Barium (Ba)	mg/kg	< 2.5	MCERTS	110	91	100		
Beryllium (Be)	mg/kg	< 0.5	MCERTS	0.6	0.6	0.6		
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.6	0.4	0.4		
Chromium (Cr)	mg/kg	< 2	MCERTS	22	21	20		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	35	33	31		
Lead (Pb)	mg/kg	< 3	MCERTS	83	85	87		
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	16	13	15		
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3		
Vanadium (V)	mg/kg	< 1	MCERTS	32	31	31		
Zinc (Zn)	mg/kg	< 3	MCERTS	78	70	69		
Mineral Oil (C10 - C40)	mg/kg	< 10	MCERTS	< 10	< 10	< 10		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22	04/02/22	04/02/22
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Iwade	**TP / BH No**	WS 1	WS 2	WS 3	WS 4	WS 5
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: GES/4693.12775	**Depth (m)**	0.50	0.50	0.35	0.30	0.30
Reporting Date: 11/02/2022	**DETS Sample No**	585129	585130	585131	585132	585133

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.17	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.44	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.40	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.14	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.16	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.23	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.14	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	1.7	< 1.6	< 1.6

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22		
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: Iwade	**TP / BH No**	WS 6	WS 7	WS 8		
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: GES/4693.12775	**Depth (m)**	0.30	0.30	0.30		
Reporting Date: 11/02/2022	**DETS Sample No**	585134	585135	585136		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6		

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - EPH Banded (Type D)						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22	04/02/22	04/02/22
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Iwade	**TP / BH No**	WS 1	WS 2	WS 3	WS 4	WS 5
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: GES/4693.12775	**Depth (m)**	0.50	0.50	0.35	0.30	0.30
Reporting Date: 11/02/2022	**DETS Sample No**	585129	585130	585131	585132	585133

Determinand	Unit	RL	Accreditation					
EPH (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	1	< 1	< 1
EPH (>C21 - C35)	mg/kg	< 6	NONE	< 6	< 6	7	< 6	< 6
EPH (C8 - C35)	mg/kg	< 6	NONE	< 6	< 6	9	< 6	< 6

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - EPH Banded (Type D)						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22	04/02/22		
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: Iwade	**TP / BH No**	WS 6	WS 7	WS 8		
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: GES/4693.12775	**Depth (m)**	0.30	0.30	0.30		
Reporting Date: 11/02/2022	**DETS Sample No**	585134	585135	585136		

Determinand	Unit	RL	Accreditation					
EPH (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	< 1	3		
EPH (>C10 - C12)	mg/kg	< 1	MCERTS	2	2	5		
EPH (>C12 - C16)	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C16 - C21)	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
EPH (>C21 - C35)	mg/kg	< 6	NONE	< 6	< 6	11		
EPH (C8 - C35)	mg/kg	< 6	NONE	< 6	< 6	19		

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Organochlorine Pesticides						
DETS Report No: 22-01101	**Date Sampled**	04/02/22	04/02/22			
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Iwade	**TP / BH No**	WS 3	WS 4			
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied			
Order No: GES/4693.12775	**Depth (m)**	0.35	0.30			
Reporting Date: 11/02/2022	**DETS Sample No**	585131	585132			

Determinand	Unit	RL	Accreditation					
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
o,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
p,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
p,p' - DDE	mg/kg	< 0.02	NONE	0.05	< 0.02			
p,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02			
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02			

DETS Ltd
l, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3

DETS Report No: 22-01101	**Date Sampled**	04/02/22	
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	
Site Reference: Iwade	**TP / BH No**	WAC	
Project / Job Ref: 12775	**Additional Refs**	None Supplied	
Order No: GES/4693.12775	**Depth (m)**	None Supplied	
Reporting Date: 11/02/2022	**DETS Sample No**	585137	

Determinand	**Unit**	**MDL**		**Landfill Waste Acceptance Criteria Limits**		
				Inert Waste Landfill	**Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
TOC[MU]	%	< 0.1	0.2	3%	5%	6%
Loss on Ignition	%	< 0.01	3.20	--	--	10%
BTEX[MU]	mg/kg	< 0.05	< 0.05	6	--	--
Sum of PCBs	mg/kg	< 0.1	< 0.1	1	--	--
Mineral Oil[MU]	mg/kg	< 10	< 10	500	--	--
Total PAH[MU]	mg/kg	< 1.7	< 1.7	100	--	--
pH[MU]	pH Units	N/a	7.5	--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1	--	To be evaluated	To be evaluated

