Shepway District Council

Proposed Leisure Centre and Mixed-Use Development at Princes Parade Hythe

Environmental Statement

Technical Annex 5

Geo-Environment

August 2017

Peter Radmall Associates
environmental planning and assessment

GEO-ENVIRONMENTAL ASSESSMENT
PRINCES PARADE
HYTHE, KENT
SHEPWAY DISTRICT COUNCIL
GEA-17436AI-15-193
MAY 2017

idom merebrook

AN idom GROUP COMPANY

GEO-ENVIRONMENTAL ASSESSMENT
PRINCES PARADE
HYTHE, KENT
SHEPWAY DISTRICT COUNCIL
GEA-17436AI-15-193
MAY 2017

Current Document Details

Authors

Gareth O'Brien
Chris McCartney
Darren Ettritch

Issued by

[redacted]

.....

C McCartney

Approved by

[redacted]

.....

K Paramor

Document Revisions

Rev	Date	Author	Checked	Approved
B	16/10/15	CJM	KRP	RJG
C	03/11/16	NTD	SMJ	SMJ
D	08/03/17	NTD	RJG	RJG
E	25/05/17	NTD	RJG	RJG

Report issued from

KENT 1 Leonard Place, Westerham Road, Keston. BR2 6HQ Tel: 01689 889 980

TABLE OF CONTENTS

APPENDIX 2 .....

- Historic Plans

APPENDIX 3 .....

- Exploratory Hole Logs
- BGS Borehole Logs

APPENDIX 4 .....

- Soil Chemistry
- Summary Spreadsheet
- Laboratory Analysis Certificates

APPENDIX 5 .....

- Field Monitoring Records
- Groundwater Level Data
- Hazardous Soil Gas Data

APPENDIX 6 .....

- Previous Investigations
- Ground Solutions Group Limited – Phase 1 Report (ref: 44518_1/OJR)
- Ground Solutions Group Limited – Phase 2 Geo-Environmental Investigation (ref: 44518/1/OJR)

EXECUTIVE SUMMARY

A Geo-Environmental Assessment was requested by Shepway District Council. The purpose of the assessment was to identify any contaminative or geotechnical issues associated with former land use at *Princes Parade, Hythe, Kent* which might impact on the site's redevelopment.

SITE DETAILS	
Approximate site area	7.5 ha
Current/previous use	Overgrown disused council-owned land, formerly an inert landfill
Proposed use	Development options comprise either a leisure centre or housing scenarios.

PHASE 1 NON-INTRUSIVE INVESTIGATION	
Expected geology	Made ground / Storm Beach Deposits / Tidal Flat Deposits to the north / Weald Clay Formation.
Groundwater	Secondary 'A' Aquifer within the superficial strata. Not located within a Source Protection Zone.
Surface water	Surface water receptors in vicinity / abstractions / flooding.

PHASE 2 EXPLORATORY INVESTIGATION	
Contamination	Contamination comprising metals, PAH, TPH and asbestos was encountered in made ground. PAH contamination in natural stratum immediately below made ground was encountered, consistent to overlying made ground.

RECOMMENDATIONS	
Geotechnical	Geotechnical recommendations comprised foundation solutions such as ground improvement (vibro stone / concrete columns) or a piled solution to be considered. Due to variable thicknesses of made ground it is recommended suspended floor slabs should be adopted.
Remediation	Made ground removal should be undertaken in any proposed private garden areas to a depth of 600 mm below finished levels, and replaced by validated clean cover. This can be reduced to 450 mm in areas of soft landscaping.

SECTION 1 INTRODUCTION

1.1 Shepway District Council (SDC) proposes to develop an area of land located at Princes Parade, Hythe for mixed-use development purposes. A Cabinet Report, dated January 2014, provided by SDC indicates various development options. Development options discussed comprise a swimming pool and leisure facility with associated car parking and soft landscaping. Two housing scenario options are also referenced. Scenario 1 comprises 12 single storey low-rise homes and scenario 2 comprises 36 town-homes. Idom Merebrook Limited (Merebrook) has been commissioned by SDC to undertake preliminary site investigation works and to advise on the geo-environmental implications of the redevelopment of the site for the proposed end use.

1.2 The objectives of the investigation are to:

i. Assess surface and sub-surface ground conditions present at the site;

ii. Identify hazards associated with ground contamination which may place constraints on the site and the proposed development;

iii. Evaluate the risks associated with any identified hazards;

iv. Provide preliminary recommendations for the mitigation of any significant risks identified; and

v. Provide preliminary geotechnical recommendations.

1.3 A Phase 1 (Non-intrusive Investigation) and a Phase 2a (Preliminary Exploratory Investigation) have been undertaken for the subject site.

1.4 This report presents the findings of the geo-environmental investigation and provides an interpretation of the geo-environmental conditions that exist at the site. The contaminative status of the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment. This report uses a Tier 1 risk assessment to ascribe a conservative qualitative appraisal of the hazards associated with the site.

