



Phase I and Phase II
Geoenvironmental Site Assessment

Draw Well Road

October 2019



PHASE I AND PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Draw well Road
Knowsley
Liverpool
L33 7BJ

Prepared for:

Prime Property Consulting



Report Ref: 12-969-r1-1

Date Issued: October 2019

Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

E3P

Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

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

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	12-969		
VERSION	Version 1		
REMARKS	Final		
DATE	September 2019		
PREPARED BY	Adeel Ahmed		
QUALIFICATIONS	MESci Hons, FGS		
SIGNATURE			
CHECKED BY	Stuart Ellis		
QUALIFICATIONS	BSc (hons), FGS		
SIGNATURE			
AUTHORISED BY	A Edgar		
QUALIFICATIONS	BSc, MSc, PIEMA, MIEnvSc, CEnv		
SIGNATURE			



EXECUTIVE SUMMARY

Site Address	Land off Draw Well Road, Knowsley Industrial Park, L33 7TQ	
Grid Reference	E343618, N398755	
Site Area	3.47 Hectares	
Current Site Use	The development is a long strip of land bisected north-south by Draw Well Road. The west side of Draw Well Road consists of one former munitions bunker. The east side comprises three derelict office buildings in the north, a car park and four disused bunkers with a redundant railway track in the centre and an active wooden pallet yard in the south (Mersey Pallet Co).	
Proposed Development	E3P understands that Prime Property Consulting are considering the proposed acquisition and future redevelopment of the site for commercial land use with associated utility infrastructure.	
Environmental Setting	Drift Geology	Shirdley Hill Sand Formation - BGS borehole logs indicate silty clay and sand to a depth of 3.00 m bgl underlain by Glacial Till clay.
	Bedrock Geology	Cheshire Formation - Sandstone
	Faults	N/A
	Hydrogeology	Secondary A aquifer strata (Drift) overlying a Principal Aquifer (Bedrock Geology). The site lies within a Source Protection Zone III. The nearest groundwater abstraction is located 101m east of the site for use as cooling. There are 12 within 250m of the site related to commercial/ industrial uses.
	Hydrology	There are no surface water features within 250m of the subject site.
	Flood Risk	The site is located within a currently defined Flood Zone 1.
Site History	Historical mapping suggests that the site was undeveloped agricultural land until post 1928 when a series of bunkers with related train lines were constructed on-site. It is understood that these were used as high explosive stores in World War II. More recently the two most northerly bunkers have been occupied by railway stores and overseas stores.	
Utility Locations	A formal GPR survey has not been completed, however a review of online records indicates service infrastructure is within the site.	
Landfill Sites and Ground Gases	There are no recorded landfills within 250m of the site however, the envirocheck report notes a potential infilled marl pit 109m north west with six infilled watercourses within 250m of the site.	
Radon	Unaffected – no special precautions required.	



E3P INTRUSIVE GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising mechanically excavated trial pits, concrete coring, window sample boreholes, and cable percussive boreholes.
Ground Conditions	MADE GROUND – The majority of Made Ground identified across the site was a gravelly sand that consisted of brick, asphalt and concrete, also localised reworked clay was identified in a number of locations to a maximum proven depth of 1.50m bgl. Two coring locations were carried out in Bunker 1 and 2 that identified that bunker 1 had a ground floor slab thickness of 1 m that consisted of a concrete slab. Bunker 2 has a thickness of 1.3 m with a 0.2m gravel layer identified at 0.7 m bgl. Drift – Drift deposits were fairly varied across the site, comprising of a dark brown slightly gravelly clayey fine to medium SAND overlaying a; stiff, high-strength, brown mottled grey, slightly gravelly CLAY with sandstone and mudstone gravel at 3.00m bgl. A firm light grey sandy CLAY was identified in a small number of exploratory holes above 2.00 m bgl. PEAT was identified in several location mainly within the north east of the site with a maximum depth of 1.4 m bgl. Stiff boulder CLAY was identified within Cable Percussive location at a maximum depth of 8.5 m bgl. Occasional fine to course gravel of Sandstone and Mudstone was identified within the cohesive deposits. Solid – Reddish brown weathered SANDSTONE was encountered within CP103 and CP104 at 6.0 m bgl and inferred in CP101 and CP102 at 7.50m bgl, this sandstone is found underlying stiff bolder CLAY identified within cable percussive holes. Groundwater – Groundwater was encountered between 2 m bgl and 4 m bgl across the site.

CONTAMINATED LAND ASSESSMENT

Human Health	Loose chrysotile fibres were identified within the Made Ground deposits in WS112 and TP110, which could be released during earthworks and then subsequently inhaled by construction workers and possibly impact third-party property. Localised impacted soils will be placed at depth during a carefully managed and regulatory authority-approved phase of enabling works, under strict construction-phase health and safety controls. Upon placement of asbestos impacted soils at depth beneath hardstanding or plots, they will present no unacceptable risk to the future site users. Localised elevated PAH elevations have been identified within Made Ground soils. These are considered to be a localised occurrence. It is considered that these areas will be overlain by hard-standing removing the pollutant linkage to receptors identified on the site.
---------------------	--



	PAHs may pose a short-term risk to construction workers who may come into contact with impacted soils during any future earthworks. The proposed development will be covered by either building, hard-standing or a 300mm cover system in the external areas, thus breaking the pathway to the proposed end users. In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard. A watching brief and further chemical testing is recommended upon demolition of the buildings.
Controlled Waters	Exceedances of lead and arsenic have been identified within the leachate sample WS111-0.4 m. It should be noted that the Tier I assessment criteria provides a conservative view, which may overstate the risk. Inorganic determinands identified above are of a general low solubility, and therefore mobility, suggesting that these will not migrate to controlled water receptors. Furthermore, the elevated results were identified from leachate samples taken within the Made Ground. Leachate tests generally provide conservative results given the aggressive nature of the test. Given that no elevated heavy metals were identified within the groundwater samples, there is potential contaminants are not leaching in the real world environment. Furthermore, the site is underlain by a low-permeability, cohesive glacial till deposits overlying the Sandstone aquifer. This clay bands will afford protection to the underlying Principal aquifer, furthermore there are no drinking water abstractions within close proximity of the site. Therefore, there is considered to be a low risk to controlled waters and the wider environment as no complete pollutant linkage can be determined.
Ground Gas	The majority of the site is Characteristic Situation 1, with elevated levels of methane identified within WS101 classified as Characteristic Situation 2 (pending completion of gas monitoring).
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR risk assessment however there is potential that upon completion of the remediation works, barrier pipe will be required.

GEOTECHNICAL ASSESSMENT

Underground Obstructions	Obstructions and cobbles of brick and concrete were encountered within the Made Ground. Due to the current large structures on-site it is anticipated that there is significant potential for large obstructions within the Made Ground. During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed units
Allowable Bearing Pressure	The underlying natural clay drift deposits have been assessed as being stiff, high strength with a net allowable bearing pressure (ABP) in the order of 100 kN/m² at circa 1 m bgl increasing to 150–200 kN/m² at circa 2 m bgl. The underlying medium dense clayey SAND has also been identified as having in the order of 100 kN/m² at circa 1 m bgl increasing to 150-180 kN/m² at circa 2 m bgl.
Foundation Options	Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure (ABP), the suitable target founding stratum has been identified as the underlying firm to very stiff, glacial CLAY or medium dense to dense SAND, where an ABP of approximately 150 kN/m² can be achieved at 4.00m bgl.



	Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying stiff to very stiff CLAY and localised areas of medium-dense SAND. However, given the topographical variances on the site with levels slightly falling to the west of the site, prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels. Therefore, upon completion of these enabling works, it is likely that the most cost-effective option for the majority of the site would be to re-engineer the Made Ground using vibro-stone columns (VSCs) to support a shallow strip or spread foundation. However, a piled foundation will likely be the only foundation option in the east of the site unless the PEAT identified in the east is removed in its entirety. It must be noted that you can't have two foundation solutions for a single building. Where proposed development levels, trees or locally variable ground conditions dictate, it would be possible to utilise a trench fill type foundation to support relatively lightly loaded structures. It will be necessary to locally deepen foundations within influence of existing or proposed trees. In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard.
Building Floor Slabs	A ground-bearing slab will be viable for the commercial structures; however, it will need to be constructed utilising a sub-base with the thickness designed by a structural engineer to ensure that settlement tolerances are taken into consideration. Where a ground-bearing floor slab is to be constructed within the conjectured zone of tree influence, the clay will need to be removed to ensure that any desiccated soil cannot swell and induce heave to the structure. Alternatively, it may be possible to design the structure to resist the influence of clay heave using exaggerated sub-base and additional reinforcement within the slab to be designed by the structural engineer. Where PEAT is present this will need to be removed or the whole floor slab piled to remove the potential for differential settlement. Alternatively, there is potential that Controlled Modulus Columns could be utilised. If this were to be the case, then the PEAT could remain in-situ. It would be possible to utilise soil stabilisation techniques that incorporate the addition of lime and OPC to construct a stiffened soil horizon with a CBR > 15% to constitute a sub-base replacement layer that could then be capped with Type 1 MOT. The use of soil stabilisation could be extended within the conjectured zone of tree influence to modify the structure of clay soils and negate the potential for volumetric instability.



Heave Precautions	Given that the underlying clay is of low volume change potential, heave precautions will not be required to the internal face of a foundation. However, heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) or ground beams within the modelled influencing distance of trees. As the underlying clay is low volume change potential, heave precautions are not required to the internal face of the external load-bearing walls (outside or within tree influence). Where a ground-bearing floor slab is to be constructed within the conjectured zone of tree influence, the clay will need to be removed to ensure that any desiccated soil cannot swell and induce heave to the structure. Alternatively, it may be possible to design the structure to resist the influence of clay heave using exaggerated sub-base and additional reinforcement within the slab, to be designed by the structural engineer.
Soakaway Drainage	The Made Ground and underlying granular soils are cohesive in nature and impacted by low-level inorganic and PAH compounds which would preclude the use of infiltration drainage systems. BRE365 testing will be required to confirm the potential for soakaway.
Sulphate Assessment	Concrete classification will be DS1 AC1s across the majority of the site, but a pH exceedance has been identified within the area of TP101 where DS-2 AC-2s will have to be used.
Cut/Fill	Development levels are unknown at this time; however, cut-and-fill works will be required to prepare the development platform. A geotechnical specification of works will be required to document filled material types, compaction methodologies and validation testing relevant to the proposed development end use.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: Waste Classification – Guidance on the classification and assessment of waste.

RECOMMENDATIONS

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

- ✳ Further investigation in areas of limited access;
- ✳ Geotechnical earthworks strategy (infrastructure);
- ✳ Remediation and enabling works strategy; and
- ✳ Build-phase contamination mitigation strategy.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
1. INTRODUCTION	9
1.1. Background	9
1.2. Proposed Development	9
1.3. Objectives	10
1.4. Limitations	11
1.5. Confidentiality	11
2. SITE SETTING	12
2.1. Site Details	12
2.2. Current Site Use	12
2.3. Surrounding Area	13
3. SITE HISTORY	15
3.1. On-Site Historical Development	15
3.2. Off-Site Historical Development	17
3.3. Planning History	18
4. ENVIRONMENTAL SETTING	19
4.1. Geology and Hydrogeology	19
4.2. Geotechnical Data	20
4.2.1. Coal Mining Information	20
4.3. Radon Risk Potential	20
4.4. Industrial Land Uses	20
4.5. Sensitive Land Uses	20
4.6. Site Sensitivity Assessment	21
4.7. Preliminary Geotechnical Assessment	21
4.8. Unexploded Ordnance	22
5. CONSULTATIONS	23
5.1. Landfill Sites and Waste Treatment Sites	23
5.2. Regulatory Database	23
6. INITIAL CONCEPTUAL SITE MODEL	25
7. GROUND INVESTIGATION	27
7.1. General Overview	27
7.2. In-Situ Standard Penetration Testing (SPT)	28
7.3. Laboratory Analysis	28
8. GROUND AND GROUNDWATER CONDITIONS	30
8.1. Summary of Ground Conditions	30
8.2. Made Ground	31
8.3. Drift Deposits	31
8.4. Solid Geology	32
8.5. Groundwater	32
8.6. Visual and Olfactory Evidence of Contamination	32
8.7. Soil Consistency	32
8.7.1. Side Stability and Ease of Excavation	33
8.8. Soil Compressibility	38
8.9. Soil Plasticity	38
8.10. pH and Sulphate	39
8.11. Ground Gas	40



8.12.	Investigation Rationale.....	40
8.13.	Monitoring Methodology.....	40
9.	TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	43
9.1.	Human Health Risk Assessment.....	43
9.1.1.	human health Risk Assessment and Mitigation	45
9.2.	Controlled Waters Risk Assessment.....	47
9.2.1.	controlled water risk assessment and mitigation.....	49
9.3.	Ground Gas	50
9.3.1.	Sources of Ground Gas.....	50
9.3.2.	Groundwater	51
9.3.3.	Gas Flow	51
9.3.4.	Gas Concentrations	51
9.3.5.	Gas Assessment	51
9.4.	COMMERCIAL Building Gas Risk Mitigation	52
9.5.	Potable water supply	56
9.6.	Conceptual Site Model	57
10.	GEOTECHNICAL ASSESSMENT	60
10.1.	Proposed Development.....	60
10.2.	Summary of Ground Conditions	60
10.3.	Site Preparation	61
10.4.	Foundation Conditions and Assessment of Potential Bearing Capacities	61
10.5.	Ground Floor Slabs.....	65
10.6.	Heave Precautions	65
10.7.	Pavement Construction.....	66
10.8.	Drainage	67
10.9.	Concrete Durability	67
10.10.	Excavations.....	67
11.	CONCLUSIONS AND RECOMMENDATIONS.....	68
	APPENDIX I LIMITATIONS.....	71
	APPENDIX II GLOSSARY	73
	APPENDIX III DRAWINGS	76
	APPENDIX IV PHOTOGRAPHS	78
	APPENDIX V EXPLORATORY LOGS	84
	APPENDIX VI CHEMICAL TESTING RESULTS	85
	APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA.....	86
	APPENDIX VIII GEOTECHNICAL TESTING RESULTS.....	89



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Prime Property Consultancy to undertake a detailed Phase I and II Geoenvironmental Site Assessment for a parcel of land off Draw Well Road, Knowsley, Merseyside.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed development for a proposed commercial development.

The scope of work includes the following elements:

- ✳ Detailed review of historic information;
- ✳ Detailed desk study;
- ✳ Design of suitable intrusive ground investigation;
- ✳ Window sample probeholes with, and construction of, environmental monitoring installations;
- ✳ Deep cable percussive boreholes with groundwater monitoring installations;
- ✳ Mechanically excavated trial pits;
- ✳ In-situ geotechnical testing;
- ✳ Chemical and geotechnical laboratory analysis;
- ✳ Groundwater monitoring and sampling;
- ✳ Ground gas monitoring;
- ✳ Contamination risk assessment and conceptual site model;
- ✳ Geotechnical assessment and interpretation; and
- ✳ Factual and interpretive reporting.

1.2. PROPOSED DEVELOPMENT

E3P understands that Prime Property Consulting are considering the proposed acquisition and future redevelopment of the site off Draw Well Road site for commercial land use with 16 commercial buildings with associated utility infrastructure. Drawing 12-969-009 (Appendix III) identifies the proposed development layout.

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



FIGURE 1.1 **SNAPSHOT OF PROPOSED DEVELOPMENT (SCHEME 1)**



1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

- ✳ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document *Land Contamination: Risk Management (LCRM) (2019)*.
- ✳ Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- ✳ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✳ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✳ Provide recommendations regarding future works required.



1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. SITE SETTING

2.1. SITE DETAILS

Site Address	Land off Draw Well Road, Knowsley, Merseyside, L33 7TY
National Grid Reference	E343618, N398755
Site Area	3.47 Hectares

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

A site location map is presented in Appendix III as Drawing 12-969-001.

2.2. CURRENT SITE USE

E3P has undertaken a site walkover of the entire site and a description of the key findings is summarised in Table 2.1.

TABLE 2.1 SITE DESCRIPTION

Occupancy/Use	A former bunker occupies the land west of Draw Well Road. The land east of Draw Well is occupied by four former bunkers which line western side of this sector of the site along Draw Well Road running roughly north-south, and approximately 30m apart from one another. The profiles of all bunkers are rectangular in shape, with the back wall sloping down towards the south and the entrance located on the northerly facing wall in the western corner. The most northerly bunker is covered with long grass with the other three overlain by overgrown vegetation. Railway Tracks are situated west of the two most northerly bunkers The southernmost area is occupied by a wooden pallet supplier, surrounded by wooden and wire mesh fencing. The very eastern sector of the site comprises hard standing for a former use as a carpark. The north of the site is occupied by three buildings; Balfour Beatty offices (now unoccupied), a large rectangular building located behind Balfour Beatty and a small square building occupying the very north west corner. The surrounding space is occupied by hardstanding ground and mature trees adjacent to the western border.
Structures	The north of the subject site is occupied by a two-story building that appears to have formerly being used for offices. Across the remainder of the site there are four bunkers lining Draw Well Road and a single bunker is located to the west of Draw Well Road. All the bunkers have a similar concrete construction with walls that are circa 1.0 m thick and are overlain by soft landscaping. Within the bunkers is a station like setup, where the train would enter and there are multiple supporting pillars across the internal former storage areas.



	A trial pit to assess the northern most bunkers foundation is presented within drawing 12-969-008 in Appendix III.	
Access	Four access points down both Acornfield Road and Draw Well Road are gated and locked. Access to buildings in the north of site and the wooden pallet yard to the south can be gained through gates located on Ashcroft Road and Kirby Bank Road respectively.	
Slope	The subject site has a natural gradual slope to the south with the west of the site sat lower topographically due to the construction of bunkers that line Draw Well Road.	
Retaining Structures	A retaining wall is present connected to Bunker 1 on Draw Well Road, with approximate height of 1.8 m and an approximate length of 5 m. This wall retains the car park present behind the office buildings in the north of the site.	
Surface Cover (%)	Buildings	30%
	Hardstand	50%
	Soft Cover	20%
Vegetation/Ecology	Rough scrub vegetation is present surrounding and on top of the bunkers on, with bunker four being the most overgrown. Semi-mature trees are scattered across the site, but area's covered in hardstanding lack vegetation. A habitat survey will be required to support the planning application.	
Hazardous Material Storage	No above-ground storage tanks (ASTs) or underground storage tanks (USTs) were observed at the site during the preliminary site walkover. Due to the previous nature of the site, it is possible that hazardous materials storage will have occurred on the site.	
Asbestos-Containing Material (ACM)	No evidence of ACM was noted across the site during the site walkover and investigation, however due to the age of the buildings it is likely that ACM will be contained within the building's fabric on site. A pre-demolition asbestos survey will be required within all existing buildings within the site boundary.	
Polychlorinated Biphenyls (PCBs)	There is no equipment identified that may contain PCBs within the site boundary; however, there is an electric substation and a transformer to the south of the site in close proximity.	
Waste Storage	Potentially hazardous waste streams are unlikely to be generated at the site and none were observed during the preliminary site inspection.	
Drainage	A formal drainage survey has not been completed; however, a review of online records held by United Utilities indicates the presence of a combined sewer located along the, north, east, south and west of the site beneath Ashcroft Road, Acornfield Road, Kirby Bank Road and Draw Well Road.	

2.3. SURROUNDING AREA

The surrounding area land uses are summarised in Table 2.2 below.

TABLE 2.2 SURROUNDING LAND USES

DIRECTION	LAND USE
North	Commercial industrial estate.
East	Commercial industrial estate.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

DIRECTION	LAND USE
South	Commercial industrial estate.
West	Commercial industrial estate.

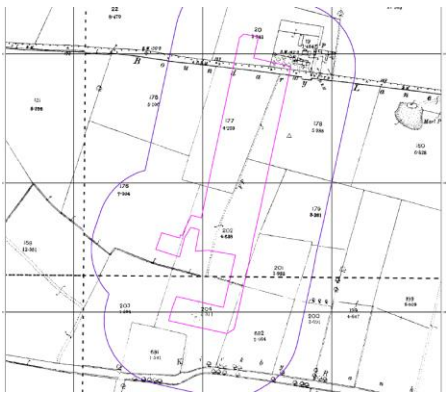
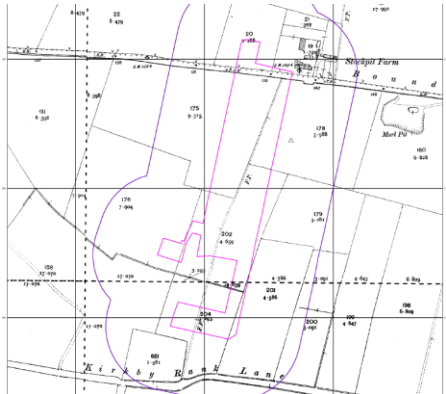
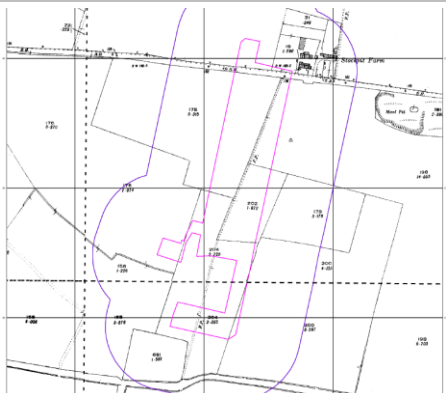


3. SITE HISTORY

3.1. ON-SITE HISTORICAL DEVELOPMENT

A review of historical mapping pertinent to the site is summarised in Table 3.1. In addition, historical site features are presented on Drawing No 12-969-003 in Appendix III.

TABLE 3.1 HISTORICAL DEVELOPMENT

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1893 1:2,500	The site is occupied predominantly by agricultural fields with five field boundaries located within the subject area. Boundary Road crossing the subject area in the north, Kirby Bank Lane is located south of the site.	
1908 1:2,500	There are no significant changes to subject site.	
1927 1:2,500	There are no significant changes to subject site.	



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1960-1962 1:2,500	Site has changed significantly and shows similar structures to present day. Roads are now present around the site area. Ashcroft Road to the north, Acornfield Road to the east, Kirby Bank Road to the south and Draw Well Road have been constructed. Four rectangular bunkers align roughly north-south along Draw Well Road with associated hardstanding. Draw Well Road is a no through Road that can be accessed from Ashcroft Road to the north. Trees can also be seen to border the eastern boundary of the site.	
1972 1:2,500	Two buildings are located in the north east of the site with a 'Builders Yard' located immediately southwest of the two buildings. Two buildings have been constructed in the north east of the site with associated hardstanding.	
1993 1:2,500	Hardstanding ground is now present in the south of the site. The two buildings located in the north east of the site and the current office buildings have been constructed.	
1994 1:2,500	There are no significant changes to subject site.	



MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
Google Earth 2019	There are no significant changes to subject site.	

3.2. OFF-SITE HISTORICAL DEVELOPMENT

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 250 m radius of the site is summarised in Table 3.2.

TABLE 3.2 SURROUNDING HISTORICAL DEVELOPMENT

SURROUNDING FEATURE	DISTANCE	DATES	DIRECTION
Tanks	2m	Pre 1994-Present	West
Electric sub-station	5m	Pre 1993-Present	West
Unspecified works Then 'Insulated Cable Works' Then 'Works' Then demolished	25m	Pre 1960-Pre 1993 Pre 1993-Pre 1967 Pre 1967-2001 2001-Present	South
Electric sub-station	20m	Pre 1994-Present	North east
Tanks Then no longer present	25m	Pre 1993-Pre 1994 Pre 1994-Present	West
Tanks Then no longer present	25m	Pre 1960-Pre 2001 Pre 2001-Present	South
Photographic Material Factory Then unspecified factory Then Knowsley Industrial Park	25m	Pre 1967-Pre 1971 Pre 1971-Pre 1994 Pre 1994-Present	East
Tanks	45m	Pre 1993-Present	West
Electric sub-station	60m	Pre 1993-Present	West
Chemical works Then demolished	80m	Pre 1967-Pre 1994 Pre 1994-Present	West
Unspecified works Then 'Funeral Furnishing Works' Then 'Work'	80m	Pre 1960-Pre 1910 Pre 1910-Pre 1972 Pre 1972-Present	North
Tanks	110m	Pre 1994-Present	East
Cooling towers Then no longer present	110m	Pre 1967-Pre 1994 Pre 1994-Present	East
Unspecified works Then demolished	125m	Pre 1960-Pre 1994 Pre 1994-Present	South east



SURROUNDING FEATURE	DISTANCE	DATES	DIRECTION
Unspecified works Then 'Engineering Works' Then unspecified works Then demolished	130m	Pre 1860-Present Pre 1972-Pre 1977 Pre 1977-Pre 1994 Pre-1994-Present	West
Unspecified works Then 'Engineering Works' Then unspecified works Then demolished	132m	Pre 1860-Present Pre 1972-Pre 1977 Pre 1977-Pre 1994 Pre 1994-Present	West
Tanks	135m	Pre 1994-Present	West
Unspecified works Then 'Engineering Works' Then unspecified works Then demolished	155m	Pre 1860-Present Pre 1972-Pre 1977 Pre 1977-Pre 1994 Pre-1994-Present	West
Unspecified works Then 'Chemical Works' Then unspecified works Then demolished	160m	Pre 1860-Present Pre 1972-Pre 1977 Pre 1977-Pre 1994 Pre-1994-Present	West
Tanks	165m	Pre 1994-Present	West
Unspecified works Then demolished	230m	Pre 1960-Pre 1967 Pre 1967-Present	West
Marl Pit Then no longer present	250m	Pre 1893-Pre 1960	East

3.3. PLANNING HISTORY

E3P has undertaken a detailed search of on-line planning records held by Knowsley Council which has identified that, with the exception of several change of use of warehouses, there is no planning application information pertinent to the site.



4. ENVIRONMENTAL SETTING

4.1. GEOLOGY AND HYDROGEOLOGY

The British Geological Survey (BGS) map for the site, (1:50,000, Solid and Drift editions) and online records indicate the site is underlain by the geological sequence presented in Table 4.1.

TABLE 4.1 SUMMARY OF UNDERLYING GEOLOGY

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Drift	Shirdley Hill Sand Formation	Sand	Secondary A Aquifer
Solid	Chester Formation	Sandstone	Principal Aquifer

TABLE 4.2 SUMMARY OF BGS BOREHOLE RECORDS

LOCATION	DEPTH	MADE GROUND	DRIFT	SOLID
100 m SW	4.3 m	1.0 m	Silty sand, peat and sandy clay	Not encountered
150 m E	2 m	1.7 m	Sand	Not encountered
200 m S	25 m	1.0 m	Silty Clay and Sand	14m – Red brown Sandstone
200 m SEE	25 m	0.3 m	Sand	4.4m – Red Brown Sandstone
200 m SE	25 m	2.0 m	Silty sand and clay	6.1m – Red brown Sandstone
300 m W	5 m	0.7 m	Silty sand and silty clay.	Not encountered
350 m N	3 m	0.8 m	Silty clay	Not encountered

TABLE 4.3 FAULTING

LOCATION	DESCRIPTION
N/A	N/A

The Envirocheck report indicates that the site is located within a Groundwater Source Protection Zone III (Total Catchment). Furthermore, there are 15 groundwater abstractions within 1 km of the site. The closest of these is located approximately 100m east of the site and is used for general cooling, general use and process water. The other abstraction within 1km are related to drinking, cooking, washing, sanitary and irrigation.