Eluate Analysis	**2:1 mg/l**	**8:1 mg/l**		**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)**		
Arsenic[U]	< 0.01	< 0.01		< 0.2	0.5	2	25
Barium[U]	< 0.02	< 0.02		0.1	20	100	300
Cadmium[U]	< 0.0005	< 0.0005		< 0.02	0.04	1	5
Chromium[U]	< 0.005	< 0.005		< 0.20	0.5	10	70
Copper[U]	< 0.01	< 0.01		< 0.5	2	50	100
Mercury[U]	< 0.0005	< 0.0005		< 0.005	0.01	0.2	2
Molybdenum[U]	< 0.001	< 0.001		< 0.1	0.5	10	30
Nickel[U]	< 0.007	< 0.007		< 0.2	0.4	10	40
Lead[U]	< 0.005	< 0.005		< 0.2	0.5	10	50
Antimony[U]	< 0.005	< 0.005		< 0.05	0.06	0.7	5
Selenium[U]	< 0.005	< 0.005		< 0.05	0.1	0.5	7
Zinc[U]	0.014	< 0.005		< 0.2	4	50	200
Chloride[U]	7	5		48	800	15000	25000
Fluoride[U]	0.7	0.5		5.4	10	150	500
Sulphate[U]	13	4		52	1000	20000	50000
TDS	113	79		824	4000	60000	100000
Phenol Index	< 0.01	< 0.01		< 0.5	1	-	-
DOC	7.4	8.6		84.7	500	800	1000
Leach Test Information							
Sample Mass (kg)	0.20						
Dry Matter (%)	85.7						
Moisture (%)	16.8						
Stage 1							
Volume Eluate L2 (litres)	0.32						
Filtered Eluate VE1 (litres)	0.17						

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepencies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Sample Descriptions
DETS Report No: 22-01101
Ground & Environmental Services Ltd
Site Reference: Iwade
Project / Job Ref: 12775
Order No: GES/4693.12775
Reporting Date: 11/02/2022

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
585129	WS 1	None Supplied	0.50	16.2	Light brown sandy clay
585130	WS 2	None Supplied	0.50	14.7	Brown sandy clay
585131	WS 3	None Supplied	0.35	16.6	Brown sandy clay
585132	WS 4	None Supplied	0.30	15.7	Brown sandy clay
585133	WS 5	None Supplied	0.30	14.7	Brown sandy clay
585134	WS 6	None Supplied	0.30	13.9	Brown sandy clay
585135	WS 7	None Supplied	0.30	15.9	Brown sandy clay
585136	WS 8	None Supplied	0.30	14.8	Brown sandy clay
585137	WAC	None Supplied	None Supplied	14.3	Brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 22-01101
Ground & Environmental Services Ltd
Site Reference: Iwade
Project / Job Ref: 12775
Order No: GES/4693.12775
Reporting Date: 11/02/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

UKAS TESTING
4480

Water Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 22-01101
Ground & Environmental Services Ltd
Site Reference: Iwade
Project / Job Ref: 12775
Order No: GES/4693.12775
Reporting Date: 11/02/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR dete	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 – C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichlorometha	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Parameter	Matrix Type	Suite Reference	Expanded Uncertainity Measurement	Unit
TOC	Soil	BS EN 12457	20.0	%
Loss on Ignition	Soil	BS EN 12457	35.0	%
BTEX	Soil	BS EN 12457	14.0	%
Sum of PCBs	Soil	BS EN 12457	23.0	%
Mineral Oil	Soil	BS EN 12457	9.0	%
Total PAH	Soil	BS EN 12457	11.6	%
pH	Soil	BS EN 12457	0.28	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18.0	%
Arsenic	Leachate	BS EN 12457	18.7	%
Barium	Leachate	BS EN 12457	11.6	%
Cadmium	Leachate	BS EN 12457	20.3	%
Chromium	Leachate	BS EN 12457	18.3	%
Copper	Leachate	BS EN 12457	24.3	%
Mercury	Leachate	BS EN 12457	23.7	%
Molybdenum	Leachate	BS EN 12457	14.7	%
Nickel	Leachate	BS EN 12457	16.1	%
Lead	Leachate	BS EN 12457	15.7	%
Antimony	Leachate	BS EN 12457	17.9	%
Selenium	Leachate	BS EN 12457	22.0	%
Zinc	Leachate	BS EN 12457	17.4	%
Chloride	Leachate	BS EN 12457	15.3	%
Fluoride	Leachate	BS EN 12457	16.4	%
Sulphate	Leachate	BS EN 12457	20.6	%
TDS	Leachate	BS EN 12457	12.0	%
Phenol Index	Leachate	BS EN 12457	14.0	%
DOC	Leachate	BS EN 12457	10.0	%
Clay Content	Soil	BS 3882: 2015	15.0	%
Silt Content	Soil	BS 3882: 2015	14.0	%
Sand Content	Soil	BS 3882: 2015	13.0	%
Loss on Ignition	Soil	BS 3882: 2015	35.0	%
pH	Soil	BS 3882: 2015	0.14	Units
Carbonate	Soil	BS 3882: 2015	16.0	%
Total Nitrogen	Soil	BS 3882: 2015	12.0	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24.0	%
Potassium (Extractable)	Soil	BS 3882: 2015	20.0	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26.0	%
Zinc	Soil	BS 3882: 2015	14.9	%
Copper	Soil	BS 3882: 2015	16.0	%
Nickel	Soil	BS 3882: 2015	17.7	%
Available Sodium	Soil	BS 3882: 2015	23.0	%
Available Calcium	Soil	BS 3882: 2015	23.0	%
Electrical Conductivity	Soil	BS 3882: 2015	10.0	%