1.5 This report has been prepared for Shepway District Council for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Shepway District Council and Merebrook as to the extent to which the findings may be appropriate for their use

SECTION 2 PHASE 1 (NON-INTRUSIVE INVESTIGATION)

2.1 INTRODUCTION

2.1.1 The non-intrusive investigation has been conducted with reference to the documents and sources detailed in Table 1 below:

Table 1: Published Data and Information Sources

SOURCE DATA	GROUNDSURE DATA
BGS 1:50,000 Series Geological Sheet 305	Ordnance Survey (OS) historical maps scaled at 1:10,560, 1:10,000, 1:2,500 and 1:1,250 dated 1872 - 2014
BGS Geology of Britain 1:50,000 online maps	Water abstraction, discharge and pollution data
Radon: guidance on protection measures for new dwellings	Registered waste management sites
Environment Agency (EA) online data maps	Mining records and natural ground stability data
UK National Air Quality Archive, online	Protected areas of environmentally sensitive land use or conservation
Planning Records	Other relevant designations and/or authorisations and Trade Directory entries

2.1.2 The above sources are all authoritative and it is believed that they are reasonably reliable. However, independent verification of the information supplied has not necessarily been carried out and Merebrook cannot be held liable for inaccuracies or deficiencies in the information.

2.2 SITE LOCATION AND SETTING

2.2.1 The site is located to the north of Princes Parade, Hythe, CT21 5QT.

2.2.2 The site occupies an area of approximately 7.5 hectares located at National Grid Reference 618523, 134832 and indicated on drawing 17436ai-304-001, presented in Appendix 1 of this report.

2.2.3 The site is bounded by the Royal Military Canal to the north, residential flats (under construction) to the east, Princes Parade Road and the beach to the south and a golf course to the west.

2.2.4 The majority of the site is disused. The site is an overgrown former inert landfill with much of the site comprising rough grass, weeds, scrubland and trees. A gated entrance onto the site is located in the southwestern corner with historical hardstanding noted in this area. The eastern portion of the site is developed with Seapoint Canoe Centre, playground and picnic area identified. A pathway was

identified north of Princes Parade through the central portion of the site and across the canal. A pathway encircles the western, northern and eastern perimeter of the site. No invasive species were noted during the site walkover, however, sporadic littering was noted on the site.

2.2.5 The elevation of the site is generally low-lying, ranging from 2.5 metres above Ordnance Datum (m AOD) to 5.0 m AOD.

2.3 SITE HISTORY

2.3.1 The site history, based on a review of the historic and current maps, dating from 1872 to 2014 is summarised below. Potentially contaminative land uses are shown in bold. Copies of key maps used in this review are provided in Appendix 2.

Table 2: Summary of the key features shown on historic maps

DATA SOURCE	SITE / SURROUNDINGS
1872 (1:10,560 scale).	The site was identified as undeveloped. A footpath was located in close proximity to the northern boundary.
	A station house was identified in close proximity to the eastern boundary while the **Royal Military Canal** was illustrated along the northern boundary of the site. The village of Seabrook was illustrated 75 m to the northeast. A **gas works** was noted 50 m to the northeast, while a **waterworks** was identified 260 m to the north. The Royal Military Road was noted 100 m to the northwest.
1897 (1: 10,560 scale).	Vegetation and a central pathway were noted on the site.
	Further residential development was noted in the village of Seabrook, while the gasworks was no longer identified. The **Hythe and Sandgate rail tracks** were developed 250 – 200 m to the north, with **Sandgate Station** 200 m to the northeast. A **gravel pit** was noted 50 m to the north. A **police station** was identified 60 m to the east while a **hospital** was developed 500 m to the east. Two **old quarries** were noted 250 m to the north and 400 m to the northwest.
1945 –1946 (1: 10,560 scale).	The central portion of the site was identified as a recreational ground.
	The railway tracks 200 m to the north of the site were removed. There was further residential development to the north of the site in Seabrook.
1961(1:10,560 scale).	A drain was identified along the northern portion of the western part of the site. An entrance into the site was constructed in the southwestern portion of the site with a slope also noted indicating that the site was being used.
	A large residential development was constructed 250 m to the north.
1973-75 (1:10,560	No significant changes identified to the site.
	A depot was constructed 200 m to the northwest of the site

DATA SOURCE	SITE / SURROUNDINGS
scale).	while a hospital was developed 250 m to the northwest of the site. Several buildings were developed along the former location of the railway tracks.
1987-89 (1:10,000 scale).	No significant changes to the site identified.
	No significant changes to the surrounding land uses.
2010 & 2014 (1:10,000 scale)	A car park was constructed in the eastern portion of the site.
	The site adjacent to the western boundary was identified as part of the golf course.