Based on the local topography, the location of surface watercourses and the presence of several drainage ditches and streams within the site boundary, it is considered likely that shallow groundwater, if present, will flow in a northerly direction, following the topographical gradient towards Kirkby Book to the south.



4.2. GEOTECHNICAL DATA

Geotechnical data presented within a commercially available environmental database is summarised in Table 4.4.

TABLE 4.4 SUMMARY OF GEOTECHNICAL DATA

HAZARD	DESIGNATION
Shrink-Swell Clay	No Hazard
Landslides	Very Low
Ground Dissolution	No Hazard
Compressible Ground	No Hazard
Collapsible Deposits	Very Low Risk
Running Sand	Low Risk

4.2.1. COAL MINING INFORMATION

The Envirocheck Report states the site is not in a coalmining affected area. The Coal Authority map was also consulted and confirms the site area is not within the Mining Reporting area.

4.3. RADON RISK POTENTIAL

The Envirocheck report indicates the site is situated in an area where less than 1% of homes are above the "Action Level" and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions.

4.4. INDUSTRIAL LAND USES

The site is located within Knowsley Industrial Estate and has 26 active entries within the trade directory that are located within 250 m.

The Mersey Pallet Co. and Brazilian Joinery Ltd are located on site.

A number of the potentially harmful industries in close proximity are noted below:

- Hydrodec UK Ltd (Oil recycling and disposal services) 22 m South West,
- Ames Goldsmith UK Ltd (Chemical manufacturers) 56 m South,
- Surface Transforms (Carbon Products) 160 m E and Rentokill Property Care 247 m North.

4.5. SENSITIVE LAND USES

The following sensitive land uses are located within the vicinity of the site:

- The site lies within a Nitrate Vulnerable Zone;
- A Local Nature Reserve is located 554 m south of the site;
- An Area of Adopted Greenbelt is located 330 m east of the site;



-  The closest residential properties are located 1.2 km west of site;
-  The site lies within Source Protection Zone III (total catchment).

4.6. SITE SENSITIVITY ASSESSMENT

The site is assessed to be located within a “**Moderate**” sensitivity setting as discussed within Table 4.5.

TABLE 4.5 SITE SENSITIVITY ASSESSMENT

SENSITIVITY PROFILE	DISCUSSION	RATING
Sensitive Land Uses Within Close Proximity (e.g. Residential, School, Nursery, Local Nature Reserves)	The site is located within a Nitrate Vulnerable Zone An area of adopted Green Belt is located 330 m east of the site A local nature reserve is located 554 m south of the site.	Moderate
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	Site is located in a source protection zone, classed as Zone III (Total catchment).	High
Distance to the Closest Groundwater Abstraction Point	101 m east separated by Ames Goldsmith UK Ltd.	Moderate
Aquifer Classification in Superficial Drift Deposits	The underlying superficial deposits are likely to comprise of silty clays to depths in excess of 5.0m which may reduce the potential for mobile phase contaminants to migrate towards the bedrock aquifer.	Moderate
Aquifer Classification in Bedrock	Principal Aquifer	High
Is the Site Underlain by Low-Permeability Drift to Depths in Excess of 10 m?	BGS boreholes records confirm that drift deposits are defined as silty clays and sands ranging in depths between 4m and 14m. The permeability of the underlying strata is likely to be variable due to the presence of both sands and clays	Low
Is the Site Located Within 50 m of a Surface Watercourse?	No watercourses within 50m of the subject site.	Low
OVERALL SITE ENVIRONMENTAL SENSITIVITY		Moderate / High

4.7. PRELIMINARY GEOTECHNICAL ASSESSMENT

Based on the desk-study information, the following geotechnical assessment has been made:

-  Given the predominantly developed nature of the site, it is likely there will be extensive Made Ground fill deposits and obstructions. Existing buildings will require demolition, with all relict foundations grubbing out, prior to the construction of the proposed development.



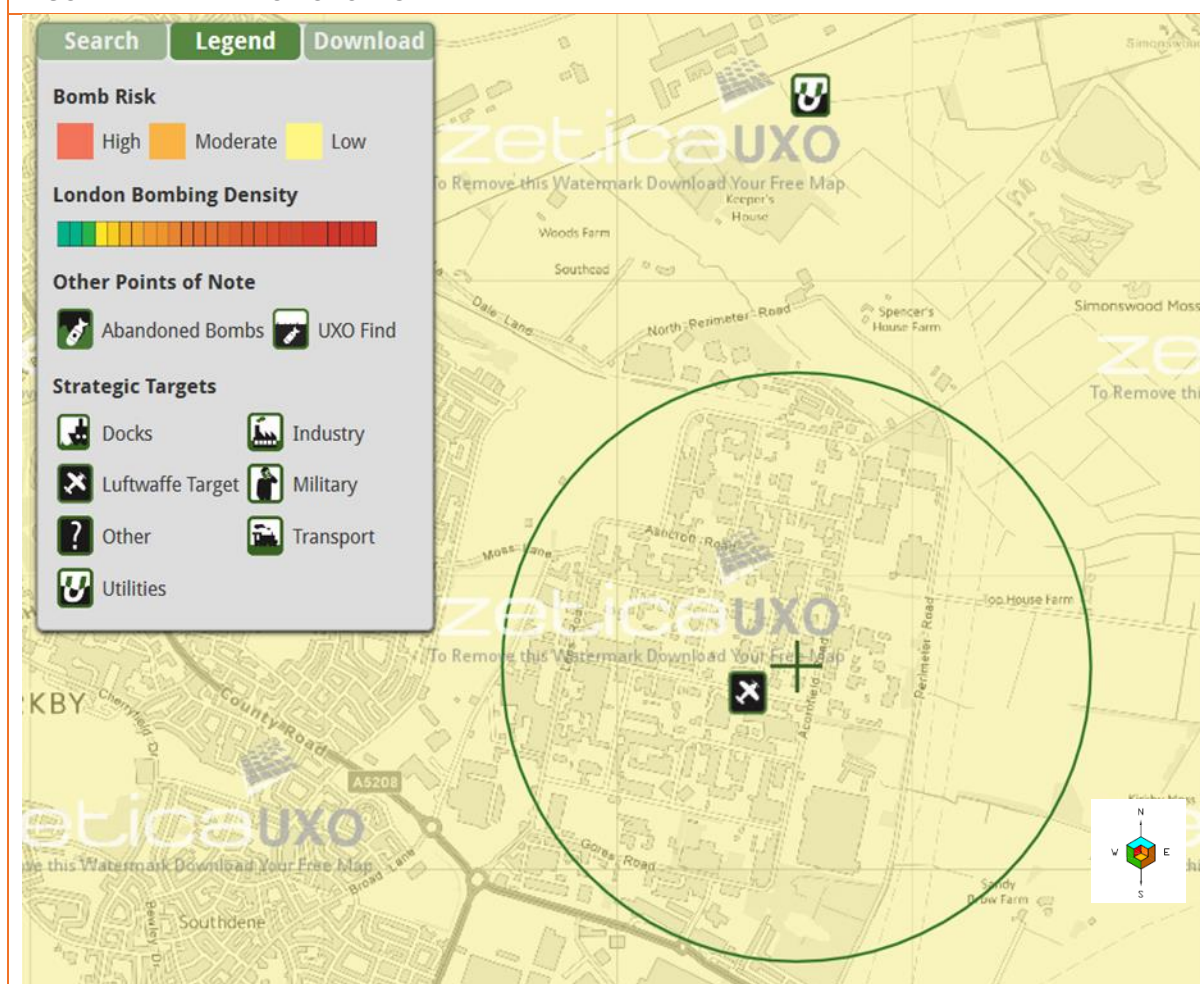
- ✿ The former bunkers on Draw Well Road have been cut into the natural landscape so a phase of groundwork to produce construction levels for the proposed developments will likely be required.
- ✿ Demolition of the existing structures and sub structures will likely produce a significant amount of demolition arisings. This material, subject to assessment, will likely be suitable for processing into recycled aggregate for use in subsequent phases of the development.

4.8. UNEXPLODED ORDNANCE

The regional unexploded bomb risk map from Zetica (2014) indicates that the site is in an area at low risk from possible unexploded ordnance (UXO) resulting from the Second World War. However, due to the historical military use of the bunkers and the site being recorded as a Luftwaffe target it is suggested that UXO measures be taken into considerations during works across the site. The fact the buildings which stored explosives are still standing suggests that bombs never detonated on-site. The Zetica UXO Risk Map is presented as Figure 4.2.

A preliminary EXO Risk Assessment was completed for the site by 1st Line Defence (report ref: EP7641-00 dated November 2018). The report concluded that *"Given the findings of this preliminary report, further research is recommended in the form of a Detailed UXO Risk Assessment."*

FIGURE 4.1 ZETICA UXO RISK MAP



Source - <https://zeticauxo.com/downloads-and-resources/risk-maps/>



5. CONSULTATIONS

5.1. LANDFILL SITES AND WASTE TREATMENT SITES

A potential infilled marl pit 109m NW with six infilled waters within a 250 m radius. The nearest registered landfill site is over 1000 m away and there are seven registered waste treatment and disposal sites within a 250 m radius.

5.2. REGULATORY DATABASE

The information summarised in Table 5.1 has been obtained from a commercially available environmental database. The summary table only includes records from within 250 m of the subject site and not otherwise detailed in the report.

TABLE 5.1 SUMMARY OF ENVIRONMENTAL DATA

RECORD	ENTRIES WITHIN 250 m	DETAILS
Contaminated Land Register Entries and Notices	0	None Identified
Authorised Industrial Processes (IPC/IPPC/LAPPC)	79	46 IPC entries within 250 m of the site. The closest of which is located 52 m south west relating to Baker Petrolite Ltd for the manufacture and use of organic chemicals within the chemical industry. There are 30 IPPC entries within 250 m of the site. The closest IPPC entry was by Future Industrial Services Ltd located 8 m SE, with the waste disposal described as hazardous waste. 3 LAPPC entries are present within 250 m of the site. The closest of which is located 218 m north of the site related to blending, packing, loading and use of bulk cement.
Fuel Stations Entries	0	None Identified
Licensed Radioactive Substances	0	None Identified
Enforcements, Prohibitions or Prosecutions	0	None Identified
Discharge Consents	0	None Identified
Pollution Incidents	3	16 m S – Category 2 Air Impact – Chemicals – 2014 188 m SE – Category 2 Air Impact – Chemicals – 2016 405 m SW Category 2 Air Impact - Fumes-2007



RECORD	ENTRIES WITHIN 250 m	DETAILS
Consents Issued Under the Planning (Hazardous Substances) Act 1990	11	Eleven entries, the closest of which is 67 m north east of related to Kodak for an unknown substance. The other substances within 250 m include dangerous substances, toxic, ethylene oxide and arsenic trioxide,
Control of Major Accident Hazard (COMAH) Sites	4	There are four entries within 250 m, one of which has ceased. The closest entry is 66 m north east of the site and is a lower tier COMAH site. 105 m south west is a higher tier site.



6. INITIAL CONCEPTUAL SITE MODEL

In accordance with EA LCRM (2019) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), E3P has developed an initial conceptual site model (CSM) to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 6.1.

TABLE 6.1 INITIAL CONCEPTUAL SITE MODEL

SOURCE	PATHWAY	RECEPTOR
Human Health		
Heavy metals, PAH associated within Made Ground and historical site use	Dermal Contact and Ingestion.	Construction Workers. Commercial End Users.
Discussion: Due to the historical uses of the site such as train lines and storage bunkers likely presence of Made Ground across the site that could potentially have sources of PAH and heavy metals related to former boilers, storage and site spillages. This could have a potential effect on construction workers and the end users of the site through dermal contact and ingestion.		
Volatile hydrocarbon compounds associated with Made Ground	Volatilisation/Accumulation. Vapour Inhalation.	Construction Workers. Commercial End Users.
Discussion: Due to the historical uses of the site such as train lines and storage bunkers likely presence of Made Ground across the site that could potentially have sources of PAH and heavy metals related to former boilers, storage and site spillages. This could have a potential effect on construction workers and the end users of the site through dermal contact and ingestion.		
Asbestos-Containing Materials (ACMs) within Made Ground	Fibre/Dust Inhalation.	Construction Workers. Commercial End Users. Third-Party Property.
Discussion: The potential presence of Made Ground across the majority of the site will produce a risk of ACM. ACM poses a risk through fibre and dust inhalation posing a risk to construction workers, site end users and third-party property.		
Hazardous Ground Gases		
Methane and carbon dioxide associated with possible on-site fill material and infilled features within 250m of the site.	Inhalation. Accumulation.	Construction Workers. Commercial End Users.
Discussion: The off-site infilled marl pit and on-site Made Ground have the potential to produce hazardous gases such as carbon dioxide and methane. These gases could accumulate within internal areas and subsequently be inhaled by construction workers and commercial end users.		
Controlled Waters		
Hydrocarbon compounds and PAHs associated with previous industrial uses.	Vertical/Lateral Migration.	Principal Aquifer.
Discussion: Potential hydrocarbon compounds and PAHs associated with previous industrial uses on the site pose a risk of Vertical/Lateral Migration down into the principal aquifer. The likelihood is negated as the presence of low permeability strata is expected under the site.		



SOURCE	PATHWAY	RECEPTOR
Buildings and Infrastructure		
pH and Sulphate	Corrosion of Concrete.	Foundations/Concrete.
Discussion: Likely probability as ash and other pH sensitive materials are expected to be encountered within the made ground on site, that may encounter future foundations and buildings on site. An intrusive investigation is required to determine the presence of these made ground material.		
Ecology		
None Identified	Lateral Migration.	TBC
Discussion: An ecology survey may be required before works are carried out on-site.		



7. GROUND INVESTIGATION

7.1. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources summarised in Table 6.1. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed between 26th June 2019 and 1st July 2019. The works are summarised in Table 7.1.

TABLE 7.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General ground conditions including the presence/nature of obstructions	WS101	Window Sample Probehole	5.45	1.0–4.0
	WS102		5.45	1.0–4.0
	WS103		3.45	-
	WS104		4.45	1.0–3.0
	WS105		5.45	1.0–4.0
	WS108		5.45	1.0–2.0
	WS109		5.45	-
	WS110		4.45	1.0–3.0
	WS111		4.45	0.5-1.0
	WS112		5.45	-
	WS113		5.45	-
	WS114		5.45	-
	WS115		5.45	-
	WS116		5.45	-
	WS117		4.45	0.5-4.0
Structure of bunker foundations	TP101-TP119	Mechanically Excavated Trial Pit	2.40	N/A
	TP104		1.50	N/A
Thickness of concrete slab within bunkers present on site	WS106	Window Sample Probehole	1.00	-
	WS107		1.30	-
Deeper general ground conditions including the presence/nature of obstructions	CP101	Cable Percussive Boreholes	9.45	-
	CP102		8.95	2.0-4.0
	CP103		9.45	-
	CP104		7.95	2.0-4.0



Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells. Two window samples were cored through the ground floor concrete slab within bunker 1 and 2 on draw well road, to determine the thickness of the slab present.

Two topsoil samples were collected, TS01 from an overgrown area surrounding a bunker on the eastern side of Draw Well Road and TS02 from the vegetation of the roof, from the bunker on the western side of Draw Well Road.

Cable percussive boreholes were drilled in order to gather geotechnical data on the deeper underlying strata.

The sampling locations are illustrated in Drawing 12-969-004 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix V.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged and samples of groundwater recovered for chemical analysis.

7.2. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in Appendix V and presented in Table 8.6 and discussed in Section 10.

7.3. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis comprising:

- ✳ Metals;
- ✳ pH, total sulphate, water-soluble sulphate (2:1 extract);
- ✳ Sulphide;
- ✳ Cyanide;
- ✳ Phenols;
- ✳ Total and speciated polycyclic aromatic hydrocarbons (PAHs);
- ✳ Semi Volatile Organic Compounds (SVOC);
- ✳ Volatile Organic Compounds (VOC);
- ✳ Asbestos identification and quantification; and,
- ✳ Speciated and banded total petroleum hydrocarbon (TPH).

I2 Analytical undertook the analytical work and the testing results are included in Appendix VI and discussed in Section 9.



Selected samples were submitted to PSL Laboratory where the following geotechnical tests were undertaken:

-  Atterberg limits determinations; and
-  Single-stage triaxial tests.
-  Particle size distribution tests
-  Dry density / moisture content relationship
-  One dimensional consolidation tests

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 10.



8. GROUND AND GROUNDWATER CONDITIONS

8.1. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 8.1.

TABLE 8.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)						
	MADE GROUND	SOFT CLAY	PEAT	ORGANIC SILT	STIFF CLAY	SAND	BED ROCK
TP101	0.0-0.7	–	–	–	0.7-2.1	–	–
TP102	0.0-0.8	–	–	–	2.0-2.4	0.8-2.0	1.3 to > 2.5
TP103	0.0-0.3	–	–	–	0.3-2.0	–	–
TP104	0.5-1.5	–	–	–	–	–	–
TP105	0.0-0.2	–	–	–	0.5-1.8	0.2-0.5	–
TP106	0.0-0.8	–	–	–	1.7-2.1	0.8-1.7	–
TP107	0.0-0.8	–	–	–	–	0.8-2.2	–
TP108	0.0-0.2	–	–	–	1.8-2.1	0.2-1.8	–
TP109	0.0-1.5	1.5-2.2	–	–	–	–	–
TP110	0.0-0.6	–	0.6-0.8	–	–	0.8-1.8	–
TP111	0.0-0.5	–	–	–	–	–	–
TP112	0.0-0.5	–	0.8-1.20	–	–	0.5-0.8 1.2-2.0	–
TP113	0.0-0.5	–	0.5-0.9	–	0.9-2.0	–	–
WS101	0.0-0.8	1.4-2.0 2.7-3.0	–	–	–	0.8-1.4 2.0-2.70 3.0-5.45	–
WS102	0.0-0.9	–	–	–	0.9-5.45	–	–
WS103	0.0-0.2	–	–	–	0.2-3.45	–	–
WS104	0.0-0.2	–	1.3-1.4	–	2.4-4.0	0.2-1.3 1.4-2.4	–
WS105	0.0-0.4	1.2-3.3	–	–	3.3-5.45	0.4-1.2	–
WS106	0.0-1.0	–	–	–	–	–	–
WS107	0.0-1.3	–	–	–	–	–	–
WS108	0.0-1.8	–	–	–	1.8-5.45	–	–
WS109	0.0-0.4	–	–	–	0.4-5.45	–	–
WS110	0.0-0.5	–	–	–	2.5-3.0 3.5-4.45	0.5-2.5 3.0-3.5	–
WS111	0.0-0.8	2.0-3.0	–	–	0.8-2.0 3.0-4.45	–	–



HOLE	DEPTH TO STRATUM (m bgl)						
	MADE GROUND	SOFT CLAY	PEAT	ORGANIC SILT	STIFF CLAY	SAND	BED ROCK
WS112	0.0-0.5	–	–	–	0.5-5.45	–	–
WS113	0.0-0.3	–	–	–	0.3-3.45	–	–
WS114	0.0-2.2	–	–	–	3.7-4.0 4.7-5.45	2.2-3.7 4.0-4.7	–
WS115	0.0-0.6	–	0.6-1.0	–	2.6-5.45	1.0-2.6	–
WS116	0.0-1.2	–	–	–	3.9-5.45	1.2-3.9	–
WS117	0.0-0.2	–	–	–	0.2-4.45	–	–
CP101	0.0-0.4	0.8-1.8	–	–	1.8-9.0	0.4-0.8	–
CP102	0.0-0.5	–	–	–	3.1-8.5	0.5-3.1	–
CP103	0.0-0.5	3.2-4.0	–	–	4.0-6.0	0.5-3.2	6.0-9.0
CP104	0.0-0.5	–	–	–	3.2-6.0	0.5-3.2	6.0-7.5

8.2. MADE GROUND

The max depth of Made Ground identified was 1.5 m bgl surrounding the disused office building to the north, the average Made Ground depth across the site was identified between 0.5 m bgl to 0.8 m bgl.

The Made Ground in the south of the site has a max depth of 1.2 m bgl with the east of the site that borders Acornfield Road having a max depth of 0.7 m bgl.

Made Ground identified across the bunker sites has been identified at 0.9m bgl with an average of 0.7 m bgl. Most of exploratory hole locations were topped with asphalt that had an average thickness of 0.2 m.

The majority of Made Ground identified across the site was a gravelly sand that consisted of brick asphalt and concrete, also reworked clays were identified in small abundance across the site.

Two coring locations were carried out in Bunker 1 and 2 that identified that bunker 1 had a ground floor slab thickness of 1 m that consisted of a concrete slab. Bunker 2 has a thickness of 1.3 m with a 0.2m gravel layer identified at 0.7 m bgl.

A depth of Made Ground plan is presented in Appendix III.

8.3. DRIFT DEPOSITS

Drift deposits were fairly varied across the site, comprising of a dark brown slightly gravelly clayey fine to medium SAND overlaying a; stiff, high-strength, brown mottled grey, slightly gravelly CLAY with sandstone and mudstone gravel at 3.00 m bgl. A firm light grey sandy CLAY was identified in a small number of exploratory holes above 2.00 m bgl.

PEAT was identified in several location mainly within the north east of the site with a maximum depth of 1.4 m bgl.

Stiff boulder CLAY was identified within Cable Percussive location at a maximum depth of 8.5 m bgl. Occasional fine to course gravel of Sandstone and Mudstone was identified within the cohesive deposits.



8.4. SOLID GEOLOGY

Reddish brown weathered SANDSTONE was encountered within CP103 and CP104 at 6.0 m bgl and inferred in CP101 and CP102 at 7.50 m bgl, this sandstone is found underlaying stiff gravelly CLAY identified within cable percussive holes.

8.5. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages are shown on the exploratory hole records in Appendix V and are summarised in Table 8.2.

TABLE 8.2 SUMMARY GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS101	3.0	Fast water ingress
WS116	4.0	Fast water ingress
WS111	3.0	Fast water ingress
TP104	1.5	Fast water ingress
CP101	6.5	Damp strata
CP102	0.4	Damp strata
CP102	6.5	Damp strata

Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater. These results are summarised in Table 8.11.

8.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation and these are summarised in Table 8.3.

TABLE 8.3 SUMMARY VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
TP104	1.5	Made Ground	Hydrocarbon sheen

8.7. SOIL CONSISTENCY

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained triaxial tests. Results of the tests are presented in Table 8.4 and Table 8.5, which indicate the clay soils to vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.



TABLE 8.4 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP101	0.9	120.0	276
TP101	1.3	120.0	276
TP101	1.6	120.0	276
TP101	1.9	120.0	276
TP102	2.3	66.6	153.18
TP103	0.5	113.3	260.59
TP103	1.0	120.0	276
TP103	1.5	120.0	276
TP103	2.0	120.0	276
TP106	1.9	96.6	222.18
TP108	1.9	113.3	260.59
TP114	2.0	39.3	90.39

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 8.6.

TABLE 8.5 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
CP103	4.0–4.5	Stiff, brown, slightly gravelly, sandy CLAY	143	Stiff
CP104	4.0–4.5	Very stiff, brown, slightly gravelly, sandy CLAY	106	Stiff
WS102	1.5–2.0	Firm, brown, slightly gravelly, sandy CLAY	224	Very Stiff

8.7.1. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation.

The presence of brick and concrete cobbles within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground and in some places, Made Ground could not be fully penetrated. The natural strata was excavated with relative ease.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

TABLE 8.6 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)
WS101	3	sandy CLAY	39	33.92	N/A	Very high strength	Very Stiff	169.58
WS102	1	sandy CLAY	12	12.10	N/A	Medium strength	Stiff	60.49
WS102	2	sandy CLAY	24	21.92	N/A	High strength	Very Stiff	109.62
WS102	3	sandy CLAY	12	10.44	N/A	Medium strength	Stiff	52.18
WS102	4	sandy CLAY	26	21.97	N/A	High strength	Very Stiff	109.83
WS102	5	sandy CLAY	40	33.18	N/A	Very high strength	Very Stiff	165.92
WS103	1	sandy CLAY	9	9.07	N/A	Medium strength	Stiff	45.37
WS103	2	sandy CLAY	15	13.70	N/A	Medium strength	Stiff	68.52
WS103	3	sandy CLAY	75	65.22	N/A	Extremely high strength	Very Stiff	326.12
WS104	3	dark brown CLAY	50	43.48	N/A	Very high strength	Very Stiff	217.41
WS105	2	sandy CLAY	4	3.65	N/A	Very low strength	Soft	18.27
WS105	3	sandy CLAY	26	22.61	N/A	High strength	Very Stiff	113.05
WS105	4	sandy CLAY	14	11.83	N/A	Medium strength	Stiff	59.14
WS105	5	sandy CLAY	39	32.36	N/A	Very high strength	Very Stiff	161.78
WS106	2	sandy CLAY	10	9.14	N/A	Medium strength	Stiff	45.68
WS106	3	very sandy CLAY	18	15.65	N/A	High strength	Very Stiff	78.27
WS108	4	sandy CLAY	20	16.90	N/A	High strength	Very Stiff	84.49
WS108	5	sandy CLAY	20	16.59	N/A	High strength	Very Stiff	82.96



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)
WS109	2	sandy CLAY	12	10.96	N/A	Medium strength	Stiff	54.81
WS109	3	sandy CLAY	15	13.04	N/A	Medium strength	Stiff	65.22
WS109	4	sandy CLAY	32	27.04	N/A	High strength	Very Stiff	135.18
WS109	5	sandy CLAY	45	37.33	N/A	Very high strength	Very Stiff	186.66
WS110	4	sandy CLAY	16	13.52	N/A	Medium strength	Stiff	67.59
WS111	1	sandy CLAY	14	14.11	N/A	Medium strength	Stiff	70.57
WS111	2	sandy CLAY	1	1.34	N/A	Extremely Low Strength	Very soft	4.57
WS111	3	sandy CLAY	14	12.18	N/A	Medium strength	Stiff	60.88
WS111	4	sandy CLAY	28	23.66	N/A	High strength	Very Stiff	118.28
WS112	1	sandy CLAY	8	8.07	N/A	Medium strength	Stiff	40.33
WS112	2	sandy CLAY	12	10.96	N/A	Medium strength	Stiff	54.81
WS112	3	sandy CLAY	12	10.44	N/A	Medium strength	Stiff	52.18
WS112	4	sandy CLAY	17	14.36	N/A	Medium strength	Stiff	71.81
WS112	5	sandy CLAY	22	18.25	N/A	High strength	Very Stiff	91.26
WS113	1	sandy CLAY	12	12.10	N/A	Medium strength	Stiff	60.49
WS113	2	sandy CLAY	28	25.58	N/A	High strength	Very Stiff	127.90
WS113	3	sandy CLAY	50	43.48	N/A	Very high strength	Very Stiff	217.41
WS114	1	sandy CLAY	2	2.02	N/A	Very low strength	Soft	10.08
WS114	2	sandy CLAY	11	10.05	N/A	Medium strength	Stiff	50.24



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)
WS114	3	sandy CLAY	4	3.48	N/A	Very low strength	Soft	17.39
WS114	4	sandy CLAY	49	10.05	N/A	Medium strength	Stiff	50.24
WS114	5	sandy CLAY	49	3.48	N/A	Very low strength	Soft	17.39
WS115	1	sandy CLAY	14	41.40	N/A	Very high strength	Very Stiff	206.99
WS115	2	sandy CLAY	12	40.65	N/A	Very high strength	Very Stiff	203.26
WS115	3	sandy CLAY	11	14.11	N/A	Medium strength	Stiff	70.57
WS115	4	sandy CLAY	38	10.96	N/A	Medium strength	Stiff	54.81
WS115	5	sandy CLAY	48	9.57	N/A	Medium strength	Stiff	47.83
WS116	4	sandy CLAY	15	32.10	N/A	Very high strength	Very Stiff	160.52
WS116	5	sandy CLAY	50	39.82	N/A	Very high strength	Very Stiff	199.11
WS117	1	sandy CLAY	13	12.67	N/A	Medium strength	Stiff	63.36
WS117	2	sandy CLAY	16	41.48	N/A	Very high strength	Very Stiff	207.41
WS117	3	sandy CLAY	25	13.11	N/A	Medium strength	Stiff	65.53
WS117	4	sandy CLAY	50	50	N/A	Medium strength	Stiff	73.08
WS101	1	fine to coarse SAND	16	16.13	Medium Dense	N/A	N/A	N/A
WS101	2	fine to coarse SAND	10	9.14	Loose	N/A	N/A	N/A
WS101	3	fine to coarse SAND	39	33.92	Dense	N/A	N/A	N/A
WS101	4	fine to coarse SAND	14	11.83	Medium Dense	N/A	N/A	N/A
WS101	5	fine to coarse SAND	50	41.48	Dense	N/A	N/A	N/A



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)
WS104	1	fine to coarse SAND	9	9.07	Loose	N/A	N/A	N/A
WS104	2	fine to coarse SAND	12	10.96	Medium Dense	N/A	N/A	N/A
WS105	1	fine to coarse SAND	12	12.10	Medium Dense	N/A	N/A	N/A
WS110	1	fine to coarse SAND	13	13.11	Medium Dense	N/A	N/A	N/A
WS110	2	fine to coarse SAND	7	6.39	Loose	N/A	N/A	N/A
WS110	3	fine to coarse SAND	20	17.39	Medium Dense	N/A	N/A	N/A
WS116	2	fine to coarse SAND	15	13.70	Medium Dense	N/A	N/A	N/A



8.8. SOIL COMPRESSIBILITY

Consolidation tests have been undertaken on selected samples of CLAY using an odometer to obtain consolidation properties. Tests include an unload cycle to help assess potential heave. The results are included in Table 8.7.