Craig Spanton
Ground & Environmental Services Ltd
Unit 2
Montpelier Business Park
Dencora Way
Ashford
Kent
TN23 4FG

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 22-01246

Site Reference:	Iwade
Project / Job Ref:	12775
Order No:	GES/4695.12775
Sample Receipt Date:	09/02/2022
Sample Scheduled Date:	09/02/2022
Report Issue Number:	1
Reporting Date:	14/02/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate						
DETS Report No: 22-01246	**Date Sampled**	07/02/22	07/02/22	07/02/22	07/02/22	
Ground & Environmental Services Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Iwade	**TP / BH No**	WS1	WS2	WS3	WS7	
Project / Job Ref: 12775	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: GES/4695.12775	**Depth (m)**	0.90 - 1.00	1.50 - 1.60	1.50 - 1.60	0.90 - 1.00	
Reporting Date: 14/02/2022	**DETS Sample No**	585676	585677	585678	585679	

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.4	7.8	7.9	7.3	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	< 10	27	36	< 10	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.03	0.04	< 0.01	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 22-01246	
Ground & Environmental Services Ltd	
Site Reference: Iwade	
Project / Job Ref: 12775	
Order No: GES/4695.12775	
Reporting Date: 14/02/2022	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
585676	WS1	None Supplied	0.90 - 1.00	16.4	Light brown clay
585677	WS2	None Supplied	1.50 - 1.60	15.1	Light brown clay
585678	WS3	None Supplied	1.50 - 1.60	16.6	Light brown clay
585679	WS7	None Supplied	0.90 - 1.00	16.5	Light brown clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 22-01246
Ground & Environmental Services Ltd
Site Reference: Iwade
Project / Job Ref: 12775
Order No: GES/4695.12775
Reporting Date: 14/02/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX 7

GUIDELINES ON CONTAMINANT LEVELS

Human Health

CLEA Soil Guideline values (SGV)

The UKs primary contaminated land guidance is contained within the Contaminated Land Exposure Assessment (CLEA) framework. Within this framework a number of Soil Guideline Values (SGVs) were published for key contaminants along with toxicological guideline values relating to intake thresholds. The soil guideline values provided by the CLEA model represent intervention values for end uses based upon potential human exposure and soil concentrations of a contaminant above these values might represent an unacceptable risk to the health of the site users. The Environment Agency had an ongoing programme of SGV publication with associated toxicological information for key contaminants. Where SGVs are available then they should be used as the basis for any human health risk assessment.

All CLEA SGVs were withdrawn for use by the Environment Agency in 2008 whilst they are under review and pending the availability of new toxicological data. To date, new SGV values have been set for benzene, toluene, ethylbenzene and xylene and mercury and selenium. In the absence of the new SGVs and toxicological report data, GES have used appropriate screening tools or Generic Assessment Criteria Levels as assessment criteria guidelines for those determinands not currently assigned SGVs. It should be noted that the former SGVs for metals were in general agreement with those site specific levels generated by RBCA and other similar computer model based risk assessment tools.