2.3.2 In summary, historic plans show that the majority of the site was undeveloped. A track and entrance onto the site was identified in 1963 which would indicate the presence of some site activity. A carpark was developed in the eastern portion of the site prior to 2010.

2.3.3 The historic maps indicate the presence of potentially significant contaminative land uses within 250 m of the site. These include:

i. An historic gasworks 50 m north of the site;

ii. The Royal Military Canal (possible presence of UXOs); and

iii. The historic rail tracks and associated station 200 – 250 m to the north / northwest.

2.3.4 Given the nature of the historical mapping process (scale, representation of conditions at discrete time intervals frequency etc.), any such maps and plans may not provide a comprehensive account of a site's history. Identification of pertinent land uses and associated potentially contaminative activities, may therefore be absent from mapping records.

2.4 GEOLOGY

2.4.1 The published geological map indicates the presence of superficial drift deposits of Storm Beach Deposits comprising gravel underlying the majority of the site. Tidal Flat Deposits comprising clay and silt are likely to underlie the northern portion of the site.

2.4.2 The underlying bedrock geology comprises clay and mudstone of the Weald Clay Formation.

2.4.3 The closest relevant British Geological Survey (BGS) historical borehole is a shallow 4.0 m borehole located 50 m to the northeast of the site (BGS Ref: TR13SE23). Topsoil was encountered to approximately 0.4 m bgl, with gravel encountered to 2.8 m bgl. This was underlain by silty sandy clay.

2.4.4 The Groundsure report did not make any reference to made ground, however, the report indicated that an historic landfill was located on the site.

2.5 HYDROGEOLOGY

2.5.1 The superficial geology underlying the site is classified by the Environmental Agency (EA) as a Secondary 'A' Aquifer. This indicates that the aquifer has permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

2.5.2 The underlying Weald Clay Formation is classified by the EA as Unproductive Stratum.

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

2.5.4 According the Groundsure Report, there are four groundwater abstraction licences within one kilometre of the site. All four licences are related to potable water abstraction with the closest licence associated with Veolia and located 199 m to the north of the site. Additional Veolia licences are located 276 and 761 m to the north, while another licence is relating to Hotel Imperial and is located 847 m to the west.

2.6 HYDROLOGY

2.6.1 The closest surface water feature is the Royal Military Canal located three metres to the north of the site. A culverted watercourse flows into the central portion of the canal, while a tertiary river flows into the western portion of the canal. This canal flows in an eastern direction along the boundary of the site, before flowing into the Hythe Bay 50 m to the south.

2.6.2 There are no surface water abstractions within one kilometre of the site.

2.6.3 According the EA's Risk of Flooding from Rivers and Seas (RoFRaS), the site is located in an area at risk from flooding. The majority of the northern and eastern portion of the site is identified as having a medium to high RoFRaS risk. The surrounding areas are also identified as having a high RoFRaS risk from flooding.

2.6.4 The site is not located in an area benefitting from flood defences.

2.6.5 According to the Groundsure Report, the site is located within an area of susceptible to groundwater flooding (superficial deposits flooding). This is due to the shallow unconsolidated sedimentary aquifer which overlies an unproductive aquifer.

2.7 CURRENT SITE ISSUES

2.7.1 Potentially significant environmental issues have been investigated within relevant distances of the site, based on the database of records supplied by Groundsure. These relate to the following searches:

i. Water discharge or pollution incidents within 250 m of the site;

ii. Waste management sites within 250 m of the site;

iii. Statutory authorisations within 50 m of the site;

iv. Trade directory entries of possible contaminative use within 50 m of the site;

v. Special protection or conservation areas within 50 m of the site; and

vi. Any other relevant issues.

2.7.2 Potentially significant environmental issues identified by the above searches are summarised in Table 3 below.

Table 3: Potentially significant environmental issues

ENVIRONMENTAL CATEGORY	DESCRIPTION
Water discharge or pollution incidents within 250 m	There is one current and three revoked discharge consents relating to one sewer storm overflow located 16 m to the southeast. One historic pollution incident was identified on the site. This was related to crude sewage on site with no significant impact identified. One unspecified pollution incident was identified 24 m to the northeast, with no significant impact identified.
Waste management sites within 250 m	The site was identified as an historic EA landfill (reference SH6) receiving both inert and commercial waste between December 1946 – December 1974.
Statutory authorisations within 50 m	There are no statutory authorisations within 50 m of the site.
Trade directory entries of possible contaminative use within 50 m	There are no potentially contaminative land uses within a 50 m radius of the site. An electricity substation was, however, identified 60 m to the northeast while a service station was noted 110 m to the northeast.
Special protection or conservation areas within 50 m	Hythe Bay located 50 m to the south which is a marine conservation zone.