TABLE 8.7 SUMMARY CONSOLIDATION TEST DATA

LOCATION	DEPTH (m)	LOAD INCREMENT	VOLUME CHANGE COEFFICIENT, M_v	CONSOLIDATION COEFFICIENT, C_v
CP103	4.0	0–85	0.220	7.671
		85–170	0.186	0.985
		170–340	0.108	1.384
		340–680	0.069	1.098
		680–85	0.045	1.317
WS102	1.5	0–35	–	–
		35–70	0.044	21.353
		70–140	0.101	3.933
		140–280	0.075	2.488
		280–35	0.032	1.453

The results returned show varying compressibility between the two samples tested.

WS102 shows the soils to be swelling and therefore is an over-consolidated clay. This must be considered when re-engineering as the clay is likely to undergo volumetric change.

The clay within CP103 at 4.00m of medium compressibility under a loading of 85–340 kN/m².

8.9. SOIL PLASTICITY

The liquid and plastic limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average plasticity index (PI) for each “type” of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth.

E3P typically only consider a soil to be shrinkable if the proportion finer than 63 µm is > 35%.

PI results are compared against guidance given in the NHBC standards, Chapter 4.2 (revised January 2014), which advocates the use of modified plasticity index (I'_p), defined as:

$$I'_p = I_p \times (\% < 425 \mu\text{m} / 100)$$

In other words, if PI is 30%, but the soil contains 80% < 425 µm, then $I'_p = 30 \times 80/100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425 µm sieve is routinely reported by testing labs.



E3P apply engineering judgement where PI results are spread over a range of classifications. Consideration is given to the average values for each particular soil type (differentiate between residual soil and alluvium), the number of results in each class and the actual values.

The Atterberg limits determinations, summarised in Table 8.8, show the clay to be of low plasticity.

TABLE 8.8 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX
WS101	2	17	13	28	15	98	14.7
WS110	2	15	15	30	15	96	14.4
WS115	3	17	33	16	17	97	16.49
CP103	2	16	27	13	14	98	13.72

The results of the Atterberg limits testing confirmed that the soils would be deemed to be “Low Volume Change Potential” in accordance with the classification system utilised by the LABC/NHBC industry guidance.

8.10. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 8.9), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

Elevated sulphate concentrations meeting Class DS-2, AC-2 were noted within the Made Ground deposits in WS101.

TABLE 8.9 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
WS101	0.60	0.55	7.8	DS-2 Ac-2s
WS101	1.20	0.042	8.3	DS-1 AC-1s
WS102	0.30	0.29	10.9	DS-1 AC-1s
WS104	0.10	0.081	8.6	DS-1 AC-1s
WS110	0.30	0.028	6.7	DS-1 AC-1s
WS110	0.70	0.017	7.0	DS-1 AC-1s
WS110	1.50	0.042	7.1	DS-1 AC-1s
WS112	0.30	0.27	8.0	DS-1 AC-1s
WS113	0.20	0.092	8.7	DS-1 AC-1s



LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	1.00	0.14	8.2	DS-1 AC-1s
TP104	1.20	0.17	7.7	DS-1 AC-1s

8.11. GROUND GAS

A ground gas assessment has been completed in accordance with guidance provided within CIRIA 665 – *Assessing risk posed by hazardous ground gases to buildings*.

8.12. INVESTIGATION RATIONALE

The ICSM has identified that the underlying Made Ground and natural strata may represent a potential source of ground gas generation. Based on the identification of these sources, E3P has determined that the site represents a low ground gas source generation potential.

Within the context of the proposed commercial end use and ground gas generation potential, the gas assessment requires that four visits are required over three months, with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2, which indicates that for low gas hazard sites (Made Ground with limited degradable material, organic clay of limited thickness) and a high sensitivity development, nominal well spacing should be between 25 m and 50 m.

TABLE 8.10 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Natural Strata	1.0–4.0
WS102	Natural Strata	1.0–4.0
WS103	Natural Strata	1.0–3.0
WS104	Natural Strata	1.0–3.0
WS105	Natural Strata	1.0–4.0
WS108	Made Ground	1.0–2.0
WS110	Natural Strata	1.0–3.0
WS111	Made Ground	0.5–1.0
WS117	Natural Strata	0.5–4.0
CP102	Natural Strata	2.0–4.0
CP104	Natural Strata	2.0–7.0

8.13. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) were measured using an infra-red gas analyser (GFM435) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an integrated flow meter.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

Gas measurements were recorded for a minimum of 60 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded. The results of the ground gas monitoring are presented in Table 8.11.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

TABLE 8.11 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	26/7/19	3.7	3.7	0.00481	2.9	2.9	0.00377	10.6	1006	Steady	0.13	1.0–4.0	2.56	1.15
WS102	26/7/19	0.1	0.1	0.0001	0.2	0.2	0.0002	20.2	1005	Steady	0.10	1.0–4.0	4.03	1.76
WS104	26/7/19	0.1	0.1	0.00013	0.8	0.8	0.00104	20	1005	Steady	0.13	1.0–3.0	1.30	0.57
WS105	26/7/19	0.1	0.1	0.00013	0.1	0.1	0.00013	18.9	1005	Steady	0.13	1.0–4.0	3.85	1.55
WS108	26/7/19	0.1	0.1	0.0001	3.9	3.9	0.0039	14.3	1005	Steady	0.10	1.0–2.0	2.02	2.00
WS110	26/7/19	0.1	0.1	0.0001	0.3	0.3	0.003	20.8	1005	Steady	0.10	1.0–3.0	2.20	0.97
WS111	No Access													
WS117	26/7/19	0.1	0.1	0.00121	0.8	0.8	0.00968	17.9	1005	Steady	-1.21	0.5–4.0	3.90	1.26
CP102	No Access													
CP104	No Access													



9. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

9.1. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

The results of this comparison have been summarised within Table 9.1.



TABLE 9.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A COMMERCIAL END USE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	640	26	32	N/A	1	No Further Action
Cadmium	mg/kg	190	26	0.8	N/A	1	No Further Action
Chromium (VI)	mg/kg	33	26	< 4.0	N/A	1	No Further Action
Lead	mg/kg	1100	26	140	N/A	1	No Further Action
Mercury	mg/kg	58	26	< 0.3	N/A	3	No Further Action
Nickel	mg/kg	980	26	34	N/A	1	No Further Action
Selenium	mg/kg	12000	26	3.8	N/A	1	No Further Action
Copper	mg/kg	68000	26	240	N/A	1	No Further Action
Zinc	mg/kg	73000 0	26	500	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	26	< 1	N/A	1	No Further Action
Phenols – Total	mg/kg	210	13	< 1	N/A	1	No Further Action
Asbestos	Fibres	NFD	19	< 0.001	WS112 0.3m (Amosite) TP110 1.2m (Chrysotile)	4	Further Action
Naphthalene	mg/kg	190	22	2.5	N/A	3	No Further Action
Acenaphthylene	mg/kg	83000	22	3.1	N/A	2	No Further Action
Acenaphthene	mg/kg	84000	22	41	N/A	1	No Further Action
Fluorene	mg/kg	63000	22	39	N/A	1	No Further Action
Phenanthrene	mg/kg	22000	22	150	N/A	2	No Further Action
Anthracene	mg/kg	52000 0	22	52	N/A	2	No Further Action
Fluoranthene	mg/kg	23000	22	310	N/A	2	No Further Action
Pyrene	mg/kg	54000	22	300	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	170	33	270 250	TS02 0.50m TS01 0.50m	2	Further Action
Chrysene	mg/kg	350	22	180	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	44	22	280 250 170	TS01 0.50m TS02 0.50m WS104 0.10m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	1200	22	120	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	35	22	200 180 160	TS01 0.50m TS02 0.50m WS104 0.10m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	500	22	100	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	3.5	22	31 35 26	TS01 0.50m TS02 0.50m WS104 0.10 m	2	Further Action
Benzo(ghi)Perylene	mg/kg	3900	22	100	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	3200	21	< 1.0	N/A	3	No Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
TPH C6-C8 (aliphatic)*	mg/kg	7800	21	< 0.1	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	2000	21	< 0.1	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	9700	21	< 2.0	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	59000	21	73	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	28000	21	390	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	28000	21	1200	N/A	1	No Further Action

Notes

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

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; NFD = no fibres detected.

Referring to Table 9.1, the results of this direct comparison indicates that the data exceeds the screening criteria for a commercial end use for the following contaminants:

- ☼ Asbestos (chrysotile and amosite);
- ☼ Benzo(a)Anthracene;
- ☼ Benzo(b)Fluoranthene;
- ☼ Benzo(a)Pyrene;
- ☼ Dibenzo(a,h)Anthracene.

Asbestos in the form of loose chrysotile and amosite fibres has been identified in the granular Made Ground in WS112 and TP110.

Exceedences in benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(a,h)anthracene were identified within WS104, TS01 and TS02. TS01 and TS02 also showed exceedances in benzo(a)anthracene.

The laboratory analysis confirms the assessment within the initial conceptual site model that the main constituents of concern were likely to be asbestos and PAHs.

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

- ☼ The main exposure pathways based on the Tier I exceedances are:
 - Dermal contact and ingestion;
 - Inhalation of loose fibres;
- ☼ The exceedances for all determinands are associated with shallow Made Ground deposits (< 0.50 m).

9.1.1. HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

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



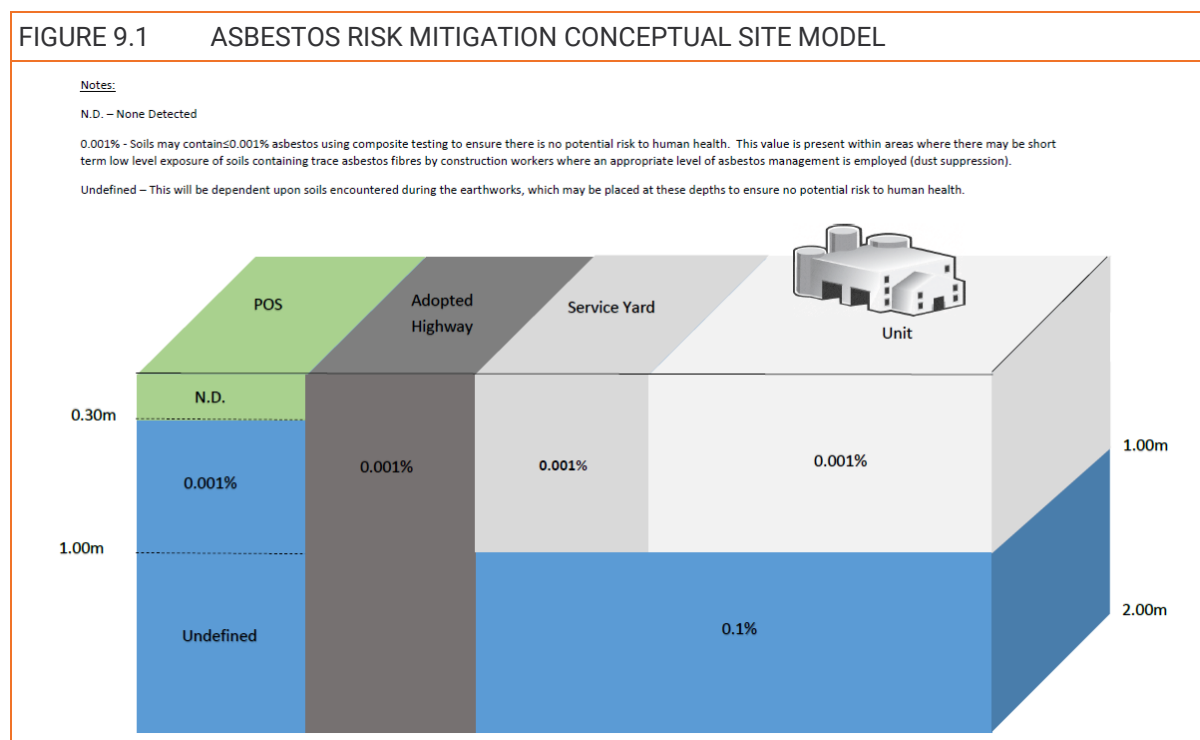
The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy; however, industry best practice (as outlined within BRE 465) will require the following minimum depths of certified clean cover:

🏡 Landscaped areas – 300 mm;

🏡 Public open space – 300 mm.

Asbestos in the form of chrysotile and amosite has also been identified within localised areas in shallow Made Ground deposits. Asbestos quantification has been undertaken to further assess where these soils may be placed and both samples have displayed a quantification of < 0.001% weighting within samples. No visual signs of ACM were encountered during the ground investigation; it is therefore likely that only trace fibres are present. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 9.1.

FIGURE 9.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Chemical analysis of the natural clay drift deposits have identified these soils to be acceptable for use as subsoil within the proposed landscaped areas; however, further chemical validation samples will be required to confirm this. There are no suitable sources of topsoil available on the site.

In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard.



9.2. CONTROLLED WATERS RISK ASSESSMENT

The site sensitivity with respect to controlled waters is summarised within Table 9.2.

TABLE 9.2 CONTROLLED WATERS SENSITIVITY PROFILE

RISK PROFILE	DISCUSSION	SENSITIVITY RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	Site is located in a source protection zone, classed as Zone III (Total catchment).	High
Distance to the Closest Groundwater Abstraction Point	101 m E, operated by Ames Goldsmith UK Ltd (industrial).	Moderate
Aquifer Classification in Superficial Drift Deposits	Sand (Secondary A).	Moderate
Aquifer Classification in Bedrock	Principal Aquifer	High
Viability for Anthropogenic Soil in Direct Contact with Aquifer (Drift or Bedrock)	Variable Made Ground with low-level (predominantly low-solubility) PAHs contamination overlying the granular and cohesive drift deposits.	High
Is the Site Located Within 50 m of a Surface Watercourse?	The risk to surface water is negligible given the absence of a viable receptor within influencing distance of the site	Low
SUMMARY The ICSM developed within the context of the site setting has only identified a single viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer. Groundwater flow is likely to follow the topographical gradient southwards.		

To further refine the ICSM, E3P has undertaken an initial qualitative assessment of the soil data analysis to assess the potential for a source of separate-phase or dissolved-phase contamination originating from either a defined on-site source or from impacted soils. This assessment is summarised in Table 9.3.

TABLE 9.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of TPH C5 to C6 that might otherwise be indicative of VOC impact
Total VOC > 1 mg/kg	
Total SVOC > 1 mg/kg	Naphthalene concentrations up to 2.5mg/kg have been recorded.
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD
C10-C12 > 10 mg/kg	All concentrations are below the laboratory LOD
C12-C16 > 50 mg/kg	Concentrations up to 73mg/kg have been recorded.
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD
Naphthalene > 2 mg/kg	Naphthalene concentrations up to 2.5mg/kg have been recorded.
Total PAH > 10 mg/kg	Concentrations of low-solubility PAH compounds up to 310 mg/kg have been detected in the soil analysis
PCB > 1 mg/kg	No potential sources of PCB have been identified



Heavy metals > 500 mg/kg	Concentrations of heavy metals are all below 500 mg/kg with the exception of zinc which is at 500 mg/kg.
------------------------------------	--

Following assessment of soils data, E3P has undertaken a Tier I controlled waters risk assessment. The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground and groundwater samples to drinking water standards in the first instance and in their absence to environmental quality standards (EQS).

These are presented in Table 9.4.

TABLE 9.4 COMPARISON OF GROUNDWATER ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}		DWS 3,4,5	N		MC	LOC. OF EX	ASSESSMENT
		AA	MAC		L	GW			
Arsenic	µg/l	50	–	10	3	3	24	WS111 0.40m	Further Action
Cadmium	µg/l	0.08	0.45	5	3	3	0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	–	3	3	< 5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	–	50	3	3	4.4	N/A 0	No Further Action
Copper (hardness)	µg/l	1–28	–	2000	3	3	58	N/A	No Further Action
Total Cyanide	µg/l	1	–	50	3	3	3.0	N/A	No Further Action
Lead	µg/l	1.2	14	10	3	3	27	WS111-0.40m	Further Action
Mercury	µg/l	–	0.07	1.0	3	3	<0.05	N/A	No Further Action
Nickel	µg/l	4	34	20	3	3	7.2	N/A	No Further Action
Selenium	µg/l	–	–	10	3	3	5.0	N/A	No Further Action
Zinc (hardness)	µg/l	8–125	–	–	3	3	23	N/A	No Further Action
pH	6–9				3	3	8	N/A	No Further Action
PAH									
Naphthalene	µg/l	2	130	10*	3	0	0.01	N/A	No Further Action
Anthracene	µg/l	0.1	0.1		3	0	0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	1.7–4	0.017		3	0	0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	1.7–4	0.017		3	0	0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	1.7–4	0.27		3	0	0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	0.12		3	0	0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	8.2–3		3	0	0.01	N/A	No Further Action
TPH-Aromatic									
TPH C5-C6 (benzene)	µg/l	10	50	1	3	0	< 1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	50	–	700	3	0	< 1.0	N/A	No Further Action
TPH C8-C10 (ethyl Benzene)	µg/l	20	–	300	3	0	< 1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	–	500	3	0	< 1.0	N/A	No Further Action
TPH C12-C16	µg/l	2	130	90 ⁵	3	0	< 1.0	N/A	No Further Action
TPH C16-C35	µg/l	50#	50#	90 ⁵	3	0	< 1.0	N/A	No Further Action
TPH Aliphatic ⁵									



DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}		DWS _{3,4,5}	N		MC	LOC. OF EX	ASSESSMENT
		AA	MAC		L	GW			
TPH C5-C6	µg/l	–	–	15000	3	0	<0.01	N/A	No Further Action
TPH C6-C8	µg/l	–	–	15000	3	0	<0.01	N/A	No Further Action
TPH C8-C10	µg/l	–	–	300	3	0	<0.01	N/A	No Further Action
TPH C10-C12	µg/l	–	–	300	3	0	<0.01	N/A	No Further Action
TPH C12-C16	µg/l	–	–	300	3	0	<0.01	N/A	No Further Action
TPH C16-C21	µg/l	–	–	300**	3	0	<0.01	N/A	No Further Action
TPH C21-C35	µg/l	–	–	300**	3	0	<0.01	N/A	No Further Action
VOC									
Tetrachloroethylene	µg/l	0.4	–	10	0	0	-	N/A	No Further Action
Trichloroethylene	µg/l	10	–	10	0	0	-	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	–	0	0	-	N/A	No Further Action
Trichloromethane	µg/l	2.5	–	–	0	3	< 1.0	N/A	No Further Action
Dichloromethane	µg/l	20	–	200	0	0	-	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	–	3	0	0	-	N/A	No Further Action
Vinyl Chloride	µg/l	–	–	0.3	0	3	< 1.0	N/A	No Further Action

Notes

Solubility < 0.01 µg/l.

AA – Annual average.

MAC – Maximum admissible concentration.

* Sum of The specified compounds are benzo[b]fluoranthene (CAS 205-99-2), benzo[k]fluoranthene (CAS 207-08-9), benzo[g,h,i]perylene (CAS 191-24-2) and indeno[1,2,3-c,d]pyrene (CAS 193-39-5).

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

9.2.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that the data exceeds the DWS values for the following inorganic compounds:

☛ Lead exceeds DWS and MAC

☛ Arsenic exceeds DWS

It should be noted that the Tier I assessment criteria provides a conservative view, which may overstate the risk. Inorganic determinands identified above are of a general low solubility, and therefore mobility, suggesting that these will not migrate to controlled water receptors. Furthermore, the elevated results were identified from leachate samples taken within the Made Ground. Leachate tests generally provide conservative results given the aggressive nature of the test.



Given that no elevated heavy metals were identified within the groundwater samples, there is potential contaminants are not leaching in the real world environment. Furthermore, the site is underlain by a low-permeability, cohesive glacial till deposits overlying the Sandstone aquifer. This clay bands will afford protection to the underlying Principal aquifer, furthermore there are no drinking water abstractions within close proximity of the site. Therefore, there is considered to be a low risk to controlled waters and the wider environment as no complete pollutant linkage can be determined.

9.3. GROUND GAS

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings* (2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

CIRIA C665 and NHBC Report No 10627-R01 provide assessments for carbon dioxide and methane based upon gas screening values (GSVs) utilising flow rates and concentrations. The site-based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{\text{concentration (by vol)}}{100} \times \text{flowrate (1 / hr)}$$

The GSVs within CIRA C665 are based upon all buildings other than standard residential houses. The thresholds for GSVs based upon CIRIA guidance are provided within Table 9.5.

TABLE 9.5 COMMERCIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH CIRIA C665 – COMMERCIAL END USE

CIRIA – NO SUBFLOOR VOID	
CLASSIFICATION	GSV (METHANE AND CARBON DIOXIDE)
CS1	< 0.07
CS2	< 0.70
CS3	< 3.5
CS4	< 15
CS5	< 70
CS6	> 70

9.3.1. SOURCES OF GROUND GAS

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

- ✳ Made Ground deposits;
- ✳ Natural strata;
- ✳ Off site infilled features.



9.3.2. GROUNDWATER

Groundwater was observed within the monitoring wells. The presence of low permeability clay stratum at a shallow depth in some areas may lead to the collections of surface waters within monitoring well rather than a true measure of groundwater. Any fluctuations in the groundwater will be picked up in future visits.

9.3.3. GAS FLOW

During the monitoring a positive flow was noted within all monitoring wells apart from WS117. The measure of positive flow may be considered to be the result of groundwater fluctuations and flooding of the well causing compression – as opposed to gas generation. However, this cannot be confirmed until further gas monitoring visits have been undertaken.

Negative flows are indicative of back pressure from wind being greater than the active flow from the wells.

9.3.4. GAS CONCENTRATIONS

Methane has been recorded within all monitoring wells with all of them at a background level of 0.1% v/v, higher readings were recorded within WS101 at 3.7% v/v.

Carbon dioxide concentrations were recorded within all the monitoring wells at concentrations ranging from background levels of 0.1 v/v to 3.9% v/v (WS101). The maximum carbon dioxide levels were also associated with low oxygen concentrations and appear to be associated with natural strata, identified in WS108.

9.3.5. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 9.6.

TABLE 9.6 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CO ₂ (% v/v)	GSV (l/hr)	MAX CH ₄ (% v/v)	GSV (l/hr)	CLASSIFICATION
WS101	2.9	0.00377	3.7	0.00481	CS2
WS102	0.2	0.0002	0.1	0.0001	CS1
WS104	0.8	0.00104	0.1	0.00013	CS1
WS105	0.1	0.00013	0.1	0.00013	CS1
WS108	3.9	0.0039	0.1	0.0001	CS2
WS110	0.3	0.0003	0.1	0.0001	CS1
WS117	0.8	0.00968	0.1	0.00121	CS1

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



Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas it is considered that gas protection measures will not be required. However, localised areas of the site have been assessed as being CS2 and structures within this area will likely require specialist protection measures as detailed below.

9.4. COMMERCIAL BUILDING GAS RISK MITIGATION

British Standard BS8485 (2015) provides different types of commercial property that require assessment. These building types are:

- ✿ **Type C Building** – Commercial building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building, including the gas protection measures. Single occupancy of ground floor and basement areas. Small to large-size rooms with active ventilation or good passive ventilation of all rooms and other internal spaces throughout ground floor and basement areas. Probably civil engineering construction. Examples include offices, some retail premises, and parts of some public buildings (such as schools, hospitals, leisure centres and parts of hotels).
- ✿ **Type D Building** – Industrial-style building having large-volume internal space(s) that are well ventilated. Corporate ownership with building management controls on alterations to the ground floor and basement areas of the building and on maintenance of ground gas protective measures. Probably civil engineering construction. Examples are retail park sales buildings, factory shop floor areas, warehouses. (Small rooms within these style buildings should be separately categorised as Type B or Type C.)

Based on the ground gas risk assessment and the proposed Type C and D Buildings, it is envisaged that a point score of 2.5 and 1.5 will be required for affected properties as summarised in Table 9.7.

TABLE 9.7 BS8485 (2015)+A1(2019) POINTS REQUIRED FOR TYPE C AND TYPE D BUILDINGS

CHARACTERISTIC SITUATION	MINIMUM GAS PROTECTION SCORE (POINTS)	
	HIGH SENSITIVITY	
	TYPE C BUILDING	TYPE D BUILDING
1	0	0
2	2.5	1.5
3	3	2.5
4	4.5	3.5
5	5.5	4.5
6	–B)	6

Notes

A) Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.

B) The gas hazard is too high for this empirical method to be used to define the gas protection measures.

The requisite 2.5 or 1.5 points must be achieved by installation of a suitable combination of measures detailed in Table 9.8.