The GES screening assessment of contaminants within samples has been carried out using these model generated values in the absence of any other values or guidelines. The version of the CLEA model, v1.06, was used. The published SGVs are shown below. Nickel SGV has been withdrawn (2015) pending an assessment of the toxicological data used in the model for nickel. Published SGV values.

	Soil Guideline Value (mg kg^{-1})		
Land use	**Residential**	**Allotment**	**Commercial**
Inorganic arsenic	32	43	640
Nickel	130	230	1,800
Cadmium	10	1.8	230
Phenol	420	280	3200
Elemental Hg	1	26	26
Inorganic Hg	170	80	3600
Methyl Hg	11	8	410
Selenium	350	120	13,000
Benzene	0.33	0.07	95
Toluene	610	120	4400
Ethylbenzene	350	90	2800
o-Xylene	250	160	2600
r-Xylene	240	180	3500
m-Xylene	230	160	3200

Based on a sandy loam soil as defined in Environment Agency (2009b) and 6% SOM.

DEFRA Category four screening level (C4SL)

In addition to the SGVs, guideline screening values proposed in the DEFRA document SP1010-Development of Category 4 Screening Levels for Assessment of Land affected by Contamination Final Project Report (C4SL) are considered along with the suitable for use levels (S4USL) derived by the Chartered Institute of Environmental Health (CIEH) in partnership with the Land Quality Management Organization (LQM). The screening levels are given for residential, commercial, allotment or public open space end uses.

PARAMETER	Residential		Commercial	Allotment	Public open Space near residential POS_{resi}	Public park land POS_{park}	Sources
	With Plant uptake	Without Plant uptake					
Inorganics - mg/kg unless stated							
Arsenic (inorganic)	37	40	640	49	79	170	DEFRA C4SL
Beryllium	1.7	1.7	12	35	2.2	63	LQM/S4USL
Boron	290	11,000	240,000	45	21,000	46,000	LQM/CIEH
Cadmium	22	150	410	3.9	220	880	LQM/S4USL
Chromium III	910	910	8,600	18,000	1,500	33,000	LQM/CIEH
Chromium VI	21	21	49	170	21	250	LQM/S4USL
Copper	2,400	7,100	68,000	520	12,000	44,000	LQM/CIEH
lead	200	310	2,300	80	630	1,300	DEFRA C4SL
Mercury (Inorganic)	40	56	1,100	19	120	240	LQM/CIEH
Nickel	180	180	980	230	230	3,400	LQM/CIEH
Selenium	250	430	12,000	88	1,100	1,800	LQM/CIEH
Vanadium	410	1,200	9,000	91	2,000	5,000	LQM/CIEH
Zinc	3,700	40,000	730,000	620	81,000	170,000	LQM/CIEH
Total sulphate	2400	2400	2400	2400	2400	2400	BRE (2005)
Water-soluble sulphate (g/l)	0.5	0.5	0.5	0.5	0.5	0.5	BRE (2005)
pH	<5	<5	<5	<5	<5	<5	-

CLEA does not currently provide guidance for total Polycyclic Aromatic Hydrocarbons (PAHs). A standalone Defra C4SL for benzo(a)pyrene has been assigned and is shown below. In addition, the Chartered Institute of Environmental Health (CIEH) in partnership with the Land Quality Management Organization (LQM) used CLEA software to derive Generic Assessment Criteria (GAC) and Assessment Sub Criteria (ASC) for the following PAH compounds:

PARAMETER	Residential						Commercial			Allotment			POS	POS	Source
	With Plant uptake			Without Plant uptake											
SOM %	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	resi	park	
Organics - mg/kg unless stated															
Acenaphthene	200	490	1080	2000	3600	5200	75000	92000	100000	34	85	202			CLEA/LQM CIEH
Acenaphthylene	170	400	900	2000	3600	5200	76000	92000	100000	28	68	163			CLEA/LQM CIEH
Anthracene	2300	5400	10700	30000	34000	36000	520000	530000	540000	380	947	2230			CLEA/LQM CIEH
Benzo(a)anthracene	7.5	11	13	12	14	15	170	170	180	2.9	6.5	13			CLEA/LQM CIEH
Benzo(a)pyrene C4SL			5			5.3			77			5.7	10	21	DEFRA C4SL
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	44	45	45	1	2.2	3.9			CLEA/LQM CIEH
Benzo(g,h,i)perylene	315	340	350	360	360	360	3900	4000	4000	290	480	646			CLEA/LQM CIEH
Benzo(k)fluoranthene	77	93	100	110	110	110	1200	1200	1200	37	76	129			CLEA/LQM CIEH
Chrysene	15	22	27	30	31	32	350	350	350	4.1	9.5	19			CLEA/LQM CIEH
Dibenzo(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.44			CLEA/LQM CIEH
Fluoranthene	280	560	890	1500	1600	1600	23000	23000	23000	52	127	288			CLEA/LQM CIEH
Fluorene	165	390	850	2200	3400	4200	60000	67000	70000	27	67	158			CLEA/LQM CIEH
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	500	510	510	9.5	21	40			CLEA/LQM CIEH
Naphthalene	1	2.3	5.5	1	2.4	6	100	260	600	4	9.8	23			CLEA/LQM CIEH
Phenanthrene	95	220	440	1300	1400	1500	22000	22000	23000	15	38	90			CLEA/LQM CIEH
Pyrene	620	1200	2000	3700	3800	3800	54000	54000	55000	11	271	620			CLEA/LQM CIEH

Petroleum Hydrocarbons represent a complex situation being a mixture of a range of compounds, the relative concentrations of which may change over time.

As discussed above, Generic Assessment Criteria (GAC) for total petroleum hydrocarbons according to both their molecular weight and chemical structure and also for a range of soil organic matter (SOM) content values have been derived using CLEA software.

The LQM CIEH GACs are again presented according to their soil organic matter content and proposed end use of the land. The generic assessment criteria for a 1%, 2.5% and 6% SOM content are tabulated below and presented according to the proposed end use.

	LQM CIEH Generic Assessment Criteria (mg/kg dry weight soil)													
	Residential						Allotment Land Use			Commercial Land Use				
	With Plant Uptake			Without Plant Uptake										
SOM %	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**	**1**	**2.5**	**6**		
Aliphatic														
EC 5 – 6	24	40	80	24	40	80	752	1730	3900	2400	4000	8000		
EC > 6 – 8	52	110	250	52	110	250	2304	5580	13000	5200	11000	25000		
EC > 8 – 10	13	30	70	13	30	70	321	770	1700	1300	3000	7000		
EC > 10 – 12	60	150	360	60	150	360	2153	4300	7150	6000	15000	32000		
EC > 12 – 16	500	1200	2600	500	1200	2600	10800	12400	13200	42000	72000	90000		
EC > 16 – 35	41000	69000	94000	41000	69000	94000	240000	260000	260000	140000	160000	180000		
EC > 35 – 44	41000	69000	94000	41000	69000	94000	240000	260000	260000	140000	160000	180000		
Aromatic														
EC 5 – 7 (benzene)	50	110	240	155	300	630	12	25	57	15000	28000	55000		
EC > 7 – 8 (toluene)	100	240	550	370	800	1800	21	50	117	33000	68000	130000		
EC > 8 – 10	20	50	110	20	53	125	8.6	21	50	2000	5000	120000		
EC > 10 – 12	63	150	340	120	280	650	12.5	31	74	11000	22000	31000		
EC > 12 – 16	140	320	660	1100	1900	2300	23	57	134	35000	37000	38000		
EC > 16 – 21	260	540	930	1800	1900	1900	47	112	260	28000	28000	28000		
EC > 21 – 35	1100	1400	1700	1900	1900	1900	370	820	1500	28000	28000	28000		
EC > 35 – 44	1100	1400	1700	1900	1900	1900	370	820	1500	28000	28000	28000		
													POS_{resi}	POS_{park}
Benzene DEFRA C4SL	0.06	0.13	0.3 (0.87)	0.16	0.3	0.64 (3.3)	0.016	0.033	0.073 (0.18)	15	28	57 (98)	140	230
Toluene	104	240	550	370	830	1800	22	50	117	33000	68000	130000		
Ethylbenzene	30	62	150	34	81	190	16	38	91	3200	7000	16000		
o-xylene	30	70	170	40	90	200	28	67	160	3700	8000	19000		
m-xylene	30	70	160	34	80	190	30	74	170	3400	8000	18000		
p-xylene	30	70	160	33	80	180	28	69	160	3200	8000	17000		

TPH values calculated using CLEA v1.06 with parameter changes in accord with DEFRA (2014) C4SL and LQM/CIEH (2015)

Inert Material

The limit values for inert waste are given in the EC Landfill Directive 1999/31/EC as applied under the Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 (*SI 2019/39*) and as defined by the council decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC(2003/33/EC).