2.8 INDICATIVE GROUND STABILITY HAZARDS

2.8.1 The site has been classified by the BGS as having a negligible to low risk from clay shrink swells, landslides, soluble rocks and collapsible ground. A moderate to high risk has been identified for compressible deposits and running sand in the northern portion of the site.

2.8.2 The Groundsure Report has indicated that rare localised small-scale iron ore mining may have occurred on the site.

2.9 RADON GAS

2.9.1 The site does not lie within a Radon Affected Area as defined by the Health Protection Agency (1% of houses are above the action level) and therefore no radon protective measures are required.

2.10 AIR QUALITY

2.10.1 The site does not lie within a designated Air Quality Management Area (AQMA) for the Shepway Local Authority.

2.11 ECOLOGY

2.11.1 Information from environmental and ecological datasets was obtained from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website and the Groundsure report. The data assessed indicates that several environmentally sensitive features are located within one kilometre of the site. This includes Hythe Bay located 50 m to the south which is a marine conservation zone. The Royal Military Canal to the north is identified as a scheduled monument, while deciduous woodlands were located 150 m to the northeast and 300 m to the northwest of the site.

2.11.2 The data also indicates that species of grey partridges and redshank have been recorded in close proximity to the site.

2.11.3 Information provided by Shepway District Council has indicated the presence of badger setts on the site.

2.12 PREVIOUS INVESTIGATIONS

2.12.1 A Phase 1 Assessment was undertaken by Ground Solutions Group Limited (GSG) in 2002 on behalf of Shepway District Council (Report ref: 44518_1/OJR). This report included a soil spike survey undertaken across the site.

2.12.2 The survey returned concentrations of methane (CH_4) below the instruments detection limit (<0.25 %v/v) with carbon dioxide (CO_2) was detected to a maximum of 7.0 % v/v. Thirty-seven locations recorded CO_2 between 1.5 to 5.0 v/v, with only five location recording concentrations greater than 5 % v/v.

2.12.3 Ground Solutions Group Limited (GSG) completed a Phase 2 Geo-Environmental Investigation – Princes Parade (44518/1/OJR) in October 2002. The investigation is summarised below:

2.12.4 Three boreholes to 7.5 m, thirty trial pits to depths between 3.3 and 5.0 m (including ten monitoring standpipes) and ten static cone penetration tests.

2.12.5 Evidence of contamination was noted in all trial pits, consistent with household refuse. In addition to the household waste, sterile unused stomach tubes were noted at one location. Landfill odours were encountered at four locations and a slight hydrocarbon odour was encountered at a further location.

2.12.6 One hundred and seventy three samples were recovered and sent to a laboratory for chemical testing. Arsenic, nickel, lead, boron, copper and sporadic PAH exceeded the applicable residential criteria (with plant uptake) in samples recovered from the top 5.0 m bgl. A suspected asbestos containing pipe encountered at 2.1 m bgl was found to contain chrysotile asbestos.

2.12.7 Leachate analysis carried out on some of the recovered soil samples encountered exceedances of applicable screening criteria for metals (lead, copper, cadmium, chromium, zinc and arsenic), PAH and TPH. Groundwater samples recovered from the three boreholes didn't encountered significant contamination. Groundwater levels in the boreholes ranged from 5.14 to 6.47 m bgl.

2.12.8 Further gas monitoring was carried out in thirteen piezometers and three boreholes during 15 August 2002. Concentrations of carbon dioxide exceeded 5% v/v in five locations, elevated methane was encountered at three locations (up to 60% v/v). Concentrations of volatile hydrocarbons were generally low across the site and ranged from less than 1 ppm to15.6 ppm.

2.12.9 Copies of both reports are contained in Appendix 6.

2.13 PRELIMINARY CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

2.13.1 From the Phase 1 assessment a preliminary site conceptual model and risk assessment have been produced using the framework established in Part IIA of the *Environmental Protection Act 1990* and detailed in Contaminated Land Report *CLR11 - Model Procedures for the Management of Land Contamination.*

2.13.2 Risk from contamination has been assessed using the source-pathway-receptor and pollutant linkage methodology, whereby a risk can only exist if all elements of: source, pathway and receptor, are present.

2.13.3 Potential Sources

i. Elevated concentrations of metals, PAH and TPH from the historic infilling across the site and the potential for associated soil gas / vapour generation;

ii. Soil and groundwater contamination associated with the site's former use as a landfill;

iii. Asbestos containing material (ACM) within the fill material imported to the site;

iv. Soil and groundwater contamination associated with historic off-site sources which includes the Royal Military Canal three metres to the north, within potential risk from UXO's and the historic gas works located 50 m to the north.

2.13.4 Potential Pathways

i. Direct contact;

ii. Ingestion and inhalation of contaminated soil and dust;

iii. Vertical migration to the underlying Secondary Aquifer to the south of the site;

iv. Vertical and horizontal migration to off-site surface water receptors; and

v. Accumulation of ground gas vapour ingress into buildings and voids.