TABLE 9.8 SUMMARY OF GROUND GAS MITIGATION MEASURES – BS8485 (2015)+A1(2019)

GAS PROTECTION SCORES FOR THE STRUCTURAL BARRIER		SCORE ^A
Floor and Substructure Design		
Precast Suspended Segmental Subfloor (Beam and Block)		0
Cast In-Situ Ground-Bearing Floor Slab (With Only Nominal Mesh Reinforcement)		0.5
Cast In-Situ Monolithic Reinforced Ground-Bearing Raft or Reinforced Cast In-Situ Suspended Floor Slab With Minimal Penetrations		1 or 1.5 ^B
Basement Floor and Walls Conforming to BS 8102:2009, Grade 2 Waterproofing^{C D}		2
Basement Floor and Walls Conforming to BS 8102:2009, Grade 3 Waterproofing^{C D}		2.5
A) The scores are conditional on breaches of floor slabs, etc., being effectively sealed. B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see A.2.2.2). C) The score is conditional on the waterproofing being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall). D) If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas resistant membrane in that table. When practical, utilities should enter the building above floor level with any conduit or meter housing being properly vented outside of the building.		
PROTECTION ELEMENT SYSTEM	SCORE	COMMENTS
Gas protection scores for ventilation protection measures		
(a) Pressure Relief Pathway – Usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is 0.
(b) Passive Subfloor Dispersal Layer – Media used to provide the dispersal layer are: - Clear void; - Polystyrene void former blanket; - Geocomposite void former blanket; - No-fines gravel layer with gas drains; and - No-fines gravel layer.	Very good performance	2.5
	Good performance	1.5
(c) Active Dispersal Layer – Usually comprising fans with active abstraction (suction) from a subfloor dilution layer with roof-level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.	1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place.



		There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least “good performance”.
(d) Active Positive Pressurisation – Provided by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.	1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient “coverage” of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least “good performance”.
(e) Ventilated Car Park – Floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park.	4	Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F [9].



Gas Protection Score for the Gas-Resistant Membrane		
Gas-resistant membrane meeting all of the following criteria: ☛ Sufficiently impervious to the gases with a methane gas transmission rate < 40 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); ☛ Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; ☛ Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); ☛ Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre-reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools); ☛ Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and ☛ Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet all the criteria opposite then the score is zero.
A) membrane with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1:2007 manometric method) is regarded as sufficiently impervious. B) For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m² and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs.		



9.5. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework. The assessment is made with reference to the UK Water Industry Research (UKWIR) publication "Guidance on the selection of Water Supply Pipes to be used in Brownfield Sites"

TABLE 9.9 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	21
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	69
Phenols (From SVOC Analysis)*	2	<1.0
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	NA
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Is free product present in soil and groundwater?	None	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No – heavy end hydrocarbon impact and low solubility PAH has not been identified within deeper Made Ground. Groundwater levels are generally found at 1.15 m bgl that has been recorded within monitoring wells. Shallow PAH impact has been identified Circa 0.5m bgl but not at pipeline depths, furthermore shallow groundwater has not been identified.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	No	
Will soils be imported to site as part of any future earth works	Currently unknown, however it is unlikely soils will be required to be imported to site.	

Notes - Pipe line depth normally between 0.75m–1.35m

Based on the assessment of current site conditions it is likely that barrier pipe will be required at the current site conditions but reassessment will be required at the end of remediation works.



9.6. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 9.0 has been prepared for the site.

TABLE 9.10 CONCEPTUAL MODEL

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Non-volatile PAHs (in MADE GROUND)	Likely	Moderate	Assessment: Non-volatile PAH exceedances have been identified within Made Ground across the site. Recommendation: A cover system to any soft landscaped areas comprising 150mm topsoil and 150mm subsoil will be required. The remainder of the site will be overlain by hardstanding which break the pathway. Construction workers will be required to wear standard PPE including gloves.	LOW
PL3	Inhalation of dust.	Future site users. Buildings. Off-site land users.	ACM in MADE GROUND	Likely	High	Assessment: Loose fibres have been identified of Amosite within WS112 and Chrysotile within TP110 containing < 0.001% weight. Recommendation: Cover system to landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.	LOW



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
PL4	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Methane, carbon dioxide (peat and potentially infilled features on and within 250 m of the site)	Low likelihood	Moderate	Assessment: Exceedances of Carbon dioxide and methane have been identified thus far. Recommendation: The ground gas assessment needs to be completed, but at this time it is likely that CS2 measures will be required.	LOW
PL5	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (principal aquifer).	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (MADE GROUND)	Likely	High	Assessment: Elevated Lead and Arsenic were identified within leachate samples. No elevated heavy metals were identified within the groundwater samples, there is potential contaminants are not leaching in the real world environment. Furthermore, the site is underlain by a low-permeability, cohesive glacial till deposits overlying the Sandstone aquifer. This clay bands will afford protection to the underlying Principal aquifer, furthermore there are no drinking water abstractions within close proximity of the site. Therefore, there is considered to be a low risk to controlled waters and the wider environment as no complete pollutant linkage can be determined. Presence of Glacial till across the site will significantly reduce downward migration into the underlying bedrock aquifer.	LOW



POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
						Recommendation: No further action	
PL6	Sulphate attack on concrete.	Building structure.	Sulphate (potential ash within MADE GROUND)	Likely	Moderate/Low	Assessment: An elevation of pH has been identified within WS101 at 14. Recommendation: Use of DC-2 AC-2s concrete.	LOW
PL7	Ingestion of tainted water supply.	Future site users. Water pipes.	Organic contaminants such as hydrocarbons, solvents (MADE GROUND)	Likely	Moderate	Assessment: No significant site wide contamination has been identified with localised exceedances in PAHs. Barrier pipe has been suggested for current site conditions but will need revaluation once remediation works are complete. Recommendation: Removal of localised PAH contamination and revaluation of UUKWIR assessment for potable water supply to the site.	LOW



10. GEOTECHNICAL ASSESSMENT

10.1. PROPOSED DEVELOPMENT

Prime Property Consulting intends to procure the site for an industrial development comprising of industrial buildings with associated public open space, estate roads and infrastructure. Drawing 12-969-009 (Appendix III) identifies the proposed development layout.

10.2. SUMMARY OF GROUND CONDITIONS

MADE GROUND

The majority of Made Ground identified across the site was a gravelly sand that consisted of brick, asphalt and concrete, also localised reworked clay was identified in a number of locations to a maximum proven depth of 1.50m bgl.

Two coring locations were carried out in Bunker 1 and 2 that identified that bunker 1 had a ground floor slab thickness of 1 m that consisted of a concrete slab. Bunker 2 has a thickness of 1.3 m with a 0.2m gravel layer identified at 0.7 m bgl

DRIFT

Drift deposits were fairly varied across the site, comprising of a dark brown slightly gravelly clayey fine to medium SAND overlaying a; stiff, high-strength, brown mottled grey, slightly gravelly CLAY with sandstone and mudstone gravel at 3.00m bgl. A firm light grey sandy CLAY was identified in a small number of exploratory holes above 2.00 m bgl.

PEAT was identified in several location mainly within the north east of the site with a maximum depth of 1.4 m bgl.

Stiff boulder CLAY was identified within Cable Percussive location at a maximum depth of 8.5 m bgl. Occasional fine to course gravel of Sandstone and Mudstone was identified within the cohesive deposits.

SOLID

Reddish brown weathered SANDSTONE was encountered within CP103 and CP104 at 6.0 m bgl and inferred in CP101 and CP102 at 7.50m bgl, this sandstone is found underlaying stiff bolder CLAY identified within cable percussive holes.

GROUNDWATER

Groundwater was encountered between 2 m bgl and 4 m bgl across the site.



10.3. SITE PREPARATION

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual Of Contract Documents For Highway Works, Volume 1 Specification For Highway Works*. This should include the following:

- ✿ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✿ Demolition of all existing buildings and removal of all concrete hardstanding.
- ✿ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✿ Buried structures and old foundations have been encountered on site. These should be excavated from below the proposed development footprint with the resulting void backfilled.

10.4. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe allowable bearing pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The results of this assessment are summarised in Table 10.1

TABLE 10.1 SUMMARY OF ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
Clayey SAND	1.00–2.00	Loose–Dense	63–161
Clayey SAND	3.00–5.00	Medium Dense – Dense	118–414
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Sandy CLAY	1.00–3.00	60–217	35–232
Sandy CLAY	3.00–5.00	78–186	124–247

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure (ABP), the suitable target founding stratum has been identified as the underlying firm to very stiff, glacial CLAY or medium dense to dense SAND, where an ABP of approximately 150 kN/m² can be achieved at 4.00m bgl.

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying stiff to very stiff CLAY and localised areas of medium-dense SAND.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

However, given the topographical variances on the site with levels slightly falling to the west of the site, prior to the detailed design of suitable foundations solutions, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels.

Therefore, upon completion of these enabling works, it is likely that the most cost-effective option for the majority of the site would be to re-engineer the Made Ground using vibro-stone columns (VSCs) to support a shallow strip or spread foundation. However, a piled foundation will likely be required in the east of the site unless the peat identified in the east is removed in its entirety. Another alternative to excavating the PEAT is utilising Controlled Modulus Columns (CMC). A plan showing the extent of the peat is provided in Appendix III Drawing 12-969-005.

Where proposed development levels, trees or locally variable ground conditions dictate, it would be possible to utilise a trench fill type foundation to support relatively lightly loaded structures.

It will be necessary to locally deepen foundations within influence of existing or proposed trees.

Table 10.2 presents potential foundation depths based on a line loading of 150kN/m^2 , these are also visually presented on the depth to founding strata drawing with Appendix III.

TABLE 10.2 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	FOUNDATION TYPE	TYPE OF CONCRETE	REMARKS
TP101	1.15	N/A	Mass Trench	DS-2 AC-2s	
TP102	>2.50	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP103	1.00	N/A	Mass Trench	DS-1 AC-1s	
TP104	>1.50	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP105	>1.80	N/A	Driven Pile/Vibro	DS-1 AC-1s	
TP106	>2.10	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP107	>2.20	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP108	>2.10	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP109	>2.20	N/A	Driven Pile/ Vibro	DS-1 AC-1s	Soft clay form 1.50m to 2.20m
TP110	>1.80	N/A	TBA	DS-1 AC-1s	Peat from 0.60m to 0.80m bgl.
TP111	TBA	N/A	TBA	DS-1 AC-1s	Trial pit completed on top of bunker
TP112	>2.00	N/A	Driven Pile	DS-1 AC-1s	Peat from 0.80m to 1.20m
TP113	>0.90	N/A	TBA	DS-1 AC-1s	Peat from 0.50-0.90m



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	FOUNDATION TYPE	TYPE OF CONCRETE	REMARKS
TP114	>2.10	N/A	Driven Pile	DS-1 AC-1s	Peat from 0.60m-1.00m
TP115	>2.00	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP116	>2.00	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP117	>2.10	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP118	>1.80	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
TP119	TBA	N/A	Driven Pile/ Vibro	DS-1 AC-1s	
WS101	3.15	3.00	Driven Pile/ Vibro	DS-1 AC-1s	
WS102	4.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS103	4.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS104	4.00	N/A	Driven Pile	DS-1 AC-1s	Peat from 1.30m to 1.40m
WS105	5.00	N/A	Driven Pile	DS-1 AC-1s	
WS106	TBA	N/A	TBA	DS-1 AC-1s	Hole completed within bunker
WS107	TBA	N/A	TBA	DS-1 AC-1s	Hole completed within bunker
WS108	5.45	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS109	2.45	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS110	>4.45	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS111	>4.45	3.00	Driven Pile/Vibro	DS-1 AC-1s	
WS112	5.45	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS113	3.45	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS114	4.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	
WS115	4.00	N/A	Driven Pile	DS-1 AC-1s	Peat from 0.60m to 1.00m
WS116	5.45	4.00	Driven Pile/Vibro	DS-1 AC-1s	
WS117	3.40	N/A	Driven Pile/Vibro	DS-1 AC-1s	
CP101	6.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	
CP102	6.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	
CP103	5.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	FOUNDATION TYPE	TYPE OF CONCRETE	REMARKS
CP104	6.00	N/A	Driven Pile/Vibro	DS-1 AC-1s	

E3P has prepared a ground improvement design risk matrix, summarised in Table 10.3, to ensure that the ground conditions have been proven by the intrusive site investigation are satisfactory to facilitate the appropriate stabilisation.

In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard.

TABLE 10.3 GROUND IMPROVEMENT DESIGN RISK MATRIX

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m²	CLAY soils are generally firm to stiff with $C_u > 80$ kN. Isolated areas of softer clay soils were encountered with $C_u > 30$ kN/m ² ; however, it is considered that these will either be piled or soft material excavated to remove the organic deposits.	PASS – However, areas of soft clay will need to be piled
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200 mm, either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column	PEAT has been identified in the east of the site. This area will require a piled foundation unless the PEAT can be removed.	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground beneath the site will require removal and processing to render the site suitable for VSC. The existing buildings substructure will also require excavation and processing into a graded aggregate suitable for vibro treatment.	PASS – on completion of enabling works
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified.	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	None identified	PASS



RISK ITEM	COMMENT	PASS/FAIL
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None identified.	PASS
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS
Cohesive soils with trees in influencing distance	Plots where tree influence has been modelled and will either be subject to a piled or mass trench-fill solution.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS – However, the areas of soft CLAY and PEAT will require a piled foundation solution.

10.5. GROUND FLOOR SLABS

A ground-bearing slab will be viable for the commercial structures; however, it will need to be constructed utilising a sub-base with the thickness designed by a structural engineer to ensure that settlement tolerances are taken into consideration.

Where a ground-bearing floor slab is to be constructed within the conjectured zone of tree influence, the clay will need to be removed to ensure that any desiccated soil cannot swell and induce heave to the structure. Alternatively, it may be possible to design the structure to resist the influence of clay heave using exaggerated sub-base and additional reinforcement within the slab to be designed by the structural engineer.

Where PEAT is present this will need to be removed or the floor slab piled to remove the potential for differential settlement. Alternatively the floor slab could be constructed on controlled modulus columns (CMC).

It would be possible to utilise soil stabilisation techniques that incorporate the addition of lime and OPC to construct a stiffened soil horizon with a CBR > 15% to constitute a sub-base replacement layer that could then be capped with Type 1 MOT. The use of soil stabilisation could be extended within the conjectured zone of tree influence to modify the structure of clay soils and negate the potential for volumetric instability.

It must be noted that demolition of the on-site structures will generate a significant amount of crush which could be utilised as capping and sub-base on the development.

10.6. HEAVE PRECAUTIONS

The site has been proven to be underlain by clay soils, which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within influencing distance of trees as per the NHBC/LABC conjectured zones of influence.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

As the clay is deemed to be low plasticity, heave precautions are not required to the internal face of the external load-bearing walls (outside or within tree influence).

If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams.

If the ground floor slab is to be constructed with a beam and block floor, a minimum subfloor void of 200 mm is required within any structures located in the zone of conjectured tree influence.

If the ground floor slab is constructed with a cast in-situ suspended floor slab, then heave precautions that can tolerate 50 mm of clay swelling are required within any part of the floor slab to be located within the zone of influence of a tree.

A summary of heave precautions is presented in Table 10.4.

TABLE 10.4 SUMMARY OF HEAVE PRECAUTIONS

		MINIMUM VOID DIMENSION FOR FOUNDATIONS, GROUND BEAMS AND SUSPENDED IN-SITU CONCRETE GROUND FLOORS		MINIMUM VOID DIMENSIONS UNDER PRECAST CONCRETE AND SUSPENDED TIMBER FLOORS
Plasticity Index of Soil	Required Foundation Depth (m)	Thickness of Void Former Against Side of Foundation or Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam and Floor Slab (mm)	Void Dimension (mm)
High Plasticity (> 40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	35	150	300
	1.5–2.0	25	75	
Moderate Plasticity (20–40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	25	100	250
	1.5–2.0	25	50	
Low Plasticity (< 20)	2.0–2.5	N/A	50	200
	> 2.0	No Special Precautions		

10.7. PAVEMENT CONSTRUCTION

A programme of remediation and enabling works will be required to remediate the proposed road subgrade in accordance with the requirements of Series 600 of the *Manual Of Contract Documents For Highway Works, Volume 1 Specification For Highway Works*.

It is considered that the Made Ground can be re-engineered using method compaction to achieve a CBR in excess of 5% if works are completed in favourable climatic conditions.



10.8. DRAINAGE

The presence of substantial depths of Made Ground across some areas of the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

The site is underlain by permeable SAND and low permeability CLAY forming a barrier between the SAND and underlying BEDROCK.

If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.

10.9. CONCRETE DURABILITY

Based upon the results of the chemical analyses it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE *Special Digest 1* (2005).

Elevated sulphate concentrations meeting Class DS-2, AC-2 were noted within the Made Ground deposits in WS101. However, upon completion of site enabling works it will, in all likelihood, be DS1 AC1s.

10.10. EXCAVATIONS

Trial pits were generally stable in both granular Made Ground and natural strata; as such, it is considered that near-surface excavations will be feasible. In areas where Made Ground exceeded 2.0 m, excavations were generally less stable.

Site observations indicated that excavations should be feasible in the near surface with normal plant; however, obstructions were identified in the near surface, including former foundations and former floor slabs. It is anticipated that any obstructions will be grubbed out during the reduced-level dig for the substructure works.

However, due to the depth and variability of the Made Ground and likelihood of trench collapse, it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures in close proximity to the site.

TABLE 10.5 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	Running sands have not been identified.

Minor Water Ingress	Yes	Minor/rapid water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	None Identified.

11. CONCLUSIONS AND RECOMMENDATIONS

CONTAMINATED LAND ASSESSMENT

Human Health	Loose chrysotile fibres were identified within the Made Ground deposits in WS112 and TP110, and further occurrences cannot be discounted. Fibres could be released during earthworks and possibly impact construction workers and third-party property. Localised impacted soils will be placed at depth during a carefully managed and regulatory authority-approved phase of enabling works, under strict construction-phase health and safety controls. Upon placement of asbestos impacted soils at depth beneath hardstanding or plots, they will present no unacceptable risk to the future site users. Localised elevated PAH elevations have been identified within Made Ground soils. These are considered to be a localised occurrence. It is considered that these areas will be overlain by hard-standing removing the pollutant linkage to receptors identified on the site. PAHs may pose a short-term risk to construction workers who may come into contact with impacted soils during any future earthworks. The proposed development will be covered by either buildings or a suitable cover system in the external areas, thus breaking the pathway to the proposed end users. In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard. A watching brief and further chemical testing is recommended upon demolition of the buildings.
Controlled Waters	Exceedances of lead and arsenic have been identified within the leachate sample WS111-0.4 m. It should be noted that the Tier I assessment criteria provides a conservative view, which may overstate the risk. Inorganic determinands identified above are of a general low solubility, and therefore mobility, suggesting that these will not migrate to controlled water receptors. Furthermore, the elevated results were identified from leachate samples taken within the Made Ground. Leachate tests generally provide conservative results given the aggressive nature of the test.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

	Given that no elevated heavy metals were identified within the groundwater samples, there is potential contaminants are not leaching in the real world environment. Furthermore, the site is underlain by a low-permeability, cohesive glacial till deposits overlying the Sandstone aquifer. This clay bands will afford protection to the underlying Principal aquifer, furthermore there are no drinking water abstractions within close proximity of the site. Therefore, there is considered to be a low risk to controlled waters and the wider environment as no complete pollutant linkage can be determined. In light of the above further investigation is recommended in areas of limited access such as the overgrown bunker and pallet yard.
Ground Gas	The majority of the site is Characteristic Situation 1, with elevated levels identified within WS101 classified as Characteristic Situation 2 (pending completion of gas monitoring).
Potable Water	UKWIR risk assessment for potable has been completed and it has been determined that with current site conditions that Barrier Pipe will be the suitable pipe selection for the site. However, post-remediation and enabling works ground conditions may be different from those identified during the site investigation.

GEOTECHNICAL ASSESSMENT

Significant concrete and brick obstructions have been encountered within the Made Ground across site, indicative of the significant development that has occurred.

During a phase of cut-and-fill enabling works to create a development platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.

It is considered that DS-1, AC-1s concrete classification will be used across the majority of the site with DS-2, AC-2s being used in the area around WS101, however it is considered that after a phase of remediation and enabling works that pH levels will be reduced and DS-1, AC-1s classification will suffice.

The underlying natural clay drift deposits have been assessed as being very stiff, high-strength with a net ABP in the order of 100 kN/m² at circa 1.0 m bgl increasing to 150–200 kN/m² at circa 2.0 m bgl.

Due to the variances in the site topography with a fall in height on the western side of the site, a phase of cut-and-fill enabling works will be required in order to create a proposed development platform suitable for the proposed development. This will generally comprise increasing the levels on the western side where bunkers have been cut into the natural landform.

PEAT has been identified on the site especially in the north-eastern sector of the site, in these locations driven pile foundations will be needed to be used for appropriate foundations or the PEAT removed from beneath structures and highways.

Where PEAT is present this will need to be removed or the whole floor slab piled to remove the potential for differential settlement.



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment
October 2019

Alternatively, there is potential that Controlled Modulus Columns could be utilised. If this were to be the case then the peat could remain in-situ.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

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



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

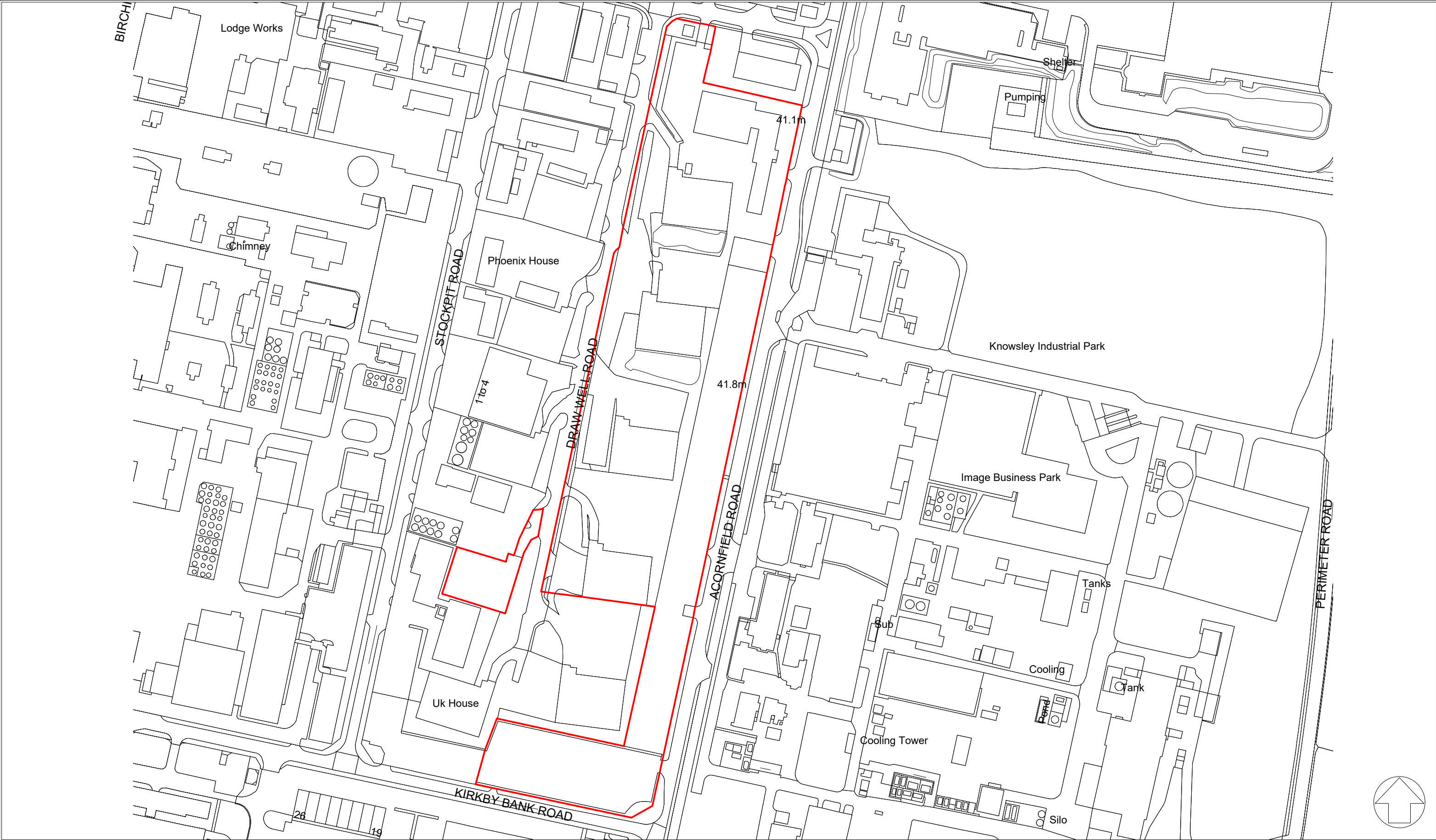
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III

DRAWINGS

Phase I and Phase II Geoenvironmental Site Assessment
October 2019



	Notes:						Client: Prime Property Consultancy	Job No: 12-969	Date: 24.06.2019	 Environmental Engineering Partnerships Ltd City Heliport & Business Centre Eccles, Manchester, M30 7RU Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk
								Drawing No: 001	Scale: NTS	
						Job Title: Bunkersite Knowsley		Drawing Title: Site Location Plan		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.
P1	-	24.06.2019	Draft	HM	SE					
Phase	Revision	Date	Issue	Drawn	Checked					



- Location Symbols

 - Approximate Window Sample Probehole Location
 - Approximate Trial Pit Location
 - Approximate Cable Percussive Borehole Location
- Site Features

 - Hardstanding
 - Carpark
 - Current Buildings
 - Underground Raised Buildings
 - Stacked Wooden Pallets
 - Dirt Track
 - Softstanding
 - Railway Track

Notes:

Client:

Job No: 12-969

Date: 24.06.2019

Prime Property Consultancy

Drawing No: 002

Scale: NTS

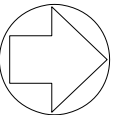
Job Title:

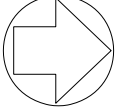
Drawing Title:

Bunkerite Knowsley

Site Features Plan

Phase	Revision	Date	Issue	Drawn	Checked
P1	-	24.06.2019	Draft	HM	SE



[illegible]



Location Symbols

WS101

Approximate Window Sample Probehole Location

TP101

Approximate Trial Pit Location

CP101

Approximate Cable Percussive Borehole Location

TS01

Approximate Trial Soil Sample Location

Limited/No Access

Notes:

P1	R1	04.07.2019	REVISION	HM	SE
P1	-	24.06.2019	Draft	HM	SE
Phase	Revision	Date	Issue	Drawn	Checked

Client:

Prime Property Consultancy

Job No:

12-969

Date:

04.07.2019

Drawing No:

004

Scale:

NTS

Job Title:

Bunkersite Knowsley

Drawing Title:

Exploratory Hole Location Plan

Environmental Engineering Partnerships Ltd

City Heliport & Business Centre

Eccles, Manchester, M30 7RU

Tel: 0161 707 9612

E-mail: info@e3p.co.uk

Website: www.e3p.co.uk

e3p

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Location Symbols			Development Constraints		
	Approximate Window Sample Probehole Location			Area Heavily Overgrown	
	Approximate Trial Pit Location			Estimated Extent of Peat	
	Approximate Cable Percussive Borehole Location			Limited Access due to Ongoing Activities	
	Approximate Trial Soil Sample Location			Asbestos <0.001% Identified	
				Elevated Non-Volatile PAHs Identified	

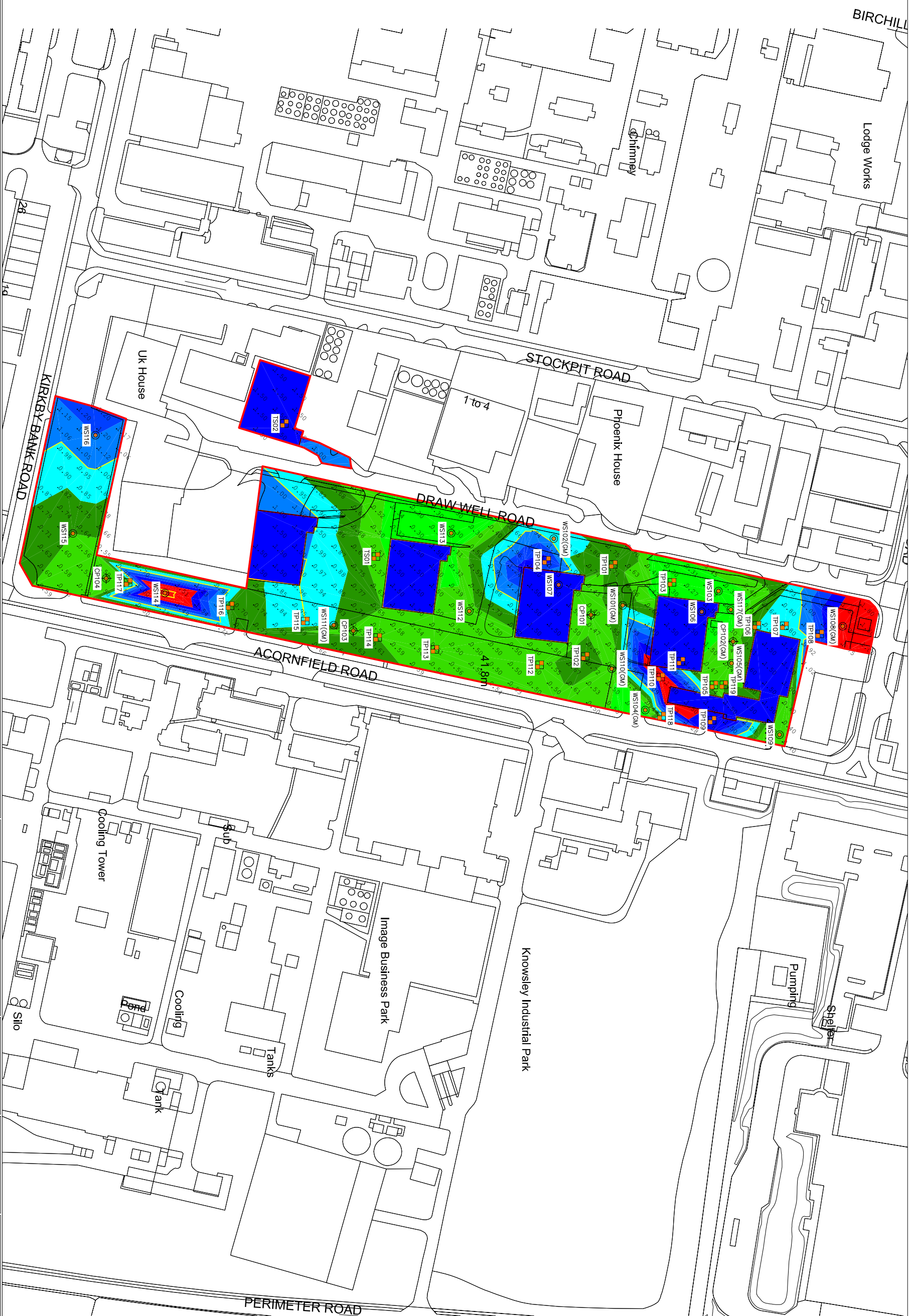
Notes:					
P1	-	25.07.2019	Draft	CB	SE
Phase	Revision	Date	Issue	Drawn	Checked

Client:	
Prime Property Consultancy	
Job Title:	
Bunkersite Knowsley	

Job No:	
12-969	
Drawing No:	
005	
Date:	
25.07.2019	
Scale:	
NTS	
Drawing Title:	
Development Constraints Plan	

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Location Symbols  Approximate Window Sample Probable Location  Approximate Trial Pit Location  Approximate Cable Percussive Borehole Location  Approximate Trial Soil Sample Location  Depth of Made Ground Filtered Below Current Buildings					Depth of Made Ground  Depth of Made Ground 0.00 - 0.18m  Depth of Made Ground 0.20 - 0.28m  Depth of Made Ground 0.40 - 0.58m  Depth of Made Ground 0.60 - 0.78m  Depth of Made Ground 0.80 - 0.98m  Depth of Made Ground 1.00 - 1.18m  Depth of Made Ground 1.20 - 1.38m  Depth of Made Ground 1.40 - 1.58m  Depth of Made Ground > 1.60m														
Notes:					Client:					Job No: 12-969									
					Prime Property Consultancy					Date: 08.10.2019									
										Drawing No: 006									
Phase P1					Revision -					Date 08.10.2019									
					Issue Draft					Drawn HM									
										Checked SE									
Job Title: Bunkerite Knowsley										Drawing Title: Depth of Made Ground Plan									
The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.										 Environmental Engineering Partnerships Ltd City Helport & Business Centre Eccles, Manchester, M30 7RU Telp: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk									



Location Symbols		Shallow Spread Footings	
	Approximate Window Sample Probehole Location		Depth to Founding Strata 0.00 - 1.24m
	Approximate Trial Pit Location		Depth to Founding Strata 1.25 - 1.49m
	Approximate Cable Percussive Borehole Location	Mass Trench Fill Footings	
	Approximate Trial Soil Sample Location		Depth to Founding Strata 1.50 - 1.74m
	Area could not be Investigated		Depth to Founding Strata 1.75 - 1.99m
			Depth to Founding Strata 2.00 - 2.24m
		Engineered Footings	
			Depth to Founding Strata 2.25 - 2.49m
			Depth to Founding Strata >2.50m

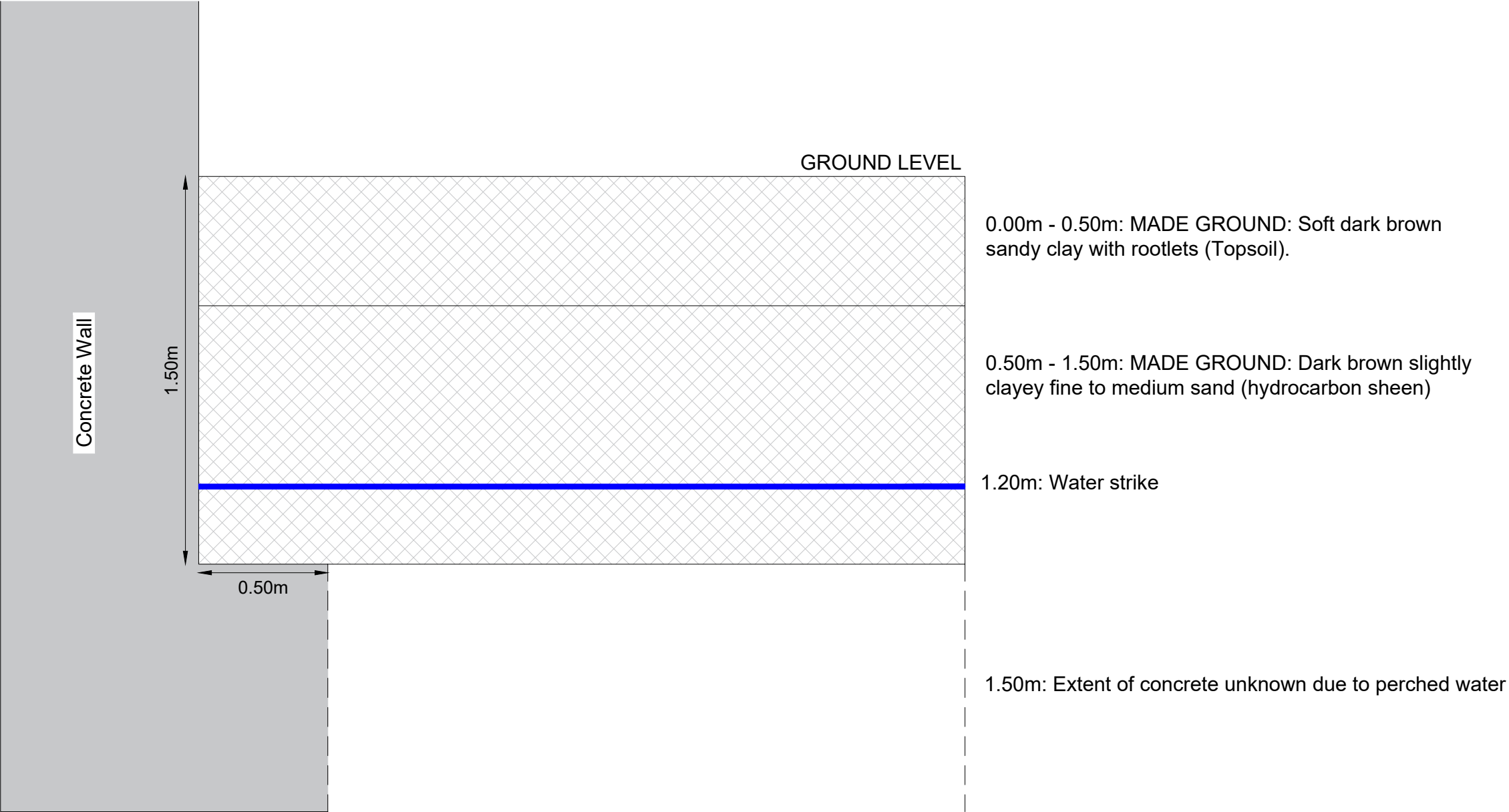
Notes:					
P1	-	25.07.2019	Draft	CB	SE
Phase	Revision	Date	Issue	Drawn	Checked

Client:	
Prime Property Consultancy	
Bunkersite Knowsley	
Job Title:	

Job No:	
12-969	
Drawing No:	
006	
Date:	
25.07.2019	
Scale:	
NTS	
Drawing Title:	
Depth to Founding Strata Plan	

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Notes:

P1	-	31.07.2019	Draft	CB	SE
Phase	Revision	Date	Issue	Drawn	Checked

Client:

Prime Property Consultancy

Job Title:

Bunkersite Knowsley

Job No:

12-969

Drawing No:

008

Date:

31.07.2019

Scale:

1:20 @ A3

Drawing Title:

Foundation Pit - TP104

 Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

APPENDIX IV PHOTOGRAPHS

Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

PLATE 1 **FOUNDATION PIT TP104**



PLATE 2 **TRIAL PIT 101**



PLATE 3 THE CURRENT BUILDING IN THE NORTH OF THE SITE



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

PLATE 4 THE EASTERN CAR PARK LOOKING SOUTH



PLATE 5 INSIDE THE NORTHERN BUNKER



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

PLATE 6

BUNKER DOORS



Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

PLATE 7 INSIDE THE NORTHERN BUNKER



APPENDIX V

EXPLORATORY LOGS

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): 1.60	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.10	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Asphalt.	
	0.40	ES					MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
				0.70			Stiff high strength dark brown sandy slightly gravelly CLAY. Gravel is fine sub-angular to rounded mudstone.	
	0.90	HVP	120					1
	1.00	ES						
	1.30	HVP	120					
	1.60	HVP	120					
	1.90	HVP	120					2
				2.10			End of Pit at 2.10m	
								3
								4
								5

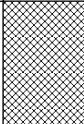
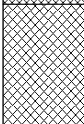
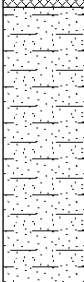
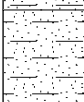
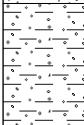
Remarks: 1. Complete

Stability: Stable.

Project Name: Draw Well Road Project No. 12969 Co-ords: - Level: Date 26/06/2019

Location: Knowsley Dimensions (m): 1.80 Scale 1:24

Client: Prime Property Consultancy Ltd Depth 2.40 Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.40			MADE GROUND: Asphalt.	
							MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt of concrete and brick.	
	1.00 1.00	B ES		0.80			Dark brown clayey SAND. (Strong Organic odour).	1
				1.70			Light brown slightly clayey SAND.	
				2.00			Firm medium strength light grey sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to rounded mudstone.	2
	2.30	HVP	66.6	2.40			End of Pit at 2.40m	3
								4
								5

Remarks: 1. Complete

Stability: Stable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): 2.00	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.00	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			MADE GROUND: Soft light brown sandy slightly gravelly CLAY. Gravel is fine to medium mudstone and sandstone with rootlets (TOPSOIL).	
	0.50	HVP	113.3				Stiff high strength dark brown slightly gravelly sandy CLAY. Gravel is fine to medium sub-rounded to round mudstone.	
	1.00	HVP	120					1
	1.50	HVP	120					
	2.00	HVP	120	2.00				2
							End of Pit at 2.00m	
								3
								4
								5

Remarks: 1. Complete

Stability: Stable.

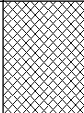
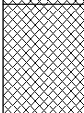
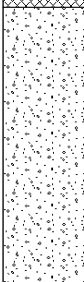
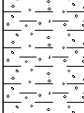
Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): Depth 1.50	Scale 1:24
Client: Prime Property Consultancy Ltd		0.60 	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND: Soft dark brown sandy clay with rootlets (TOPSOIL).	
				0.50			MADE GROUND: Dark brown slightly clayey fine to medium SAND.	1
	1.20	ES						
▼ 1.50				1.50			End of Pit at 1.50m	2
								3
								4
								5

Remarks: 1. Terminated due to Collapse. 2. Water strike encountered at 1.50m bgl.

Stability: Unstable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): 1.70	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.10	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40			MADE GROUND: Concrete slab.	
	0.60	ES		0.80			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
	1.00	ES		1.70			Dark brown clayey slightly gravelly fine to medium SAND. Gravel is fine to medium sub-rounded to rounded of mudstone.	1
	1.90	HVP	96.6	2.10			Stiff high strength light grey sandy slightly gravelly CLAY. Gravel is fine sub-rounded to rounded of mudstone.	2
							End of Pit at 2.10m	3
								4
								5

Remarks: 1. Complete

Stability: Stable.



e3p

Trial Pit Log

TrialPit No
TP107
Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969Co-ords: -
Level:Date
26/06/2019

Location: Knowsley

Dimensions
(m): 1.80Scale
1:24

Client: Prime Property Consultancy Ltd

Depth
2.20Logged
A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
							MADE GROUND: Asphalt.	
	0.60	ES		0.40			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
	0.90	ES		0.80			Dark brown clayey fine to medium SAND.	1
				1.40			Light greyish brown slightly gravelly fine to medium SAND. Gravel is fine to medium sub-angular to rounded mudstone.	2
				2.20			End of Pit at 2.20m	3
								4
								5

Remarks: 1. Complete

Stability: Stable.



Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): 1.80	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.10	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Asphalt.	
	0.60	ES					MADE GROUND: Black sandy fine to coarse gravel. Gravel is sub-angular to angular slate brick and sandstone.	1
	1.50	ES		1.30			Light yellow clayey fine to medium SAND.	
	1.90	HVP	113.3	1.80			Stiff high strength light grey sandy CLAY.	2
				2.10			End of Pit at 2.10m	3
								4
								5

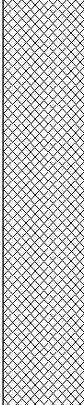
Remarks: 1. Complete

Stability: Stable.

Project Name: Draw Well Road Project No. 12969 Co-ords: - Level: Date 26/06/2019

Location: Knowsley Dimensions (m): 2.10 Scale 1:24

Client: Prime Property Consultancy Ltd Depth 2.20 Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES		0.20			MADE GROUND: Asphalt.
							MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.
				1.50			Very soft low strength light grey very sandy CLAY.
				2.20			End of Pit at 2.20m

Remarks: 1. Complete
Stability: Stable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 26/06/2019
Location: Knowsley		Dimensions (m): 2.00	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 1.80	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.40			MADE GROUND: Asphalt.	
				0.60			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
				0.80			MADE GROUND: Dark brown amorphous spongy peat.	
	1.20	ES					MADE GROUND: Dark brown clayey sand. (Strong Organic odour).	1
				1.80			End of Pit at 1.80m	2
								3
								4
								5

Remarks: 1. Complete 2. Land drain encountered at 1.5m

Stability: Stable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 1.80	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.40	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Asphalt.	
	0.40	ES		0.50			MADE GROUND: Black gravelly fine to coarse sand. Gravel is fine to coarse sub-angular to angular asphalt and concrete.	
	0.70	ES		0.80			Dark brown clayey slightly gravelly fine to medium SAND. Gravel is fine to medium sub-rounded to rounded mudstone.	
				1.20			Dark brown amorphous spongy PEAT.	1
	1.40	B		2.40			Light brown slightly clayey fine to medium SAND.	2
							End of Pit at 2.40m	3
								4
								5

Remarks: 1. Complete	
Stability: Unstable.	

Project Name: Draw Well Road Project No. 12969 Co-ords: - Level: Date 27/06/2019

Location: Knowsley Dimensions (m): 1.80 Scale 1:24

Client: Prime Property Consultancy Ltd Depth 2.10 Logged A.AHMED

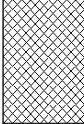
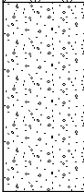
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20			0.20			MADE GROUND: Asphalt.	
	0.30	ES		0.50			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
	0.70	ES		0.90			Dark brown amorphous spongy PEAT.	
				2.10			Firm light grey slightly sandy CLAY.	1
							End of Pit at 2.10m	2
								3
								4
								5

Remarks: 1. Complete Stability: Stable.

Project Name: Draw Well Road Project No. 12969 Co-ords: - Level: Date 27/06/2019

Location: Knowsley Dimensions (m): 2.00 Scale 1:24

Client: Prime Property Consultancy Ltd Depth 2.10 Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.20			MADE GROUND: Asphalt.	
				0.60			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
				1.00			Dark brown amorphous spongy PEAT.	
	1.20	ES		1.60			Light brown slightly clayey slightly gravelly fine to medium SAND. Gravel is fine to medium sub-rounded to rounded sandstone and mudstone.	1
				2.00			Soft low strength light grey slightly sandy CLAY.	2
		HVP	39.3	2.10			End of Pit at 2.10m	3
								4
								5

Remarks: 1. Complete

Stability: Stable.

Trial Pit Log

TrialPit No
TP115
Sheet 1 of 1

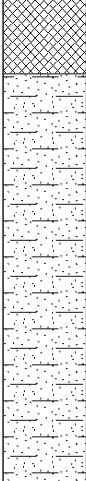
Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 2.00	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.00	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Asphalt.	
	0.40	ES					MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
	0.60	B						
				1.00			Dark brown fine to medium clayey SAND.	1
	1.50	ES						
				2.00			End of Pit at 2.00m	2
								3
								4
								5

Remarks: 1. Complete

Stability: Stable.

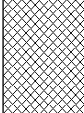
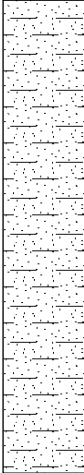
Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 2.00	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.00	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.20			MADE GROUND: Asphalt.	
				0.70			MADE GROUND: Dark brown gravelly fine to medium sand with frequent cobbles. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick cobbles are angular brick.	
				2.00			Dark brown fine to medium clayey SAND. (Strong sulphur odour).	1
							End of Pit at 2.00m	2
								3
								4
								5

Remarks: 1. Complete

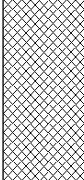
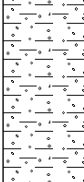
Stability: Stable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 1.80 0.60	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 2.10	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.20			MADE GROUND: Asphalt.	
				0.60			MADE GROUND: Dark brown gravelly fine to medium sand with frequent cobbles. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick cobbles are angular brick.	
	1.00	ES					Orangish brown slightly clayey fine to medium SAND.	1
				2.10			End of Pit at 2.10m	2
								3
								4
								5

Remarks: 1. Complete	
Stability: Stable.	

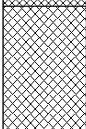
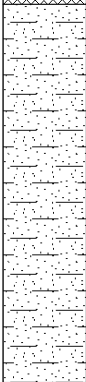
Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 1.50	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 1.40	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.20			MADE GROUND: Asphalt.	
				0.80			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
				1.40			Dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-rounded to round mudstone.	1
							End of Pit at 1.40m	2
								3
								4
								5

Remarks: 1. Complete

Stability: Stable.

Project Name: Draw Well Road	Project No. 12969	Co-ords: - Level:	Date 27/06/2019
Location: Knowsley		Dimensions (m): 2.00	Scale 1:24
Client: Prime Property Consultancy Ltd		Depth 1.80	Logged A.AHMED

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Asphalt.	
				0.60			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
	1.00	B		1.80			Dark brown clayey fine to medium SAND. (Strong sulphur odour).	1
							End of Pit at 1.80m	2
								3
								4
								5

Remarks: 1. Complete	
Stability: Stable.	

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

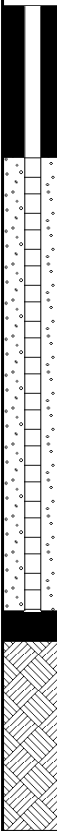
Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 26/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Asphalt.	
		0.60	ES					MADE GROUND: Reddish black gravelly fine to medium sand. Gravel is fine to coarse angular to sub-angular of brick asphalt and concrete.	
		1.00	D		0.80			Loose dark brown clayey fine to medium SAND.	1
		1.00	SPT	N=8 (2,1/2,2,2,2)					
		1.20	ES						
					1.40			Soft brownish grey slightly sandy slightly silty CLAY.	
		2.00	D		2.00			Medium dense brown slightly clayey fine to medium SAND.	2
		2.00	SPT	N=10 (2,2/2,2,3,3)					
					2.70			Soft to firm slightly sandy CLAY.	
		3.00	D		3.00			Medium dense dark brown slightly clayey SAND.	3
		3.00	SPT	N=39 (7,9/9,10,10,10)					
		4.00	D						4
		4.00	SPT	N=14 (3,3/3,3,3,5)					
		5.00	SPT	50 (11,7/50 for 240mm)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1.Complete. 2. Monitoring well installed 3. Groundwater encountered at 3.00m bgl.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

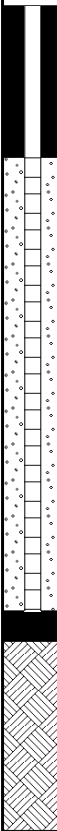
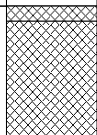
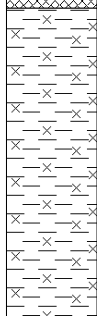
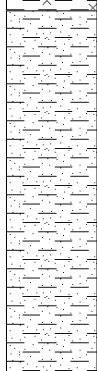
Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 26/06/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.10			MADE GROUND: Asphalt.	
		1.00	D		0.90			MADE GROUND: Red black sandy gravel. Gravel is fine to medium sub-angular to angular brick asphalt and sandstone.	
		1.00	SPT	N=12 (2,2/2,2,4,4)				Stiff high strength brown slightly gravelly slightly silty CLAY. Gravel is fine to medium sub-rounded to round mudstone.	1
		1.10	ES						
		1.50	U						
		2.00	D		3.00				2
		2.00	SPT	N=24 (4,4/5,6,6,7)					
		3.00	D						
		3.00	SPT	N=12 (9,5/3,3,3,3)				Stiff high strength brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium sub-rounded to round mudstone.	3
		4.00	D		5.45				4
		4.00	SPT	N=26 (6,6/6,6,7,7)					
		5.00	D						5
		5.00	SPT	N=40 (6,6/7,10,11,12)					
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete 2. Monitoring well installed

				Borehole Log			Borehole No. WS103 Sheet 1 of 1	
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type WS
Location: Knowsley				Level:		Scale 1:50		
Client: Prime Property Consultancy Ltd				Dates: 26/06/2019		Logged By V. WILKINSON		

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20		MADE GROUND: Asphalt.		
		1.00	D		1.00		Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub angular to angular mudstone sandstone.	1	
		1.00	SPT	N=9 (2,2/2,2,3,2)					
		1.40	ES				Firm to stiff brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium sub angular to angular mudstone sandstone.	2	
		2.00	D						
		2.00	SPT	N=15 (2,2/3,3,4,5)					
		3.00	SPT	75 (75 for 70mm/75 for 70mm)	3.45			3	
							End of Borehole at 3.45m	4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
 1. Incomplete. 2. Refused on stiff clay



Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 26/06/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20			MADE GROUND: Asphalt.	
								Loose brown medium to coarse slightly clayey SAND.	
		0.90	ES						1
		1.00	SPT	N=9 (2,3/2,2,3,2)					
					1.30				
					1.40			Dark brown amorphous spongy PEAT.	
								Medium dense light brown fine to medium clayey SAND.	
		2.00	SPT	N=12 (2,3/3,3,3,3)					2
		2.50	U		2.40				
								Stiff high strength brown sandy slightly gravelly CLAY. Gravel is angular to rounded fine to medium mudstone and sandstone.	
		3.00	D						3
		3.00	SPT	50 (7,9/50 for 290mm)					
					4.00				4
								End of Borehole at 4.00m	
									5
									6
									7
									8
									9
									10

Remarks

1. Complete 2. Monitoring well

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

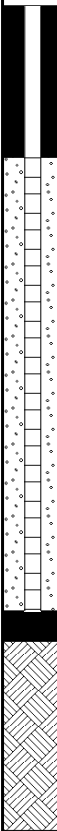
Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 26/06/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20			MADE GROUND: Asphalt.	
					0.40			MADE GROUND: Firm brown sandy very gravelly clay. Gravel is angular to rounded fine to medium mudstone sandstone and brick	
		1.00	SPT	N=12 (5,4/3,3,3,3)				Medium dense dark brown clayey medium to coarse SAND.	1
		1.10	ES		1.20			Soft low strength to firm grey slightly silty slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium sandstone and mudstone.	
		2.00	D						2
		2.00	SPT	N=4 (1,1/1,1,1,1)					
		3.00	D						3
		3.00	SPT	N=26 (4,4/4,7,7,8)	3.30				
		4.00	D					Stiff high strength brown sandy slightly gravelly CLAY. Gravel is fine to sub angular to rounded fine to medium mudstone and sandstone	4
		4.00	SPT	N=14 (3,3/3,3,4,4)					
		5.00	D						5
		5.00	SPT	N=39 (6,9/9,10,10,10)	5.45				
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete 2. Monitoring well installed



					Borehole Log			Borehole No. WS107 Sheet 1 of 1	
Project Name: Draw Well Road					Project No. 12969		Co-ords:		Hole Type WS
Location: Knowsley					Level:		Scale 1:50		Logged By V. WILKINSON
Client: Prime Property Consultancy Ltd					Dates: 27/07/2019				

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							MADE GROUND: Concrete slab.		
					0.70		MADE GROUND: Black fine to medium Gravel.		
					0.90		MADE GROUND: Concrete slab.	1	
					1.30		End of Borehole at 1.30m	2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
 1. Coring completed to the thickness of the floor slab within bunker.