The regulations and associated guidance provide waste acceptance criteria, which set the limits of contaminants permitted in various waste categories going to landfill. These criteria are of particular use where CLEA guidance or DEFRA Screening values has not yet been provided.

Inert waste is defined as waste which contains insignificant potential for pollution and does not endanger the quality of surface water or groundwater. The Landfill Directive states that inert waste will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health.

For risk assessment purposes we would consider that any materials (soils) containing concentrations of potential contaminants that would result in them being classified as inert would be considered as uncontaminated and therefore representing a low risk to human health.

Similarly, such material would not be considered to represent a significant risk to water resources.

Where CLEA or Defra screening values exist, these would always be used in preference to inert waste values when assessing risks to human health.

Selected inert waste acceptance criteria as given in Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills for the Landfill Directive are given below.

Landfill acceptance criteria for inert waste (mg/kg)	
Total organic carbon (TOC)	30,000
BTEX compounds	6
Mineral oils (C10 – C40)	500
PCBs	1
PAH	100

Risks to Plants

The CLEA framework does not provide a method for the assessment of phytotoxic risks to plants. However maximum permissible concentrations have been published in the Sludge (Use in Agriculture) Regulations 1989 (SI 1989, No. 1263). This legislation enforces the provisions of the EC Directive 86/278/EEC for potentially toxic elements (PTEs) on soils for agricultural use where sewage sludge has been applied (see table below). These limits relate to the potential risk to plants and not human health for which CLEA is the overriding risk assessment model.

Maximum permissible concentration in agricultural soils following sewage sludge application (mg/kg).				
	pH 5.0<5.5	**pH 5.5<6.0**	**pH 6.0-7.0**	**pH >7.0**
Zinc	200	250	300	450
Copper	80	100	135	200
Nickel	50	60	75	110

Risks to buried concrete

The potential risks to buried concrete can be assessed by reference to the BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground'. This document provides a methodology for the specification of concrete based on the ground conditions encountered and is based upon chemical analysis and associated factors (e.g. groundwater). The guidance provides a Design Sulphate Class (DS) based upon the ground conditions and it is considered that a low concentration of sulphate and pH (i.e. DS – 1 and DS – 2) is considered to represent a low risk to buildings.

Risks to buried services

In addition, where water is supplied in plastic pipes which could come into contact with contaminated ground then this can lead to premature failures, resulting in leakage and loss of water quality. Risks to water supply pipes are assessed using guidance published by the UK Water Industry Research (UKWIR) entitled '*Guidance for the Selection of Water Pipes to be used in Brownfield Sites'* (Report Ref. No. 10/WM/03/21). This is known as the UKWIR guidance.

Previous guidance from WRAS has been withdrawn but may still be in use by certain water supply companies. In general water companies have adopted a common set of guidelines as given in the ***Contaminated Land Assessment Guidance from January 2014.***

Additional threshold values for determining pipe material have also been published by certain water supply companies. If these threshold values are exceeded then consideration should be given to the selection of pipe material or to the use of barrier pipes. The UKWIR threshold values, together with those of certain water supply companies are presented in the table below for a range of potential hazards.

Substance[(1)]	Water UK Guidance	Thames Water
Total VOC	0.5	-
Total BTEX & MTBE	0.1	0.1 or either
Total SVOC	2	-
EC5-EC10 aliphatic and aromatic hydrocarbons	2	-
EC5-EC12 aliphatic hydrocarbons		0.5
EC5-EC12 aromatic hydrocarbons		0.5
EC10-EC16 aliphatic and aromatic hydrocarbons	10	-
EC12-EC21 aliphatic hydrocarbons		10
EC12-EC21 aromatic hydrocarbons		10
EC16-EC40 aliphatic and aromatic hydrocarbons	500	-
EC21-EC35 aliphatic hydrocarbons		500
EC21-EC35 aromatic hydrocarbons		500
Phenols	2	5*
Cresols and chlorinated phenols	2	2
Naphthalene	**-**	**5**
Ethers	0.5	-
Nitrobenzene	0.5	-
Ketones	0.5	-
Aldehydes	0.5	-
Amines	0	-
Corrosives pH and EC	# ##	

All units mg kg-1 in soil;
pH <7 for wrapped steel, pH <5 wrapped ductile iron and copper and ##EC >400µS/cm;
*Phenol limit at 2mg/kg in presence of BTEX.