2.13.5 Potential Receptors

i. The general public and current site users;

ii. Residents of future development;

iii. Construction workers;

iv. Groundwater in underlying Secondary Aquifer; and

v. Off-site surface water receptor the Royal Military Canal located to the north of the site and Hythe Bay 50 m to the south.

2.13.6 Pollutant Linkages and Risk Ratings

2.13.6.1 From the Phase 1 assessment a preliminary site conceptual model has been produced as Table 4 which identifies the potential pollutant linkages. These have been used to inform the Phase 2 intrusive investigation presented in the subsequent sections.

Table 4: Preliminary Conceptual Model

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	**PATHWAYS**	**RECEPTORS**	
Heavy metals and hydrocarbons (made ground and landfill material)	Contact with contaminated soil	Human health (current users)	**Moderate risk identified** Potential for made ground and landfill material which can contain elevated metals and hydrocarbons.
	Ingestion and inhalation of contaminated soil and dust	Human health (current users)	
Heavy metals and hydrocarbons (made ground and landfill material)	Contact with contaminated soil	Human health (future residents and construction workers)	**Moderate risk identified** Potential for made ground and landfill material which can contain elevated metals and hydrocarbons.
	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	
Asbestos (made ground and landfill material)	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	**Moderate risk** Potential for made ground and landfill material to contain asbestos.
Contamination (all forms)	Vertical migration to aquifer	Controlled waters	**Moderate risk identified** Potential for contamination to affect shallow gravel aquifer south of the site.
Contamination (all forms)	Horizontal migration to surface water	Controlled waters	**Moderate risk identified** Royal Military Canal located to the north of the site.
Hydrocarbons	Direct contact	Plastic water pipes	**Moderate risk identified** Cannot rule out presence of hydrocarbon contamination at this stage.
Hazardous Gas/Vapours In soil	Ingress into buildings and voids	Human health (future residents and construction workers)	**Moderate risk identified** Potential for made ground and landfill material which could act as source of hazardous gas. Cannot rule out fuel spillages as source of vapours

SECTION 3 SITE INVESTIGATION RATIONALE

3.1.1 A site investigation rationale has been devised in accordance with the findings of the Phase 1 investigation and the resultant preliminary conceptual site model and risk assessment. Priority contaminants were identified as heavy metals, hydrocarbons, PAHs and asbestos.

3.1.2 Intrusive sampling locations were chosen on the basis of providing broad spatial coverage of the site while also targeting the areas of suspected landfill material.

3.1.3 It should be noted that intrusive locations were limited due access restrictions and ecological considerations. This included the steep slopes and bund surrounding the site, dense vegetation and the presence of nesting birds and possible badger setts identified in the northwestern and southeastern portion of the site.

3.2 SITE INVESTIGATION METHODS

3.2.1 An intrusive investigation was carried out by Merebrook from 17 to 18 June 2015 and comprised the following scope of work:

i. Seven shallow windowless sample probe holes (MW1 to MWS7) to a maximum depth of 5.45 m bgl; and

ii. Five machine-dug trial holes (MTP1 to MTP5) to a maximum depth of 3.0 m bgl.

3.2.2 Exploratory hole locations are indicated on drawing 17436ai-304-001 in Appendix 1. Logging of exploratory holes was undertaken by a Merebrook Officer. Exploratory hole logs are contained in Appendix 3.

3.2.3 All intrusive locations were assessed by a representative from Ordtek due to the proximity to the Royal Military canal and the risk from potential unexploded ordnance (UXO). Additionally, a representative from Middlemarch Environmental supervised the site works due to the sensitive ecological receptors identified on site.

3.2.4 A tracked windowless sampling rig was used to advance MWS1 to MWS7. This comprised a rig-mounted drop hammer to drive a hollow steel barrel into the ground. The barrel is recovered along with a removable plastic sleeve, which lines the barrel and holds a core of soil which is retracted for logging and sampling. SPTs were performed at approximate 1 m intervals in all windowless sample holes.

3.2.5 MWS1, MWS4, MWS6 and MWS7 were installed to 4.0 m bgl for groundwater and gas monitoring.

3.2.6 Representative soil samples were taken from various depths and strata to assess the contaminative status of the site. Soil samples were submitted to an MCERTS/ UKAS accredited laboratory for chemical analysis of a broad suite of potential contaminants. The results are provided in Appendix 4.

SECTION 4 GROUND CONDITIONS

4.1 SURFACE GROUND CONDITIONS

4.1.1 The surface of the site was predominantly uneven and comprised rough grass, waist-high vegetation brambles, scrubland and medium-sized trees. A bund surrounded the site to the south, while steep densely vegetated slopes bounded the western and northern portion of the site.