Borehole Log

Borehole No.

WS108

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 27/07/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.20			MADE GROUND: Asphalt.	
		1.00	SPT	N=21 (6,3/4,5,7,5)				MADE GROUND: Firm dark grey slightly sandy gravelly clay. Gravel is sub angular to angular fine to coarse mudstone sandstone and brick.	1
		1.90 2.00 2.00	ES D SPT	N=10 (2,2/2,2,3,3)	1.80			Stiff high strength dark brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium mudstone and sandstone.	2
		3.00 3.00	D SPT	N=18 (3,3/4,4,5,5)					3
		4.00 4.00	D SPT	N=20 (4,4/5,5,5,5)					4
		5.00 5.00	D SPT	N=20 (4,4/5,5,5,5)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete 2. Monitoring well installed

				Borehole Log			Borehole No. WS109 Sheet 1 of 1	
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type WS
Location: Knowsley				Level:		Scale 1:50		
Client: Prime Property Consultancy Ltd				Dates: 27/07/2019		Logged By V. WILKINSON		

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.20		MADE GROUND: Asphalt.		
		0.70	ES		0.40		MADE GROUND: Firm brown sandy very gravelly clay. Gravel is angular to rounded fine to medium mudstone sandstone and brick.		
		1.00	D				Stiff high strength dark brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium mudstone and sandstone.	1	
		1.00	SPT	N=12 (2,2/3,3,3,3)					
		2.00	D					2	
		2.00	SPT	N=15 (3,3/3,4,4,4)					
		3.00	D		3.00			3	
		3.00	SPT	N=32 (5,6/8,8,8,8)			Stiff high strength dark brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium mudstone and sandstone.		
		4.00	D					4	
		4.00	SPT	N=45 (7,8/8,11,13,13)					
		5.00	D					5	
		5.00	SPT	N=45 (7,8/8,11,13,13)					
					5.45		End of Borehole at 5.45m	6	
								7	
								8	
								9	
								10	

Remarks
 1. Complete



Borehole Log

Borehole No.

WS110

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 27/07/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.20			MADE GROUND: Asphalt.	
		0.70	ES		0.50			MADE GROUND: Black slightly clayey fine to medium sand.	
		1.00	SPT	N=13 (4,4/4,3,3,3)				Medium dense dark brown slightly clayey fine to medium SAND.	1
		1.50	ES		1.50			Medium dense grey slightly clayey gravelly fine to medium SAND. Gravel is sub-angular to rounded fine to medium sandstone and mudstone	2
		2.00	D SPT	N=7 (0,0/0,2,2,3)	2.50			Firm medium strength dark brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium mudstone and sandstone	3
		3.00	D SPT	N=20 (2,2/5,5,5,5)	3.00			Medium dense brown slightly clayey fine to medium SAND.	4
		4.00	D SPT	N=16 (2,2/3,3,5,5)	4.45			Stiff high strength dark brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to medium mudstone and sandstone.	5
								End of Borehole at 4.45m	6
									7
									8
									9
									10

Remarks

1. Incomplete. 2. Collapse 3m bgl. 3. Monitoring well installed

Borehole Log

Borehole No.

WS111

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 27/07/2019

Logged By
V. WILKINSON

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.20			MADE GROUND: grey sandy gravelly Asphalt. Gravel is fine to medium sub-angular to angular asphalt.	
		1.00	SPT	N=14 (3,3/3,3,4,4)	0.80			Black slightly clayey gravelly fine to medium sand. Gravel is sub-angular to angular firm to medium brick mudstone and sandstone with rootlets.	
		1.10	ES					Stiff high strength brown sandy slightly gravelly CLAY. Gravel is sub-angular to angular fine to medium mudstone and sandstone.	1
		2.00	D SPT	N=0 (1,0/0,0,0,0)	2.00			Very soft very low strength brown sandy slightly gravelly CLAY. Gravel is sub-angular to angular fine to medium mudstone and sandstone.	2
		3.00	D SPT	N=14 (3,3/3,3,3,5)	3.00			Stiff high strength brown sandy slightly gravelly CLAY. Gravel is sub-angular to angular fine to medium mudstone and sandstone.	3
		4.00	D SPT	N=28 (5,5/7,7,7,7)	4.45			End of Borehole at 4.45m	4
									5
									6
									7
									8
									9
									10

Remarks

1. Incomplete due to rig breakdown. 2. Monitoring well installed.

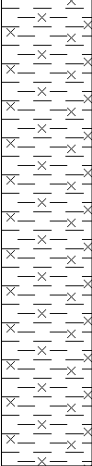
				Borehole Log			Borehole No. WS112 Sheet 1 of 1	
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type WS
Location: Knowsley				Level:		Scale 1:50		
Client: Prime Property Consultancy Ltd				Dates: 27/07/2019		Logged By V. WILKINSON		

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.20		MADE GROUND: Asphalt.		
		0.70	ES		0.50		MADE GROUND: Firm to stiff brown slightly silty slightly gravelly CLAY. Gravel is sub-angular to rounded firm to medium brick mudstone and sandstone.		
		1.00	D				Stiff high strength brown sandy slightly gravelly CLAY. Gravel is sub-rounded to rounded fine to medium mudstone.	1	
		1.00	SPT	N=8 (2,2/2,2,2,2)					
		1.50	U						
		2.00	D					2	
		2.00	SPT	N=12 (3,3/3,3,3,3)					
		3.00	D					3	
		3.00	SPT	N=12 (3,3/3,3,3,3)					
		4.00	D		4.00		Stiff high strength brown sandy slightly gravelly CLAY. Gravel is sub-angular to angular fine to medium mudstone and sandstone.	4	
		4.00	SPT	N=17 (4,4/4,4,4,5)					
		5.00	D					5	
		5.00	SPT	N=22 (5,5/5,5,6,6)					
					5.45		End of Borehole at 5.45m	6	
								7	
								8	
								9	
								10	

Remarks
 1. Complete



				Borehole Log			Borehole No. WS113 Sheet 1 of 1	
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type WS
Location: Knowsley				Level:		Scale 1:50		
Client: Prime Property Consultancy Ltd				Dates: 27/07/2019		Logged By V. WILKINSON		

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30		MADE GROUND: Firm to stiff brown very gravelly clay. Gravel is angular to rounded fine to medium brick mudstone sandstone with rootlets.	1	
		0.50	ES						
		1.00	D						
		1.00	SPT	N=12 (2,2/3,3,3,3)					
		2.00	D						
		2.00	SPT	N=28 (4,5/5,6,8,9)					
		3.00	D		3.45		Stiff high strength dark brown slightly silty slightly gravelly CLAY. Gravel is sub-angular to rounded mudstone and sandstone.	3	
		3.00	SPT	N=50 (8,9/10,13,13,14)					
							End of Borehole at 3.45m		4
									5
									6
									7
									8
									9
									10

Remarks
 1. Incomplete. 2. Refused on stiff clay





Borehole Log

Borehole No.

WS114

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 28/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Asphalt.	
		0.50	ES		0.70			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	1
		1.00	SPT	N=2 (1,0/0,1,0,1)				MADE GROUND: Dark brown clayey slightly gravelly fine to medium SAND. Gravel is fine to coarse asphalt and brick.	
		1.70	ES						2
		2.00	SPT	N=11 (2,3/3,3,3,2)	2.20				
		3.00	SPT	N=4 (2,2/1,1,1,1)				Loose light brown slightly clayey fine to medium SAND.	3
					3.70				
		4.00	D		4.00			Very stiff extremely high strength greyish brown slightly sandy CLAY.	4
		4.00	SPT	N=50 (4,4/12,12,13,13)				Dense light brown very clayey SAND.	
					4.70				
		5.00	D					Very stiff very high strength greyish brown sandy CLAY.	5
		5.00	SPT	N=49 (6,9/10,11,14,14)	5.45				
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete



				Borehole Log				Borehole No. WS115 Sheet 1 of 1	
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type WS	
Location: Knowsley				Level:		Scale 1:50			
Client: Prime Property Consultancy Ltd				Dates: 28/06/2019		Logged By A.AHMED			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=14 (3,2/3,3,4,4)	0.20			MADE GROUND: Asphalt.	1 2 3 4 5 6 7 8 9 10
					0.60			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	
		1.00	SPT	1.00			Dark brown amorphous spongy PEAT.		
		1.20	ES				Dark brown clayey fine to medium SAND. (Strong Organic odour).		
		2.00	SPT	N=12 (4,4/3,3,3,3)	1.80			Medium dense light yellow slightly clayey fine to medium SAND.	
				2.60			Stiff high strength light grey slightly sandy slightly gravelly CLAY. Gravel is fine sub-rounded to round mudstone.		
		3.00	D	N=11 (1,2/2,3,3,3)	3.40			Stiff high strength brown slightly sandy CLAY.	
		3.00	SPT						
		4.00	D	N=38 (5,6/7,8,12,11)					
		4.00	SPT						
5.00	D	N=48 (8,7/12,12,12,12)							
5.00	SPT								
				5.45		End of Borehole at 5.45m			
Remarks 1. Complete									

Borehole Log

Borehole No.

WS116

Sheet 1 of 1

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 28/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.20			MADE GROUND: Asphalt.	
		1.00	SPT	N=25 (6,5/5,7,7,6)	1.20			MADE GROUND: Black gravelly fine to medium sand. Gravel is fine to coarse sub-angular to angular asphalt concrete and brick.	1
		1.50	ES					Medium dense light brown clayey fine to medium SAND. (Strong sulphur odour).	
		2.00	SPT	N=15 (3,4/5,3,4,3)					2
		3.00	D SPT	N=9 (2,3/2,2,2,3)					3
		4.00	D SPT	N=15 (2,3/3,3,4,5)	3.90			Very stiff high strength dark brown sandy CLAY.	4
		5.00	D SPT	50 (9,9/50 for 255mm)	5.45			End of Borehole at 5.45m	5
									6
									7
									8
									9
									10

Remarks

1. Complete 2. Water strike encountered at 4.00m bgl.

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
WS

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 28/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Light grey sandy gravel. Gravel is fine to coarse sub-angular to angular asphalt and concrete.	
		0.50	ES					Stiff high strength brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-rounded to round mudstone.	1
		1.00 1.00	D SPT	N=13 (2,3/2,3,4,4)					2
		2.00 2.00	D SPT	N=16 (4,3/3,4,5,4)					3
		3.00 3.00	D SPT	N=25 (5,5/6,7,6,6)					4
		4.00 4.00	D SPT	50 (6,8/50 for 250mm)	4.45			End of Borehole at 4.45m	5
									6
									7
									8
									9
									10

Remarks

1. Incomplete 2. Refused on stiff clay 3. Monitoring well installed.

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
CP

Location: Knowsley

Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 27/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Asphalt.	
					0.40			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is sub-rounded to angular brick concrete and ash.	
		0.50	B		0.80			Reddish brown slightly clayey SAND.	
		1.00	B					Soft grey silty CLAY.	1
		1.00	U						
					1.80			Stiff high strength brown slightly gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone.	2
		2.00	D SPT	N=11 (1,2/2,3,3,3)					
		2.00							
		3.00	U						3
		4.00	D SPT	N=14 (2,3/3,3,4,4)					4
		4.00							
		5.00	U						5
		6.00	D SPT	N=17 (2,3/4,4,4,5)					6
		6.00							
					6.50			Very stiff brown bolder CLAY with bands of fine to medium sand and gravel. Gravel is fine to medium rounded to sub-rounded mudstone.	7
		7.50	D SPT	50 (15 for 82mm/50 for 275mm)					8
		7.50							
		8.50	D SPT	50 (25 for 145mm/50 for 225mm)					
		8.50							
		9.00	D SPT	50 (3,11/50 for 180mm)	9.00			End of Borehole at 9.00m	9
		9.00							
									10

Remarks

1. Chiselling from 7.50m to 9.00m bgl for 1 hour 2. Water strike encountered at 6.50m bgl.

Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
CP

Location: Knowsley

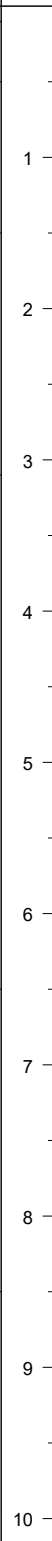
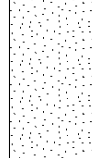
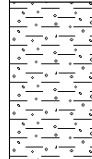
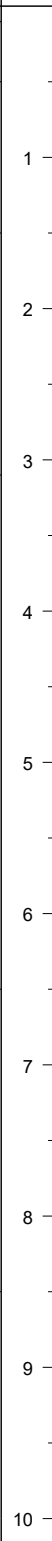
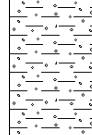
Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

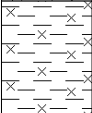
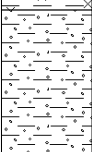
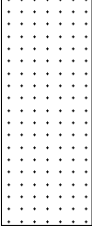
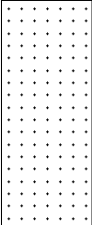
Dates: 27/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	 0.40	0.10			0.10			MADE GROUND: Asphalt.	
		0.50	B		0.50			MADE GROUND: Light grey sandy gravel. Gravel is fine to medium sub-rounded to sub-angular limestone.	
		1.00	D					Medium dense bark brown fine to coarse SAND.	
		1.00	SPT	N=11 (1,2/2,3,3,3)					
					1.50			Medium dense grey fine silty SAND.	
		2.00	D						
		2.00	SPT	N=13 (2,3/3,3,3,4)					
		3.00	U		3.10			Stiff high strength brown slightly gravelly CLAY. Gravel is fine to coarse angular to sub-angular of mudstone and sandstone	
		4.00	D						
		4.00	SPT	N=12 (2,3/3,3,3,3)					
	 6.50	5.00	D						
		5.00	SPT	N=14 (2,2/3,3,4,4)					
		6.00	D						
		6.00	SPT	N=17 (1,2/3,3,3,8)	6.50			Very stiff brown slightly sandy gravelly CLAY. Gravel is fine to medium rounded to sub-rounded mudstone.	
		7.50	D						
		7.50	SPT	49 (2,3/49 for 295mm)					
		8.50	D		8.50			End of Borehole at 8.50m	
		8.50	SPT	50 (4,10/50 for 235mm)					

Remarks

1. Chiseling from 7.50m to 9.50m bgl for 1 hour. 2. Water strikes encountered at 0.40m bgl and 6.50m bgl. 3. Monitoring well installed. 4. Hole likely refusal on bedrock.

				Borehole Log			Borehole No. CP103 Sheet 1 of 1		
Project Name: Draw Well Road				Project No. 12969		Co-ords:		Hole Type CP	
Location: Knowsley				Level:		Scale 1:50			
Client: Prime Property Consultancy Ltd				Dates: 28/06/2019		Logged By A.AHMED			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Asphalt.	1 2 3 4 5 6 7 8 9 10
		0.50	B		0.50			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is sub-rounded to angular brick concrete and ash. Medium dense light brown slightly clayey SAND.	
		1.00 1.00	D SPT	N=9 (1,1/2,2,2,3)					
		2.00 2.00	D SPT	N=11 (1,2/2,3,3,3)					
		3.00 3.00	D SPT	N=14 (1,2/3,3,4,4)	3.20			Stiff high strength grey silty CLAY.	
		4.00	U		4.00			Very stiff high strength slightly gravelly CLAY. Gravel is fine to coarse sub-angular to rounded of mudstone and sandstone.	
		5.00 5.00	D SPT	N=17 (2,3/3,4,5,5)					
		6.00	U		6.00			Reddish brown weathered SANDSTONE.	
		7.50 7.50	D SPT	50 (6,8/50 for 180mm)	7.50			Dense reddish brown weathered SANDSTONE.	
		9.00 9.00	D SPT	50 (25 for 145mm/50 for 160mm)	9.00			End of Borehole at 9.00m	

Remarks
1.Chiseling from 7.50m to 9.50 bgl for 1 hour.


Project Name: Draw Well Road

Project No.
12969

Co-ords:

Hole Type
CP

Location: Knowsley

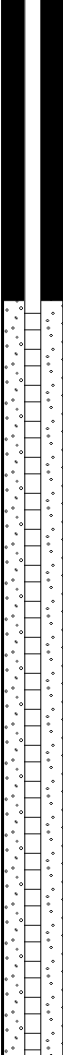
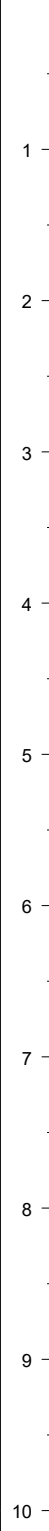
Level:

Scale
1:50

Client: Prime Property Consultancy Ltd

Dates: 29/06/2019

Logged By
A.AHMED

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Asphalt.	
		0.50	B		0.50			MADE GROUND: Dark brown gravelly fine to medium sand. Gravel is sub-rounded to angular brick concrete and ash.	
		1.00	B					Medium dense brown slightly clayey SAND.	
		1.00	D						
		1.00	SPT	N=20 (3,4/5,5,5,5)					
		2.00	D		2.00			Loose brown slightly clayey SAND.	
		2.00	SPT	N=4 (1,0/1,1,1,1)					
		3.00	D		3.20			Firm medium strength grey silty CLAY.	
		3.00	SPT	N=6 (1,1/1,2,1,2)					
		4.00	U		4.00			Stiff high strength brown sandy CLAY.	
		5.00	D						
		5.00	SPT	N=14 (1,3/3,3,4,4)					
		6.00	D		6.00			Dense reddish brown weathered SANDSTONE.	
		6.00	SPT	50 (3,7/50 for 235mm)					
					7.50			End of Borehole at 7.50m	
7.50	D								
7.50	SPT	50 (20,5/50 for 105mm)							

Remarks

1.Chiseling from 6.00m to 7.50m bgl for 1 hour. 2. Monitoring well installed.

APPENDIX VI

CHEMICAL TESTING

RESULTS

**Adeel Ahmed**

e3p
Office 4
Heliport Business Park
Eccles
Liverpool Road
Manchester
M30 7RU

t: 0161 707 9612

e: aahmed@e3p.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 19-48062

Project / Site name:	Bunkersite- Draw Well Road	Samples received on:	02/07/2019
Your job number:	12-969	Samples instructed on:	02/07/2019
Your order number:	12969-32467-SE	Analysis completed by:	09/07/2019
Report Issue Number:	1	Report issued on:	09/07/2019
Samples Analysed:	3 leachate samples - 26 soil samples		

Signed: 

Zina Abdul Razzak
Senior Quality Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257712	1257713	1257714	1257715	1257716
Sample Reference	WS101	WS101	WS102	WS104	WS105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.60	1.20	0.30	0.10	1.10
Date Sampled	26/06/2019	26/06/2019	26/06/2019	26/06/2019	27/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.4	14
Total mass of sample received	kg	0.001	NONE	0.40	0.46

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	8.3	10.9	8.6	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1500	260	4200	490	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1100	84	590	160	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.55	0.042	0.29	0.081	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	552	41.9	295	81.3	-
Sulphide	mg/kg	1	MCERTS	120	21	270	18	-
Total Sulphur	mg/kg	50	MCERTS	1400	250	2400	1700	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.1	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	-
----------------------------	-------	---	--------	-------	-------	-------	-------	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	2.5	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.87	< 0.05	3.1	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.82	0.48	0.28	41	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.41	1.6	0.24	39	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.71	6.5	1.9	150	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.23	2.3	0.40	47	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.73	5.3	4.0	200	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.72	4.3	3.8	190	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.39	2.2	2.3	170	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.37	1.6	2.1	120	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.32	1.9	2.2	170	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.32	0.66	1.9	65	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.37	1.5	2.4	160	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.67	1.4	82	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.44	26	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.74	2.1	90	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	5.39	30.7	25.3	1550	< 0.80
-----------------------------	-------	-----	--------	------	------	------	------	--------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.5	< 1.0	12	11	3.6
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	13
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	0.12
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.8	< 0.2	< 0.2	0.5	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	6.4	28	17	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	29	12	28	57	6.9
Lead (aqua regia extractable)	mg/kg	1	MCERTS	99	8.7	34	76	3.7
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.4	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	6.3	16	21	5.1
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	5.4



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257712	1257713	1257714	1257715	1257716
Sample Reference				WS101	WS101	WS102	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	1.20	0.30	0.10	1.10
Date Sampled				26/06/2019	26/06/2019	26/06/2019	26/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	33	59	82	8.3

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257712	1257713	1257714	1257715	1257716
Sample Reference				WS101	WS101	WS102	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	1.20	0.30	0.10	1.10
Date Sampled				26/06/2019	26/06/2019	26/06/2019	26/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	8.1	10	< 2.0	7.2	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	22	21	< 4.0	73**	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	48	47	71	390**	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	150	69	500	1100	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	34	25	140	190	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	280	180	720	1700	< 10



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257712	1257713	1257714	1257715	1257716
Sample Reference	WS101	WS101	WS102	WS104	WS105
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.60	1.20	0.30	0.10	1.10
Date Sampled	26/06/2019	26/06/2019	26/06/2019	26/06/2019	27/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

** Discrepancy due to method variation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257717	1257718	1257719	1257720	1257721
Sample Reference	WS108	WS109	WS110	WS110	WS110
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.30	0.70	0.30	0.70	1.50
Date Sampled	27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.0	14
Total mass of sample received	kg	0.001	NONE	0.50	0.49

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	6.7	7.0	7.1
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	320	240	230
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	56	33	83
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	0.028	0.017	0.042
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	28.2	16.5	41.7
Sulphide	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	-	290	130	170
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	---	---	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.22	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.41	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.41	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.26	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.37	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.31	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.29	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.34	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	2.61	< 0.80	< 0.80	< 0.80	< 0.80
-----------------------------	-------	-----	--------	------	--------	--------	--------	--------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	2.0	< 1.0	< 1.0	< 1.0	1.4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	78	57	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.68	0.99	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	1.8	2.5	5.4
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	22	7.1	2.6	6.0
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	8.5	2.7	< 1.0	1.9
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	38	1.9	1.4	4.0
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	30	46	-	-	-



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257717	1257718	1257719	1257720	1257721
Sample Reference				WS108	WS109	WS110	WS110	WS110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	0.30	0.70	1.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	43	46	9.8	1.7	6.7

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257717	1257718	1257719	1257720	1257721
Sample Reference				WS108	WS109	WS110	WS110	WS110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	0.30	0.70	1.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	5.4	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	11	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	35	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	54	< 10	< 10

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257717	1257718	1257719	1257720	1257721
Sample Reference				WS108	WS109	WS110	WS110	WS110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	0.30	0.70	1.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

** Discrepancy due to method variation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257722	1257723	1257724	1257725	1257726
Sample Reference	WS111	WS112	WS112	WS113	WS113
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.10	0.30	0.70	0.20	0.50
Date Sampled	27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	10	6.9
Total mass of sample received	kg	0.001	NONE	0.51	0.47

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Amosite	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Detected	-	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	< 0.001	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	< 0.001	-	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	8.0	-	8.7	-
Total Cyanide	mg/kg	1	MCERTS	-	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	1300	-	840	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	540	-	180	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.27	-	0.092	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	268	-	91.7	-
Sulphide	mg/kg	1	MCERTS	-	13	-	41	-
Total Sulphur	mg/kg	50	MCERTS	-	890	-	650	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.3	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
----------------------------	-------	---	--------	---	-------	---	-------	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	0.28	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	0.34	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	1.2	< 0.05	3.9	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	0.51	< 0.05	3.0	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	2.1	< 0.05	20	0.51
Pyrene	mg/kg	0.05	MCERTS	-	2.8	< 0.05	20	0.55
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	2.3	< 0.05	13	0.43
Chrysene	mg/kg	0.05	MCERTS	-	1.6	< 0.05	10	0.35
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1.7	< 0.05	14	0.48
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.72	< 0.05	5.6	0.17
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	2.3	< 0.05	11	0.40
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.70	< 0.05	4.6	0.22
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	1.5	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.86	< 0.05	5.1	0.26

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	16.7	< 0.80	113	3.37
-----------------------------	-------	-----	--------	---	------	--------	-----	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	5.7	4.9	6.3	7.3
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	69	-	73
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	0.72	-	0.82
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	14	-	27	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	54	24	26	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	63	5.8	35	7.6
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	10	29	21	30
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	29	-	31



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257722	1257723	1257724	1257725	1257726
Sample Reference				WS111	WS112	WS112	WS113	WS113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.10	0.30	0.70	0.20	0.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	89	35	93	39

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257722	1257723	1257724	1257725	1257726
Sample Reference				WS111	WS112	WS112	WS113	WS113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.10	0.30	0.70	0.20	0.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	-	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	-	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	-	29	< 1.0	54	8.4
TPH (C21 - C35)	mg/kg	1	MCERTS	-	380	< 1.0	120	4.4
TPH (C35 - C40)	mg/kg	10	MCERTS	-	18	< 10	12	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	-	430	< 10	190	15

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257722	1257723	1257724	1257725	1257726
Sample Reference				WS111	WS112	WS112	WS113	WS113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.10	0.30	0.70	0.20	0.50
Date Sampled				27/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

** Discrepancy due to method variation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257727	1257728	1257729	1257730	1257731
Sample Reference	WS117	TP101	TP104	TP109	TP110
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	1.00	1.20	0.50	1.20
Date Sampled	28/06/2019	26/06/2019	26/06/2019	26/06/2019	26/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.4	11
Total mass of sample received	kg	0.001	NONE	0.40	0.39

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	< 0.001

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	8.2	7.7	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	430	750	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	270	350	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.14	0.17	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	137	174	-	-
Sulphide	mg/kg	1	MCERTS	-	23	11	-	-
Total Sulphur	mg/kg	50	MCERTS	-	560	2000	-	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	2.4

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	-	-
----------------------------	-------	---	--------	---	-------	-------	---	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.48	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.40	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	4.8	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.88	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	4.9	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	4.5	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	3.3	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	2.1	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	2.2	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	1.4	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	2.1	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.85	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.33	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	1.1	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	< 0.80	29.4	-
-----------------------------	-------	-----	--------	--------	---	--------	------	---

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	2.1	4.7	5.5	26	6.0
Barium (aqua regia extractable)	mg/kg	1	MCERTS	65	-	-	190	39
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.67	-	-	1.7	0.39
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.3	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	25	10	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	17	16	120	16
Lead (aqua regia extractable)	mg/kg	1	MCERTS	6.9	7.1	10	150	43
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	26	9.4	31	9.9
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	27	-	-	26	11



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257727	1257728	1257729	1257730	1257731
Sample Reference				WS117	TP101	TP104	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	1.20	0.50	1.20
Date Sampled				28/06/2019	26/06/2019	26/06/2019	26/06/2019	26/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	36	41	20	110	26

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257727	1257728	1257729	1257730	1257731
Sample Reference				WS117	TP101	TP104	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	1.20	0.50	1.20
Date Sampled				28/06/2019	26/06/2019	26/06/2019	26/06/2019	26/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	7.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	15	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	27	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	51	< 10