4.2 SUB-SURFACE GROUND CONDITIONS

4.2.1 A significant proportion of infilled material was encountered within the former landfilled areas across the site. The areas where underlying natural geology was encountered were generally consistent with the published geology.

4.2.2 A summary of the ground conditions encountered is presented in Table 5, whilst a more detailed assessment of the strata is contained in the following sections of the report.

Table 5: Summary of Sub-surface Ground Conditions

STRATA	DEPTH TO TOP RANGE (m bgl)	THICKNESS RANGE (m)
Made Ground	0.0	0.2 – >3.0 m
Clay	0.6	2.0 m
Drift – Tidal Flats Deposits	2.0	>1.0 m
Drift – Storm Beach Deposits	1.9 – 2.8	>2.1
Solid – Weald Clay Formation	Not encountered	-

4.2.3 Made Ground

4.2.3.1 As the majority of the site was a former landfill, a significant amount of made ground was revealed across the site, ranging in thickness from 0.2 to > 3.0 m bgl, as the depth was not proven in MTP1 to MTP5. Made ground predominantly comprised an upper stratum of topsoil over made ground composed of brown sandy gravelly silt / clay with frequent rootlets. Gravel-sized materials consisted of minor quantities of flint, brick, concrete occasional glass, whole bricks and bituminous pieces. This was underlain by what appeared to be a layer of compacted silty clayey gravelly sand / sandy gravel with frequent whole red bricks, brick and concrete fragments occasional glass, slate and wooden fragments.

4.2.3.2 This was underlain by made ground comprising silty sandy gravelly clay / clayey gravel with variable quantities of red brick, concrete, ash, cinders and bituminous pieces. Significant quantities of landfill waste were encountered in MTP1 to MTP5. This included frequent whole red bricks, concrete fragments, wooden, metal and

bituminous fragments, glass bottles, plastic waste material (bags, bottles etc.) and ceramics.

4.2.3.3 Infilled material was revealed across the site, with landfill waste predominantly encountered at MTP1 to MTP5. Suspected asbestos clad pipe was encountered at MTP1 at 1.1 m bgl, while asbestos fragments were also encountered at MTP2 at 0.4 m bgl and MTP5 at 0.6 m bgl. Frequent quantities of ash, cinders, clinkers and bituminous pieces were encountered at MWS1 (0.4 – 1.6 m bgl), MWS2 (0.25 – 0.8 m bgl), MWS6 (0.1 – 2.5 m bgl) and MWS7 (0.4 – 1.1 m bgl). Minor quantities were encountered at MWS1 (2.2 – 2.7 m bgl), MWS2 (0.80 – 2.0 m bgl), MWS3 (0.3 – 1.8 m bgl) and MWS5 (1.5 – 1.9 m bgl).

4.2.3.4 Groundwater was encountered within the made ground at MWS6 at 3.5 m bgl.

4.2.3.5 SPTs carried out within predominantly cohesive made ground revealed 'N' values ranging from 4 to 9, indicating the presence of soft and firm (low and medium strength) ground conditions. SPT 'N' values of 4 and 5 were recorded in granular made ground suggesting loose conditions, whilst an 'N' value of 18 was obtained in MWS1, indicating medium dense conditions.

4.2.4 Natural Ground

4.2.4.1 Storm Beach Deposits were encountered beneath the made ground at MWS1, MWS2, MWS3, MWS4, MWS6 and MWS7 at depths ranging from 1.9 to 2.8 m bgl. The stratum was typically described as brown sandy gravel. The gravel content comprised fine to coarse sub rounded to rounded flint.

4.2.4.2 Firm greyish brown mottled orange clay was encountered at MWS5 from 0.6 to 2.6 m bgl. This was underlain by suspected Tidal Flats deposits comprising silty sandy gravel and soft grey clayey silt revealed to 3.0 m bgl.

4.2.4.3 The Weald Clay Formation was not encountered during the site investigation.

4.2.4.4 No visual or olfactory evidence of contamination was noted in the natural ground during the site investigation.

4.2.4.5 Groundwater was encountered at MWS1 to MWS6, within the superficial Storm Beach Deposits, ranging in depths from 2.5 – 3.5 m bgl.

4.2.4.6 SPTs performed within the granular soils recorded 'N' values generally in the range 4 to 16, indicating the presence of loose and medium dense ground conditions, whilst locally at depths of 4.0 and 5.0 m bgl SPT 'N' values of 28 and 35 were obtained. SPTs undertaken within cohesive deposits encountered in MWS5 recorded 'N' values of between 5 and 12, suggesting soft and firm (low and medium strength) ground conditions.

SECTION 5 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

5.1 FOUNDATIONS

5.1.1 The proposed development comprises a swimming pool and leisure facility with associated car parking and soft landscaped areas.