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257727	1257728	1257729	1257730	1257731
Sample Reference				WS117	TP101	TP104	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	1.20	0.50	1.20
Date Sampled				28/06/2019	26/06/2019	26/06/2019	26/06/2019	26/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	< 0.1	-	-	< 0.1
Phenol	mg/kg	0.2	ISO 17025	-	< 0.2	-	-	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Hexachloroethane	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	< 0.2	-	-	< 0.2
Isophorone	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
2-Nitrophenol	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	< 0.1	-	-	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	< 0.1	-	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	< 0.1	-	-	< 0.1
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	< 0.1	-	-	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	< 0.3	-	-	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
4-Nitroaniline	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Azobenzene	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Carbazole	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	< 0.2	-	-	< 0.2
Anthraquinone	mg/kg	0.3	MCERTS	-	< 0.3	-	-	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	< 0.3	-	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	< 0.05	-	-	< 0.05

** Discrepancy due to method variation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number	1257732	1257733	1257734	1257735	1257736
Sample Reference	TP111	TP112	TP113	TS01	TS02
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.40	0.30	0.50	0.50
Date Sampled	26/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	18	6.4
Total mass of sample received	kg	0.001	NONE	0.48	0.45

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Sulphide	mg/kg	1	MCERTS	-	-	-	-	-
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	-
----------------------------	-------	---	--------	---	---	---	---	---

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	2.1	0.62	1.8	0.92
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.96	0.12	1.8	2.3
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	5.8	0.53	11	7.3
Fluorene	mg/kg	0.05	MCERTS	< 0.05	5.0	0.53	15	8.9
Phenanthrene	mg/kg	0.05	MCERTS	0.28	31	3.9	110	100
Anthracene	mg/kg	0.05	MCERTS	0.16	10	1.2	52	46
Fluoranthene	mg/kg	0.05	MCERTS	1.4	75	11	280	310
Pyrene	mg/kg	0.05	MCERTS	1.5	72	11	270	300
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.91	63	7.3	250	270
Chrysene	mg/kg	0.05	MCERTS	0.98	57	5.2	170	180
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.3	73	8.9	280	250
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.32	41	3.4	63	120
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.81	63	7.8	180	200
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.53	29	3.3	88	100
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	10	1.1	31	35
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.51	36	3.8	89	100

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	8.65	573	69.5	1870	2050
-----------------------------	-------	-----	--------	------	-----	------	------	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.1	8.3	5.0	30	32
Barium (aqua regia extractable)	mg/kg	1	MCERTS	49	110	110	480	520
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.50	0.46	0.62	7.3	6.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	< 0.2	0.7	0.8
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	33	38	240	210
Lead (aqua regia extractable)	mg/kg	1	MCERTS	12	140	20	92	91
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	18	19	34	29
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	3.1	3.8
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	19	14	16	150	100



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257732	1257733	1257734	1257735	1257736
Sample Reference				TP111	TP112	TP113	TS01	TS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.30	0.50	0.50
Date Sampled				26/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	22	44	68	500	500

Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257732	1257733	1257734	1257735	1257736
Sample Reference				TP111	TP112	TP113	TS01	TS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.30	0.50	0.50
Date Sampled				26/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	-	< 1.0	< 1.0	-	-
TPH (C6 - C8)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
TPH (C8 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
TPH (C10 - C12)	mg/kg	2	MCERTS	-	11	11	-	-
TPH (C12 - C16)	mg/kg	4	MCERTS	-	29	8.9	-	-
TPH (C16 - C21)	mg/kg	1	MCERTS	-	310	37	-	-
TPH (C21 - C35)	mg/kg	1	MCERTS	-	1200	150	-	-
TPH (C35 - C40)	mg/kg	10	MCERTS	-	210	25	-	-
TPH Total C5 - C40	mg/kg	10	MCERTS	-	1800	250	-	-



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257732	1257733	1257734	1257735	1257736
Sample Reference				TP111	TP112	TP113	TS01	TS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.40	0.30	0.50	0.50
Date Sampled				26/06/2019	27/06/2019	27/06/2019	27/06/2019	27/06/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

** Discrepancy due to method variation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257780				
Sample Reference				WS114				
Sample Number				None Supplied				
Depth (m)				0.50				
Date Sampled				28/06/2019				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	8.0				
Total mass of sample received	kg	0.001	NONE	0.55				

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-				
Asbestos in Soil	Type	N/A	ISO 17025	-				
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-				
Asbestos Quantification Total	%	0.001	ISO 17025	-				

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-				
Total Cyanide	mg/kg	1	MCERTS	-				
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-				
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-				
Sulphide	mg/kg	1	MCERTS	-				
Total Sulphur	mg/kg	50	MCERTS	-				
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.8				

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-				
----------------------------	-------	---	--------	---	--	--	--	--

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-				
Acenaphthylene	mg/kg	0.05	MCERTS	-				
Acenaphthene	mg/kg	0.05	MCERTS	-				
Fluorene	mg/kg	0.05	MCERTS	-				
Phenanthrene	mg/kg	0.05	MCERTS	-				
Anthracene	mg/kg	0.05	MCERTS	-				
Fluoranthene	mg/kg	0.05	MCERTS	-				
Pyrene	mg/kg	0.05	MCERTS	-				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-				
Chrysene	mg/kg	0.05	MCERTS	-				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-				

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-				
-----------------------------	-------	-----	--------	---	--	--	--	--

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-				
Chromium (hexavalent)	mg/kg	4	MCERTS	-				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-				



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257780				
Sample Reference				WS114				
Sample Number				None Supplied				
Depth (m)				0.50				
Date Sampled				28/06/2019				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-				



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257780				
Sample Reference				WS114				
Sample Number				None Supplied				
Depth (m)				0.50				
Date Sampled				28/06/2019				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	-				
TPH (C6 - C8)	mg/kg	0.1	MCERTS	-				
TPH (C8 - C10)	mg/kg	0.1	MCERTS	-				
TPH (C10 - C12)	mg/kg	2	MCERTS	-				
TPH (C12 - C16)	mg/kg	4	MCERTS	-				
TPH (C16 - C21)	mg/kg	1	MCERTS	-				
TPH (C21 - C35)	mg/kg	1	MCERTS	-				
TPH (C35 - C40)	mg/kg	10	MCERTS	-				
TPH Total C5 - C40	mg/kg	10	MCERTS	-				



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257780				
Sample Reference				WS114				
Sample Number				None Supplied				
Depth (m)				0.50				
Date Sampled				28/06/2019				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
SVOCs								
Aniline	mg/kg	0.1	NONE	-				
Phenol	mg/kg	0.2	ISO 17025	-				
2-Chlorophenol	mg/kg	0.1	MCERTS	-				
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-				
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-				
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-				
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-				
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-				
2-Methylphenol	mg/kg	0.3	MCERTS	-				
Hexachloroethane	mg/kg	0.05	MCERTS	-				
Nitrobenzene	mg/kg	0.3	MCERTS	-				
4-Methylphenol	mg/kg	0.2	NONE	-				
Isophorone	mg/kg	0.2	MCERTS	-				
2-Nitrophenol	mg/kg	0.3	MCERTS	-				
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-				
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-				
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-				
Naphthalene	mg/kg	0.05	MCERTS	-				
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-				
4-Chloroaniline	mg/kg	0.1	NONE	-				
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-				
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-				
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-				
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-				
2-Methylnaphthalene	mg/kg	0.1	NONE	-				
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-				
Dimethylphthalate	mg/kg	0.1	MCERTS	-				
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-				
Acenaphthylene	mg/kg	0.05	MCERTS	-				
Acenaphthene	mg/kg	0.05	MCERTS	-				
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-				
Dibenzofuran	mg/kg	0.2	MCERTS	-				
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-				
Diethyl phthalate	mg/kg	0.2	MCERTS	-				
4-Nitroaniline	mg/kg	0.2	MCERTS	-				
Fluorene	mg/kg	0.05	MCERTS	-				
Azobenzene	mg/kg	0.3	MCERTS	-				
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-				
Hexachlorobenzene	mg/kg	0.3	MCERTS	-				
Phenanthrene	mg/kg	0.05	MCERTS	-				
Anthracene	mg/kg	0.05	MCERTS	-				
Carbazole	mg/kg	0.3	MCERTS	-				
Dibutyl phthalate	mg/kg	0.2	MCERTS	-				
Anthraquinone	mg/kg	0.3	MCERTS	-				
Fluoranthene	mg/kg	0.05	MCERTS	-				
Pyrene	mg/kg	0.05	MCERTS	-				
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-				
Chrysene	mg/kg	0.05	MCERTS	-				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-				

** Discrepancy due to method variation.



Analytical Report Number: 19-48062
Project / Site name: Bunkersite- Draw Well Road
Your Order No: 12969-32467-SE

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1257723	WS112	0.30	204	Loose Fibres	Amosite	< 0.001	< 0.001
1257731	TP110	1.20	163	Loose Fibres	Chrysotile	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257737	1257738	1257739		
Sample Reference				WS103	WS109	WS111		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.10	0.30	0.40		
Date Sampled				26/06/2019	27/06/2019	27/06/2019		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	8.0	8.0	7.0		
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	3.0		

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	9.7	9.9	11		
----------------------------	------	---	-----------	-----	-----	----	--	--

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2		
-------------------	------	-----	------	-------	-------	-------	--	--

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	8.5	2.2	24		
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08		
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	U/S		
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4	0.8	4.4		
Copper (dissolved)	µg/l	0.7	ISO 17025	1.7	3.5	58		
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	27		
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5		
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.6	< 0.3	6.7		
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0		
Zinc (dissolved)	µg/l	0.4	ISO 17025	2.9	1.8	23		

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10		

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257737	1257738	1257739		
Sample Reference				WS103	WS109	WS111		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.10	0.30	0.40		
Date Sampled				26/06/2019	27/06/2019	27/06/2019		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status					
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10		



Analytical Report Number: 19-48062

Project / Site name: Bunkersite- Draw Well Road

Your Order No: 12969-32467-SE

Lab Sample Number				1257737	1257738	1257739		
Sample Reference				WS103	WS109	WS111		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.10	0.30	0.40		
Date Sampled				26/06/2019	27/06/2019	27/06/2019		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status					

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 19-48062

Project / Site name: Bunkersite- Draw Well Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1257712	WS101	None Supplied	0.60	Brown loam and sand with gravel and brick.
1257713	WS101	None Supplied	1.20	Brown clay and gravel.
1257714	WS102	None Supplied	0.30	Brown loam and sand with gravel.
1257715	WS104	None Supplied	0.10	Grey loam and sand with gravel.
1257716	WS105	None Supplied	1.10	Brown sand.
1257717	WS108	None Supplied	0.30	Brown clay and sand with gravel.
1257718	WS109	None Supplied	0.70	Brown clay with gravel.
1257719	WS110	None Supplied	0.30	Brown sandy loam.
1257720	WS110	None Supplied	0.70	Brown sandy loam.
1257721	WS110	None Supplied	1.50	Brown sandy loam.
1257722	WS111	None Supplied	1.10	Brown sandy clay.
1257723	WS112	None Supplied	0.30	Brown loam and sand with gravel.
1257724	WS112	None Supplied	0.70	Brown clay with gravel.
1257725	WS113	None Supplied	0.20	Brown gravel with vegetation.**
1257726	WS113	None Supplied	0.50	Brown clay with gravel.
1257727	WS117	None Supplied	0.50	Brown clay with gravel.
1257728	TP101	None Supplied	1.00	Brown clay with gravel.
1257729	TP104	None Supplied	1.20	Brown clay and sand with gravel.
1257730	TP109	None Supplied	0.50	Brown loam and sand with gravel.
1257731	TP110	None Supplied	1.20	Brown loam and sand with gravel.
1257732	TP111	None Supplied	0.50	Brown clay and sand with gravel.
1257733	TP112	None Supplied	0.40	Brown clay and sand with gravel.
1257734	TP113	None Supplied	0.30	Brown clay and sand with gravel.
1257735	TS01	None Supplied	0.50	Brown loam and sand with gravel and vegetation.
1257736	TS02	None Supplied	0.50	Brown loam and sand with gravel and vegetation.
1257780	WS114	None Supplied	0.50	Brown loam and sand with gravel and brick.

** NON MCERTS MATRIX

Analytical Report Number : 19-48062

Project / Site name: Bunkersite- Draw Well Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS

Iss No 19-48062-1 Bunkersite- Draw Well Road 12-969

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

The results included within the report are representative of the samples submitted for analysis.

Page 31 of 32

Analytical Report Number : 19-48062

Project / Site name: Bunkersite- Draw Well Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"	L009-PL	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

**Stuart Ellis**

e3p
Office 4
Heliport Business Park
Eccles
Liverpool Road
Manchester
M30 7RU

t: 0161 707 9612

e: sellis@e3p.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 19-51952

Project / Site name:	Draw Well	Samples received on:	26/07/2019
Your job number:	12969	Samples instructed on:	29/07/2019
Your order number:		Analysis completed by:	05/08/2019
Report Issue Number:	1	Report issued on:	05/08/2019
Samples Analysed:	3 water samples		

Signed:

Marzena Babik
Quality Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 19-51952

Project / Site name: Draw Well

Lab Sample Number	1278163	1278164	1278165		
Sample Reference	WS102	WS105	WS117		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	None Supplied	None Supplied	None Supplied		
Date Sampled	26/07/2019	26/07/2019	26/07/2019		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.6	8.6	7.2		
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
----------------------------	------	---	-----------	-------	-------	-------	--	--

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	ISO 17025	3.15	3.75	0.76		
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	< 0.02	< 0.02		
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0		
Chromium (dissolved)	µg/l	0.2	ISO 17025	1.0	3.4	1.0		
Copper (dissolved)	µg/l	0.5	ISO 17025	6.7	14	5.0		
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	1.2	0.5		
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05		
Nickel (dissolved)	µg/l	0.5	ISO 17025	7.2	2.0	3.8		
Selenium (dissolved)	µg/l	0.6	ISO 17025	5.0	2.8	2.5		
Zinc (dissolved)	µg/l	0.5	ISO 17025	2.2	1.3	4.9		

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10		



Analytical Report Number: 19-51952

Project / Site name: Draw Well

Lab Sample Number				1278163	1278164	1278165		
Sample Reference				WS102	WS105	WS117		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				26/07/2019	26/07/2019	26/07/2019		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0		
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0		
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		



Analytical Report Number: 19-51952

Project / Site name: Draw Well

Lab Sample Number	1278163	1278164	1278165		
Sample Reference	WS102	WS105	WS117		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	None Supplied	None Supplied	None Supplied		
Date Sampled	26/07/2019	26/07/2019	26/07/2019		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Dibenzofuran	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 19-51952

Project / Site name: Draw Well

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Low level total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 *for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Monohydric phenols in water - LOW LEVEL 1 ug/l	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	NONE
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS102		W	19-51952	1278163	c	pH at 20oC in water (automated)	L099-PL	c
WS105		W	19-51952	1278164	c	pH at 20oC in water (automated)	L099-PL	c
WS117		W	19-51952	1278165	c	pH at 20oC in water (automated)	L099-PL	c

APPENDIX VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

Draw Well Road

Phase I and Phase II Geoenvironmental Site Assessment

October 2019

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C₅-C₆ (aliphatic)	
TPH C₆-C₈ (aliphatic)	
TPH C₈-C₁₀ (aliphatic)	
TPH C₁₀-C₁₂ (aliphatic)	
TPH C₁₂-C₁₆ (aromatic)	
TPH C₁₆-C₂₁ (aromatic)	
TPH C₂₁-C₃₅ (aromatic)	



The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons criteria working group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi-volatile fractions (C₅-C₁₂) and the Tier 1 values for aromatic compound for the non-volatile fractions (C₁₂-C₃₅). The comparison of total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

CONTROLLED WATERS

* Sum of The specified compounds are benzo[b]fluoranthene (CAS 205-99-2), benzo[k]fluoranthene (CAS 207-08-9), benzo[g,h,i]perylene (CAS 191-24-2) and indeno[1,2,3-c,d]pyrene (CAS 193-39-5)

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



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



4043

Contract Number: PSL19/4096

Report Date: 25 July 2019
Client's Reference: 12-969
Client Name: E3P
Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

For the attention of: Adeel Ahmed

Contract Title: Draw Well Road
Date Received: 5/7/2019
Date Commenced: 5/7/2019
Date Completed: 25/7/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

L Knight
(Senior Technician)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

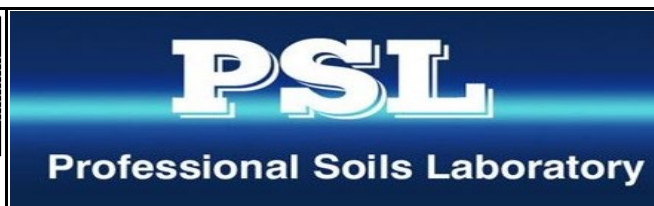
S Royle
(Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS101		D	2.00		Brown slightly gravelly very sandy CLAY.
WS102		U	1.50		Very stiff brown slightly gravelly very sandy CLAY.
WS110		D	2.00		Brown slightly gravelly very sandy CLAY.
WS112		U	1.50		Stiff brown slightly gravelly very sandy CLAY.
TP112		B	1.40		MADE GROUND grey very sandy slightly clayey silty gravel with cobbles.
WS115		D	3.00		Brown slightly gravelly very sandy CLAY.
CP102		D	1.00		Brown slightly gravelly slightly clayey silty SAND.
CP103		D	2.00		Brown slightly gravelly very sandy CLAY.
CP103		U	4.00		Stiff brown slightly gravelly very sandy CLAY.
CP104		U	4.00		Stiff brown slightly gravelly very sandy CLAY.



Draw Well Road

Contract No:
PSL19/4096
Client Ref:
12-969

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL
Professional Soils Laboratory

Draw Well Road

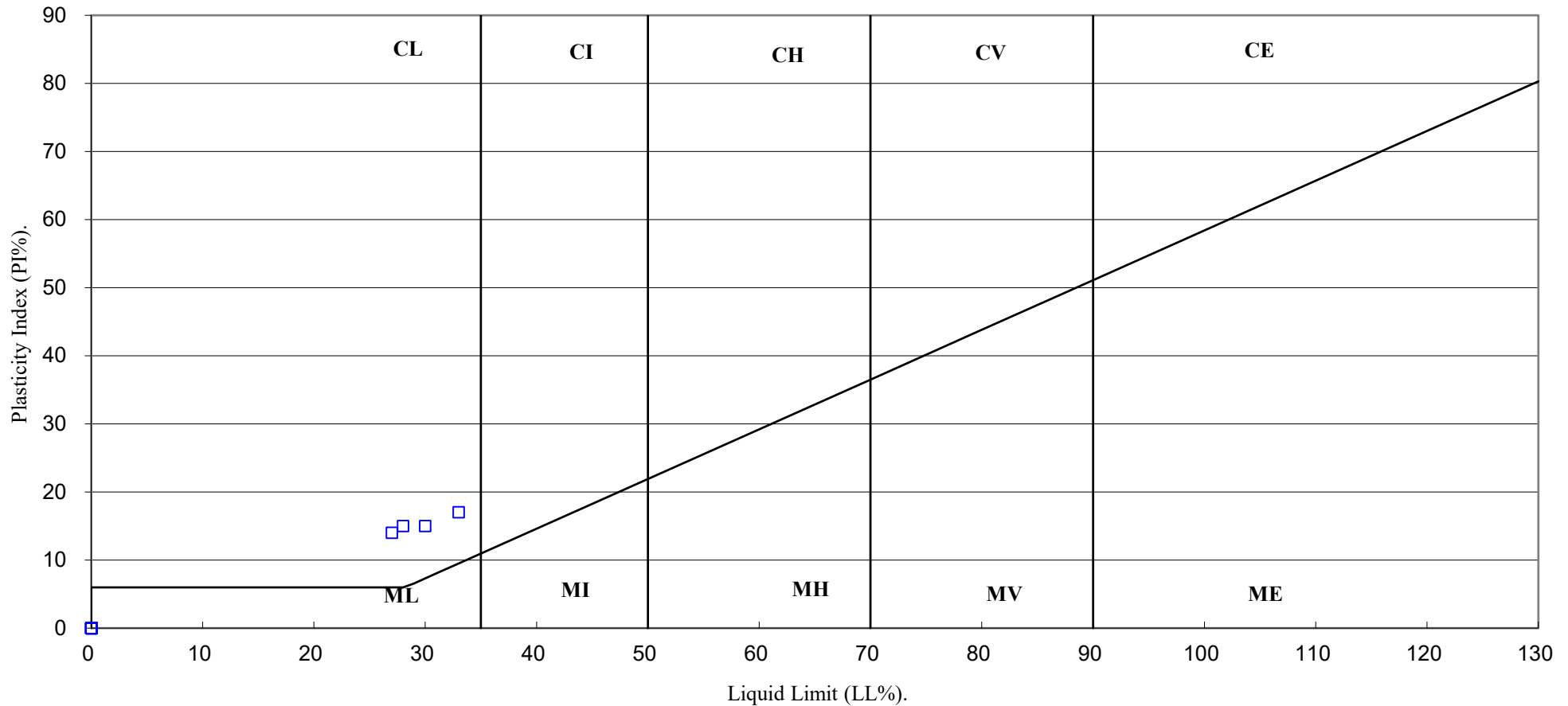
Contract No:

PSL19/4096

Client Ref:

12-969

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

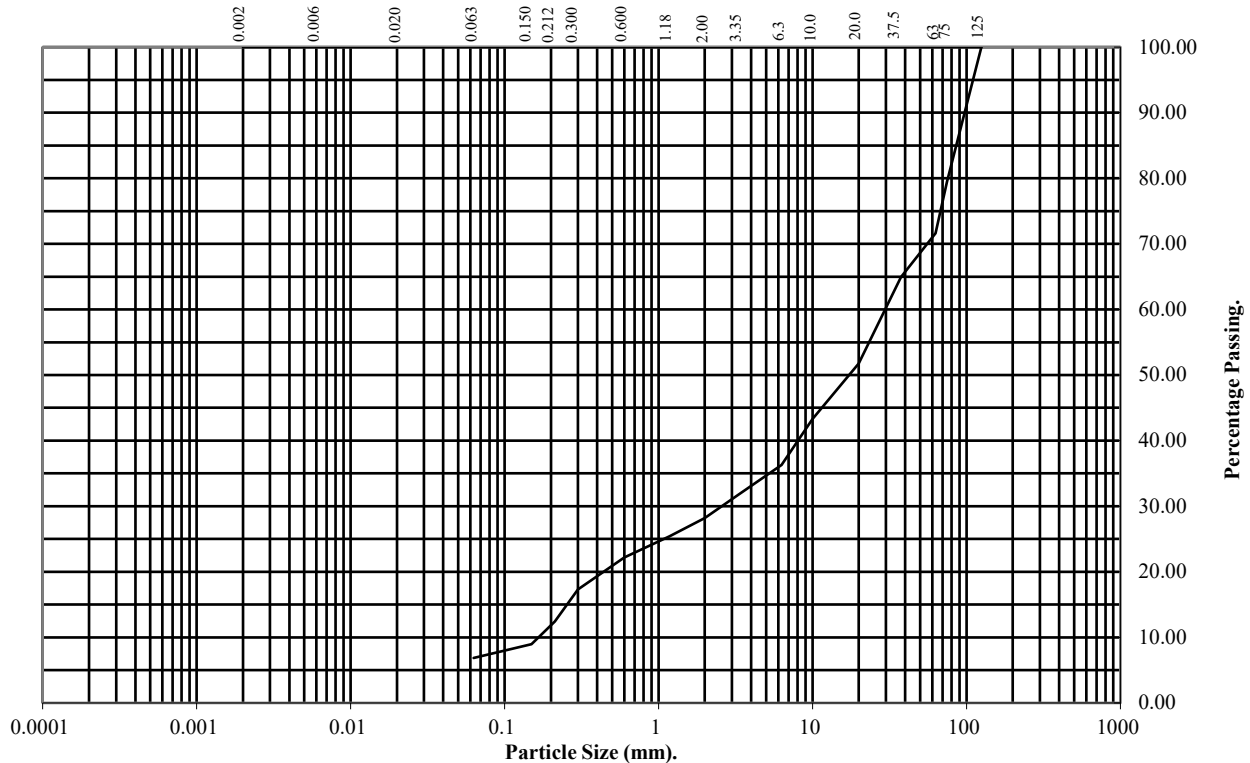
Hole Number: TP112

Top Depth (m): 1.40

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	80
63	72
37.5	65
20	52
10	43
6.3	36
3.35	32
2	28
1.18	25
0.6	22
0.3	17
0.212	12
0.15	9
0.063	7

Soil Fraction	Total Percentage
Cobbles	28
Gravel	44
Sand	21
Silt/Clay	7

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

Draw Well Road

Contract No:
PSL19/4096
Client Ref:
12-969

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : 1990

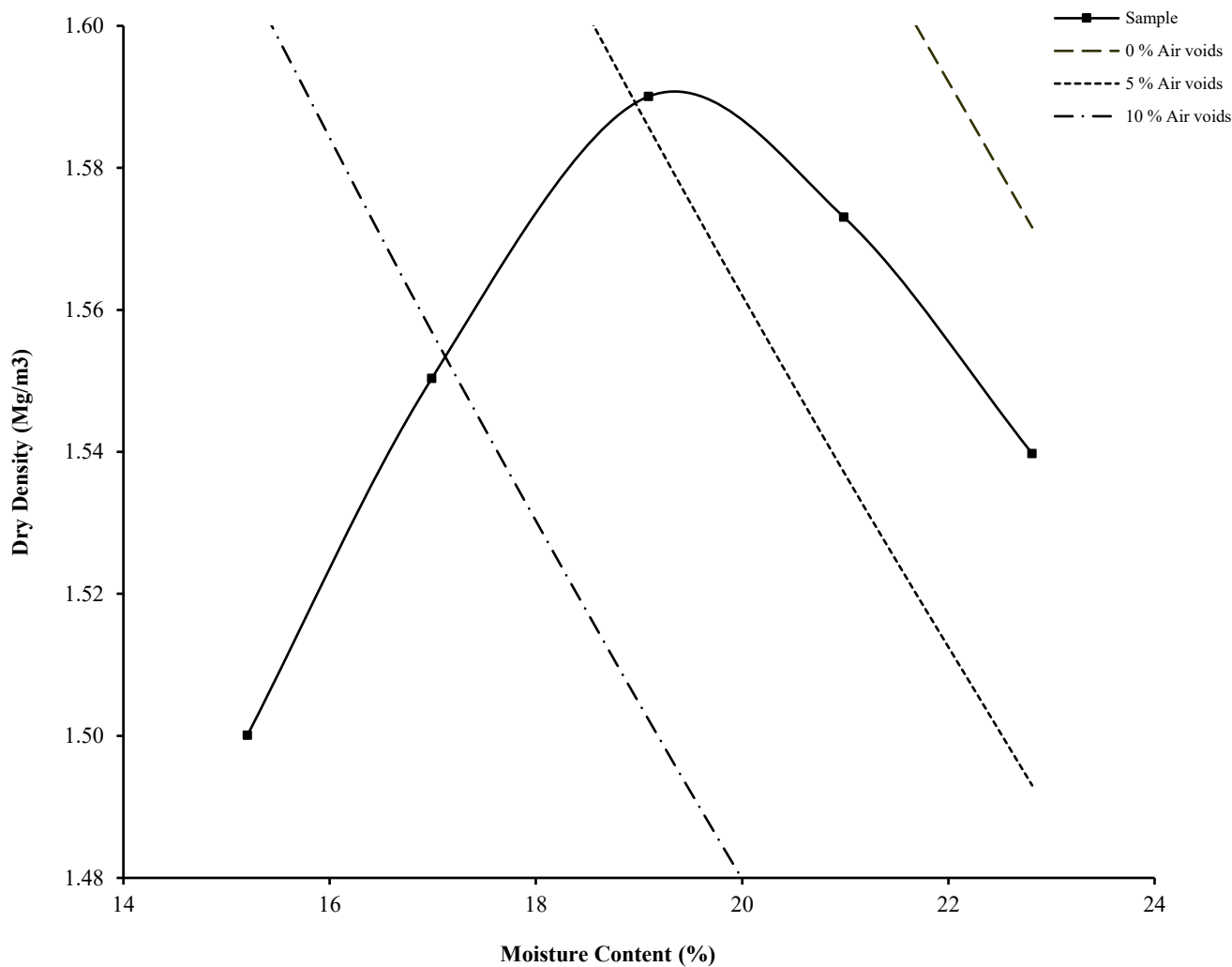
Hole Number: TP112

Top Depth (m) : 1.40

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	19	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.45	Assumed	Material Retained on 37.5 mm Test Sieve (%):	35
Maximum Dry Density (Mg/m ³):	1.59		Material Retained on 20.0 mm Test Sieve (%):	13
Optimum Moisture Content (%):	19			
Remarks				
See summary of soil descriptions.				