5.1.2 The recent ground investigation has revealed ground conditions consisting of typically significant thicknesses of made ground (0.2 - > 3.0 m) underlain by superficial deposits of sand and gravel (locally silt / clay). SPTs performed in the made ground revealed soft / firm (low / medium strength) and loose ground conditions, whilst the natural granular deposits were found to be loose and medium dense in nature. Localised deposits of natural cohesive soil were found to be soft and firm (low and medium strength) in nature.

5.1.3 Based on the ground conditions revealed across the site, traditional shallow foundations are considered unlikely to be feasible for the new structure (s). It is recommended that an alternative solution, such as ground improvement or piles is considered.

5.1.4 Ground improvement would involve techniques such as stone columns or vibro concrete columns (VCC). These would be installed along the lines of all load bearing walls and keyed into an underlying competent stratum in order to provide a more uniform founding medium. This would enable strip footings to be constructed on the improved ground. Allowable bearing pressures of around 100 kN/m² are likely to be achievable for footings up to 1 m wide. Light mesh reinforcement would need to be installed in all footings constructed on vibro treated ground. In order to assess the suitability of using ground improvement a specialist contractor should ideally be invited to attend site to view the ground conditions for themselves.

5.1.5 Alternatively, a piled solution could be adopted at the site. It is envisaged that bored / Continuous Flight Auger (CFA) piles will be feasible at the site. Driven piles could possibly be considered as they have the advantage that no arisings are generated, however, the effects of noise / vibrations are likely to be an issue given the proximity of the existing residential development and a canal.

5.1.6 The advantage of using bored / CFA piles is the low noise / vibration of the system, however, arisings are generated by this system. Piles would need to be taken through made ground and superficial deposits to found within an underlying competent stratum.

5.1.7 It is recommended that the advice of a specialist contractor be sought in order to determine the most appropriate / cost effective system and to advise on pile diameters, depths and safe working capacity. Ideally, boreholes would need to be undertaken to determine ground conditions at depth and to obtain parameters for pile design.

5.1.8 Any ground improvement or piling activities would need to consider their impact on the Royal Military Canal.

5.1.9 If a housing scenario is to be adopted as mentioned in the cabinet report similar ground geotechnical recommendations will need to be adopted, given the depth of made ground across the site. Detailed development plans were not provided within the cabinet report document and should such plans be made available recommendations may need to be reviewed.

5.2 EXCAVATIONS AND GROUNDWATER

5.2.1 Based on the ground conditions observed at the site, any shallow excavations have the potential to become unstable in the short term. Therefore, if man-entry is required excavations should be supported by shoring or otherwise battered back to a safe angle in order to protect the workforce from possible collapse.

5.2.2 Groundwater was encountered in the windowless sample holes at depths ranging from 2.3 to 3.6 m bgl. It is therefore possible that groundwater ingress could occur in any shallow excavations, and provision for dewatering during the construction period should be considered.

5.3 FLOOR SLABS

5.3.1 Due to the significant thicknesses of made ground present across the site it is recommended that suspended floor slabs are adopted for proposed new structures.

5.4 BURIED CONCRETE

5.4.1 Recommendations given in BRE Special Digest 1:2005 "Concrete in aggressive ground" have been followed in order to give recommendations with respect to buried concrete.

5.4.2 Water soluble sulphate analysis was carried out on eighteen soil samples obtained from depths of between 0.2 and 3.5 m bgl with soil pH determination also carried out on these samples. Water soluble sulphate contents ranged between 0.022 and 1.8 g/l. In accordance with BRE guidelines the characteristic value is calculated by determining the mean of the highest 20 % of results. In this case the characteristic value is 1.48 g/l. On this basis the Design Sulphate Class is DS-2.

5.4.3 The pH values in the soil samples varied between 7.2 and 9.0. The mean of the lowest 20 % of values is 7.4 which represents the characteristic value. Mobile groundwater conditions have been assumed and on this basis the Aggressive Chemical Environment for Concrete (ACEC) class for the site is AC-2.

5.5 ROADS AND PAVED AREAS

5.5.1 For preliminary design purposes a California Bearing Ratio (CBR) value of < 2 % should be assumed for roads / hardstanding at existing ground levels.

5.6 SOAKAWAYS

5.6.1 The presence of significant thicknesses of made ground beneath the site is likely to preclude the use of shallow soakaways for the proposed development.

SECTION 6 ENVIRONMENTAL ASSESSMENT

6.1 SOIL QUALITY

6.1.1 A total of eighteen soil samples were submitted to the laboratory for chemical analysis, including two samples from natural ground and sixteen samples from made ground. The laboratory chemical analysis certificates are contained in Appendix 4. The results of the analysis are summarised in Table 6 and 8.

6.1.2 An initial screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against *Suitable for Use Levels* (S4ULs) published in 2015 by LQM/CIEH[1]. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. As different development scenarios are proposed, this report has assessed using three sets of screening levels:

i. POSresi (POS2) – Referring to the leisure centre with associated car parking and landscaping; and

ii. Residential without home-grown produce – Referring to residential scenarios; and

iii. Residential with home-grown produce – Referring to residential scenarios.