		Draw Well Road	Contract
			PSL19/4096
			Client Ref
			12-969

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:

CP103

Top Depth (m):

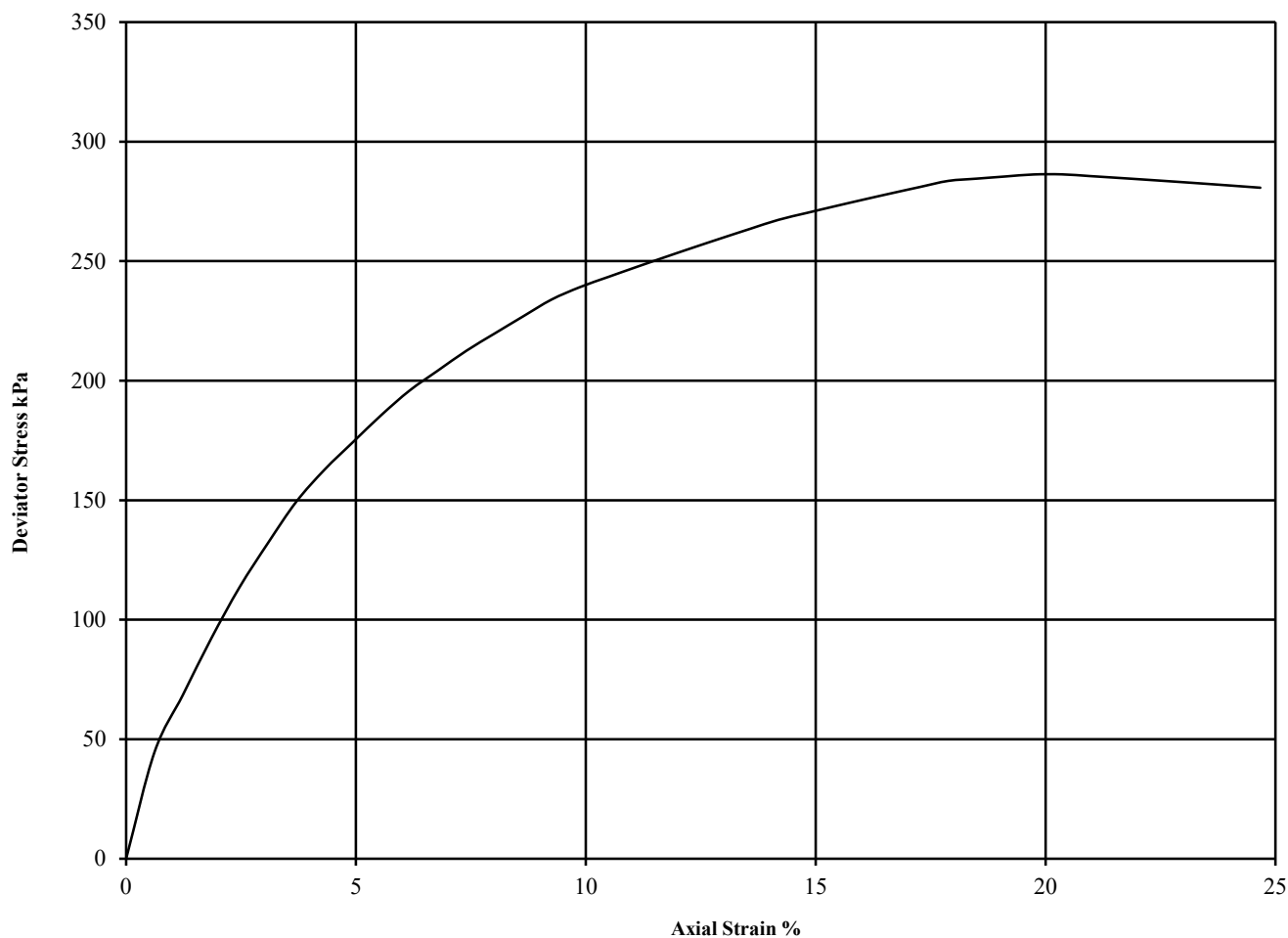
4.00

Sample Number:

Base Depth (m):

Sample Type

U



Diameter (mm):		103	Height (mm):		167	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	15	2.18	1.90	85	286	143	20.4	Plastic	



4043

PSL

Professional Soils Laboratory

Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

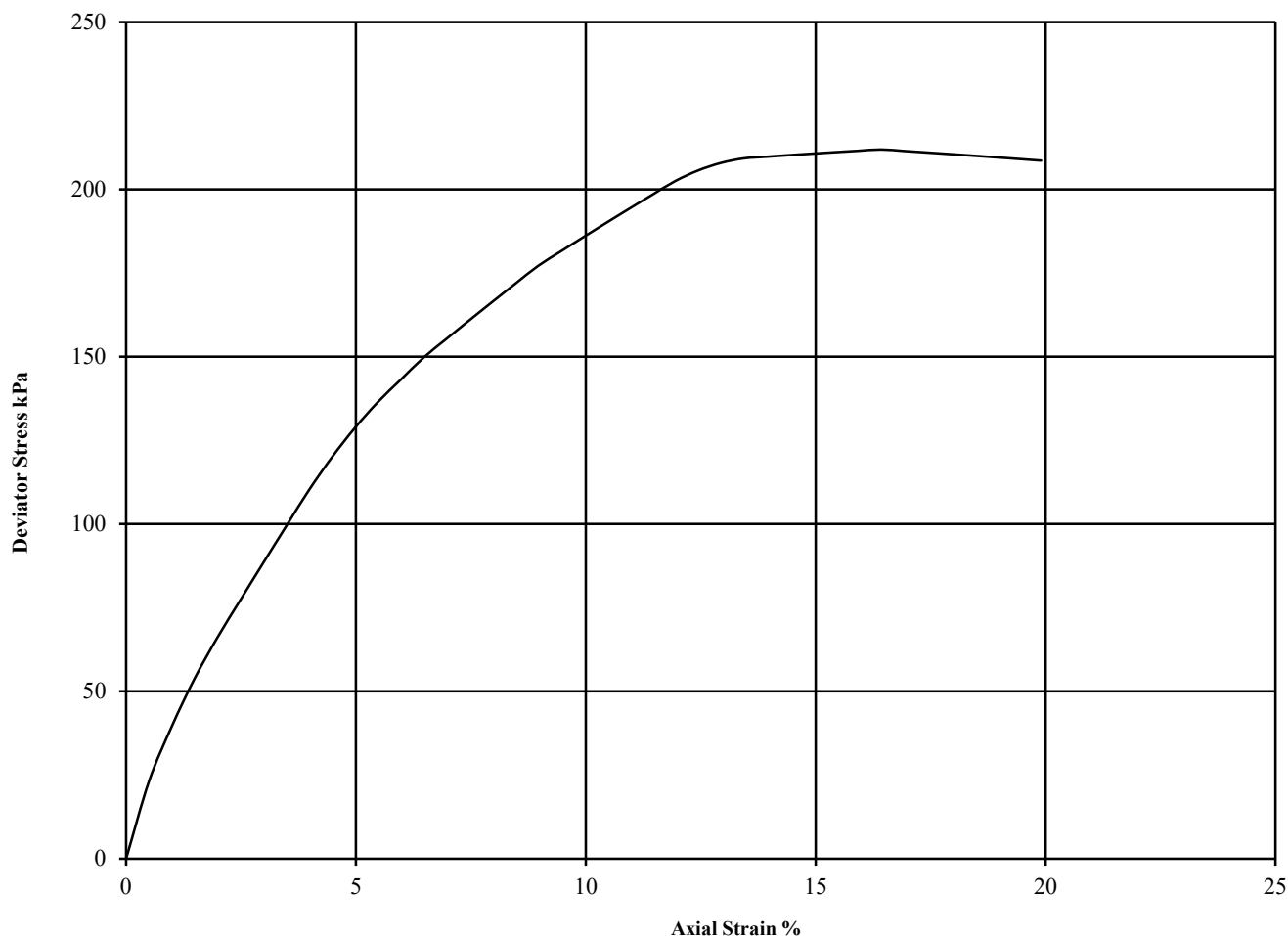
Hole Number: CP104

Top Depth (m): 4.00

Sample Number:

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Undisturbed Sample
				Pressure	Deviator	Strength			Sample taken from top of tube
				(kPa)	Stress	Cu			Rate of strain = 2 %/min
				θ_3	(kPa)	(kPa)			Latex Membrane used 0.2 mm thick,
					$(\theta_1-\theta_3)_f$	$\frac{1}{2}(\theta_1-\theta_3)_f$			Correction applied 0.34
1	17	2.17	1.86	85	212	106	16.4	Plastic	See summary of soil descriptions



4043

PSL

Professional Soils Laboratory

Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:

WS102

Top Depth (m):

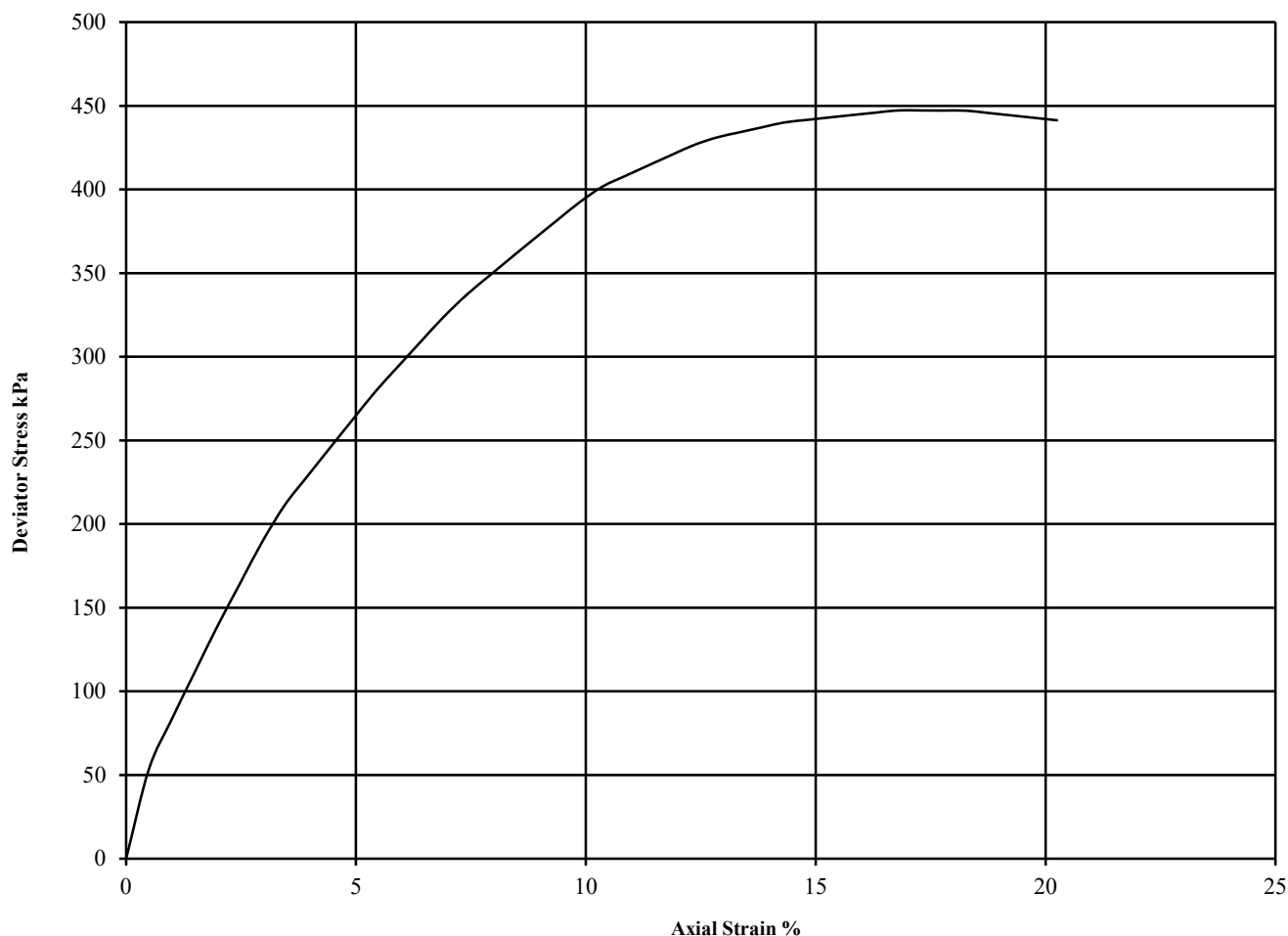
1.50

Sample Number:

Base Depth (m):

Sample Type

U



Diameter (mm):		81	Height (mm):		164	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample
				θ_3	$(\theta_1-\theta_3)_f$	$^{1/2}(\theta_1-\theta_3)_f$			Sample taken from top of tube
									Rate of strain = 2 %/min
									Latex Membrane used 0.2 mm thick, Correction applied 0.42
1	13	2.35	2.07	35	447	224	16.8	Plastic	See summary of soil descriptions



4043

PSL

Professional Soils Laboratory

Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number:

WS112

Top Depth (m):

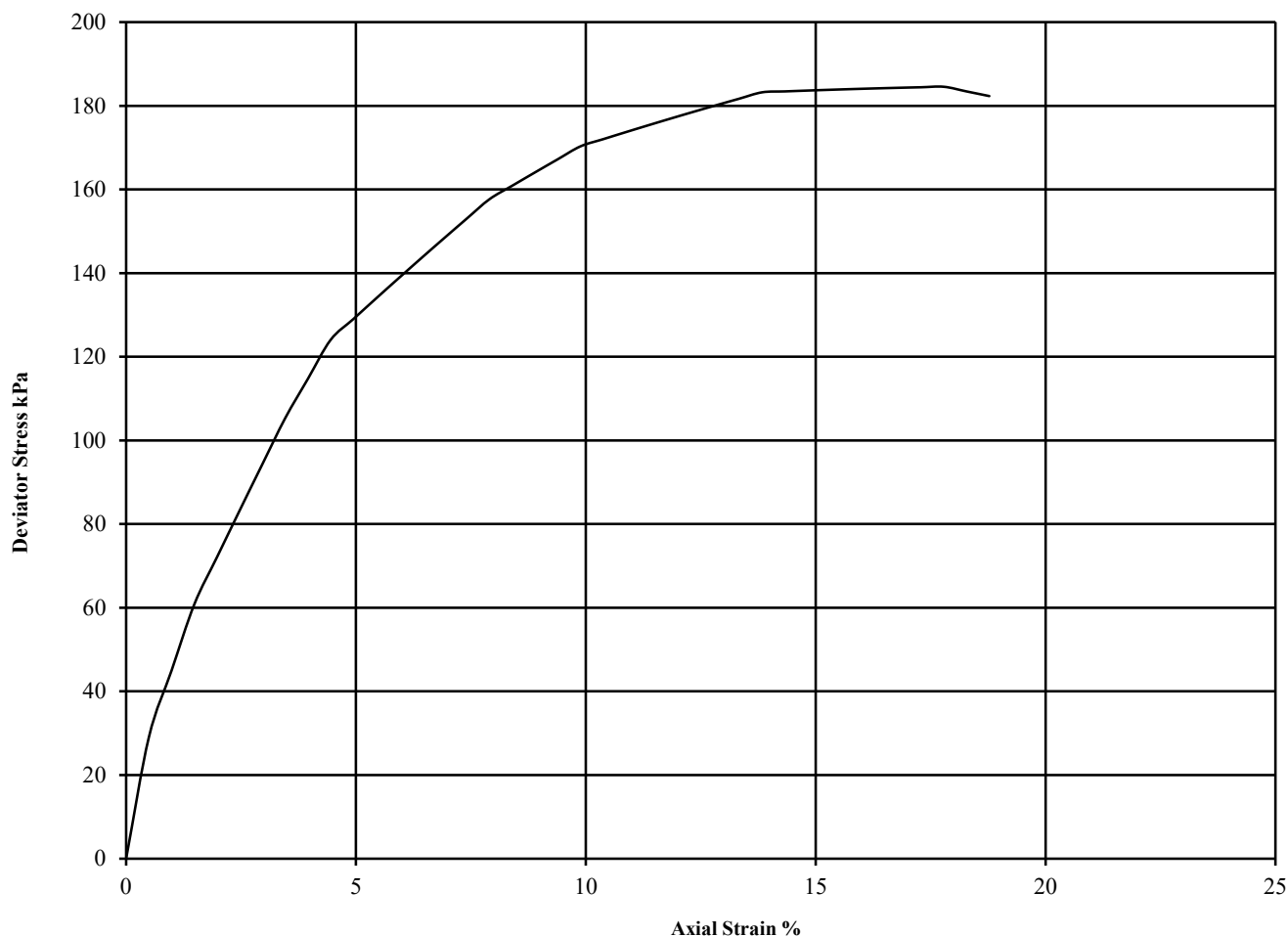
1.50

Sample Number:

Base Depth (m):

Sample Type

U



Diameter (mm):		84	Height (mm):		170	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Undisturbed Sample
				Pressure	Deviator	Strength			Sample taken from top of tube
				(kPa)	Stress	Cu			Rate of strain = 2 %/min
					(kPa)	(kPa)			Latex Membrane used 0.2 mm thick,
				θ_3	$(\theta_1-\theta_3)_f$	$^{1/2}(\theta_1-\theta_3)_f$			Correction applied 0.40
1	16	2.23	1.93	35	185	92	17.8	Plastic	See summary of soil descriptions



4043

PSL

Professional Soils Laboratory

Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP103

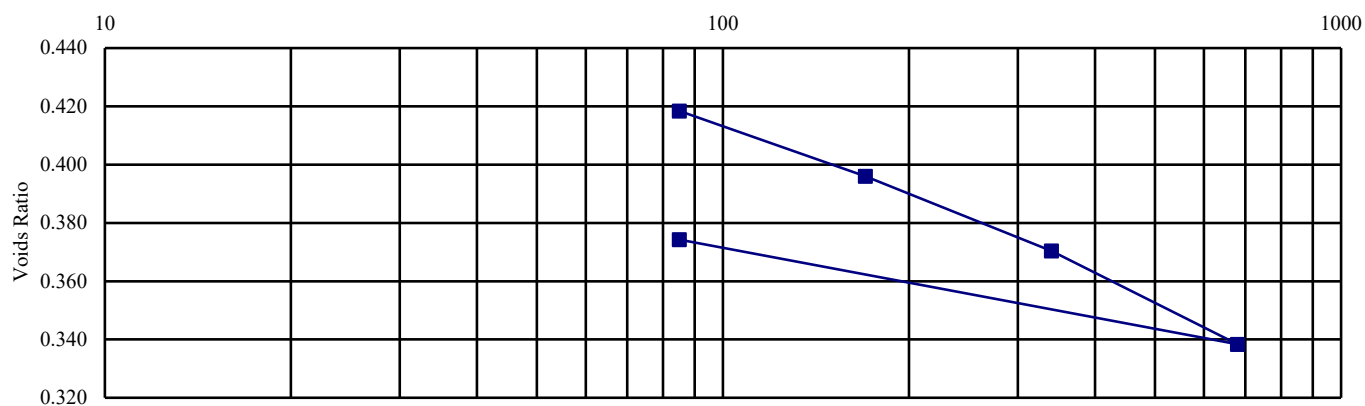
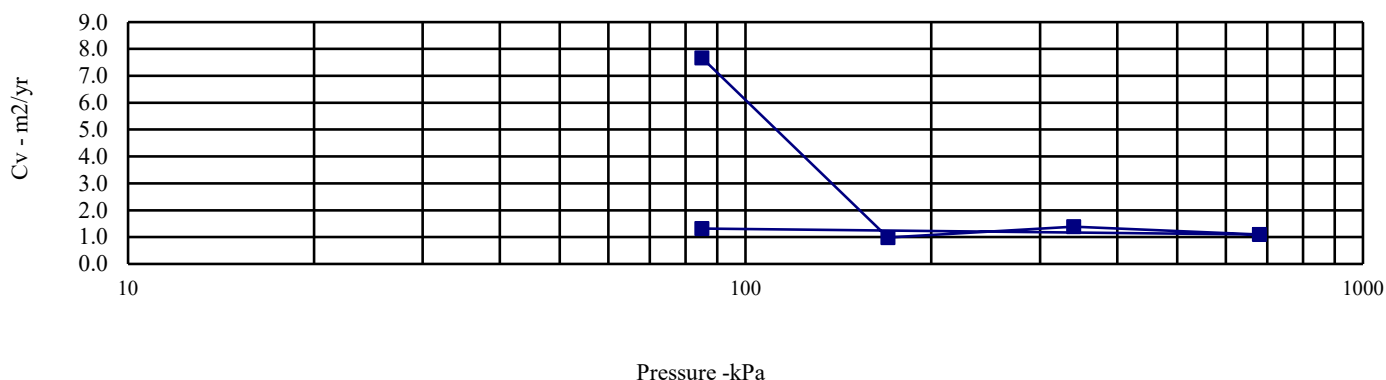
Top Depth (m): 4.00

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	16	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.12	0	85	0.220	7.671	Method used to	
Dry Density (Mg/m3):	1.83	85	170	0.186	0.985	determine CV:	T90
Voids Ratio:	0.445	170	340	0.108	1.384	Nominal temperature	
Degree of saturation:	92.4	340	680	0.069	1.098	during test ' C:	20
Height (mm):	20.15	680	85	0.045	1.317	Remarks:	See summary of soil descriptions
Diameter (mm)	74.938						
Particle Density (Mg/m3):	2.65						
Assumed							



Draw Well Road

Contract No:

PSL19/4096

Client Ref:

12-969

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: WS102

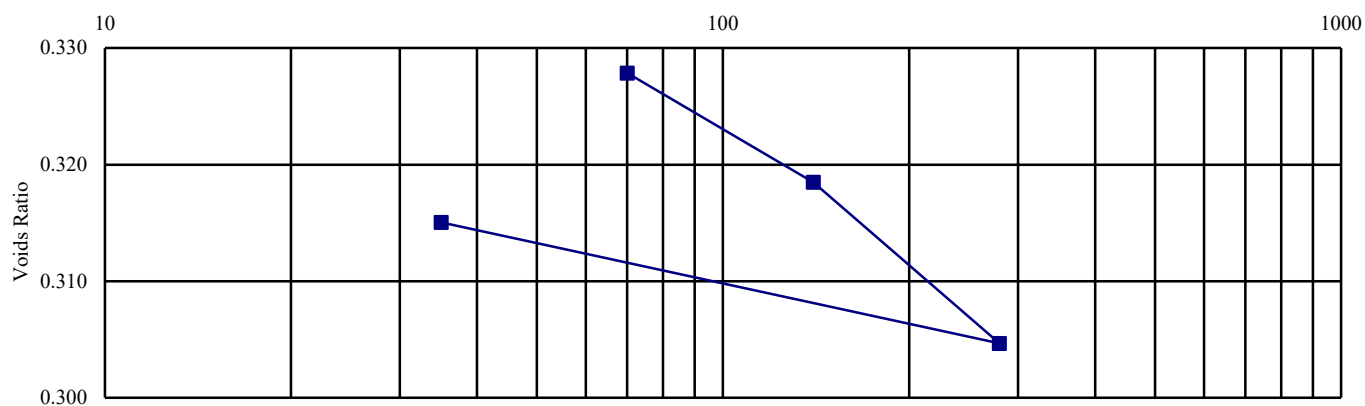
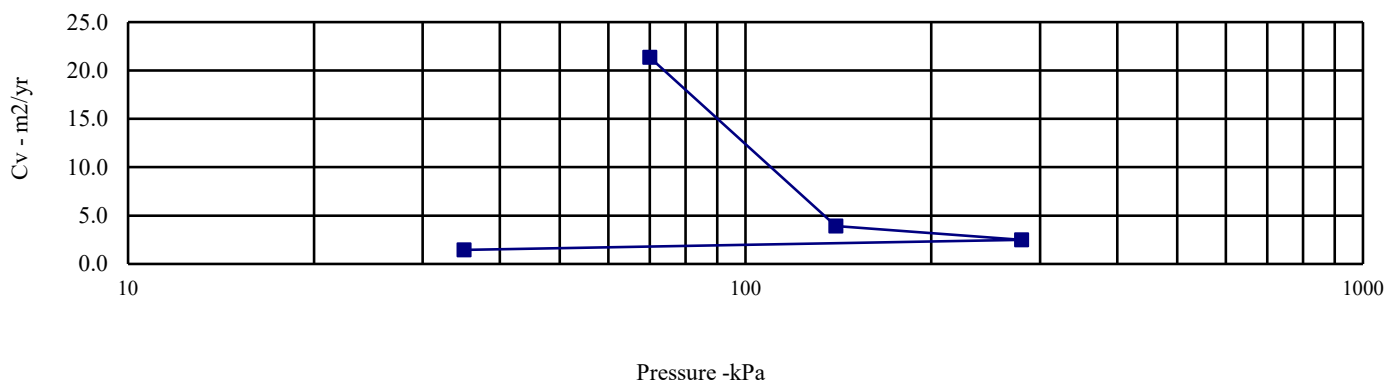
Top Depth (m): 1.50

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	13	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.24	0	35	Swelling	Swelling	Method used to	
Dry Density (Mg/m3):	1.99	35	70	0.044	21.353	determine CV:	T90
Voids Ratio:	0.330	70	140	0.101	3.933	Nominal temperature	
Degree of saturation:	100.9	140	280	0.075	2.488	during test ' C:	20
Height (mm):	20.014	280	35	0.032	1.453	Remarks:	
Diameter (mm)	74.923					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Draw Well Road

Contract No:
PSL19/4096
Client Ref:
12-969