6.1.3 For lead the DEFRA Category 4 Screening Level[2] has been used as this is based on updated toxicological data and a low risk to human health.

6.1.4 An additional set of phytotoxin screening levels have been adopted from 'The Code of Agricultural Practice for the Protection of Soil' Ministry of Agriculture, Fisheries and Food (MAFF), 1993, which are protective of healthy plant growth. Landscaped areas are proposed within all scenarios.

Table 6: Summary of Soils Chemical Analysis Results - POSresi (POS2)

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Asbestos in soil	-	Detected	-	5	Detected	5
pH	-	9	7.96	18	5 – 9	-

[1] Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM / CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3100. All rights reserved.

[2] SP1010 *Development of Category 4 Screening Levels Main Report* (Dec 2013) and SP1010 *Policy Companion Document* (Mar 2014).

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Arsenic	$mg.kg^{-1}$	50	16.92	18	79	0
Cadmium	$mg.kg^{-1}$	1.1	0.32	18	120	0
Chromium (total)	$mg.kg^{-1}$	110	33.11	18	1500	0
Hexavalent Chromium	$mg.kg^{-1}$	<4.0	<4.0	18	7.7	0
Lead	$mg.kg^{-1}$	850	200.5	18	630	2
Mercury	$mg.kg^{-1}$	1.3	0.41	18	120	0
Nickel	$mg.kg^{-1}$	87	33.5	18	230	0
Selenium	$mg.kg^{-1}$	2.7	1.21	18	1100	0
TPH Aliphatic >EC_5 - EC_6	$mg.kg^{-1}$	<0.1	<0.1	18	600000	0
TPH Aliphatic >EC_6 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	620000	0
TPH Aliphatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	13000	0
TPH Aliphatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	1.2	1.01	18	13000	0
TPH Aliphatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	35	4.03	18	13000	0
TPH Aliphatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	62	11.18	18	250000	0
TPH Aliphatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	120	28.25	18	250000	0
TPH Aromatic >EC_5 - EC_7	$mg.kg^{-1}$	<0.1	<0.1	18	56000	0
TPH Aromatic >EC_7 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	56000	0
TPH Aromatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	5000	0
TPH Aromatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	2.7	1.25	18	5000	0
TPH Aromatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	380	30.84	18	5000	0
TPH Aromatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	2200	217.33	18	3800	0
TPH Aromatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	2500	328.06	18	3800	0
Benzene	$mg.kg^{-1}$	<1.0	<1.0	18	73	0
Toluene	$mg.kg^{-1}$	<1.0	<1.0	18	25000	0
Ethylbenzene	$mg.kg^{-1}$	<1.0	<1.0	18	56000	0
Xylene	$mg.kg^{-1}$	<1.0	<1.0	18	43000	0
Acenaphthene	$mg.kg^{-1}$	23	2.07	18	15000	0
Acenaphthylene	$mg.kg^{-1}$	4	0.9	18	15000	0
Anthracene	$mg.kg^{-1}$	53	5.48	18	74000	0
Benz(a)anthracene	$mg.kg^{-1}$	130	16.42	18	29	3
Benzo(a)pyrene	$mg.kg^{-1}$	91	13.29	18	5.7	7
Benzo(b)fluoranthene	$mg.kg^{-1}$	110	16.03	18	7.2	7
Benzo(ghi)perylene	$mg.kg^{-1}$	57	6.83	18	640	0
Benzo(k)fluoranthene	$mg.kg^{-1}$	56	7.72	18	190	0
Chrysene	$mg.kg^{-1}$	100	13.5	18	57	1
Dibenz(ah)anthracene	$mg.kg^{-1}$	11	1.58	18	0.57	9
Fluoranthene	$mg.kg^{-1}$	300	34.82	18	3100	0
Fluorene	$mg.kg^{-1}$	22	2.26	18	9900	0
Indeno(123-cd)pyrene	$mg.kg^{-1}$	50	7.61	18	82	0
Naphthalene	$mg.kg^{-1}$	1.2	0.29	18	4900	0
Phenanthrene	$mg.kg^{-1}$	190	19.69	18	3100	0

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Pyrene	$mg.kg^{-1}$	230	27.93	18	7400	0
Phenol	$mg.kg^{-1}$	<1.0	<1.0	18	1300	0
PHYTOTOXICITY RISK ASSESSMENT						
	Units	Max	Mean	No of Test	Screening Level (SL)	No > SL
Copper	$mg.kg^{-1}$	850	97.09	18	200	2
Nickel	$mg.kg^{-1}$	87	33.5	18	110	0
Zinc	$mg.kg^{-1}$	1200	279.11	18	300	4

Notes: * Number of samples exceeding screening level nd = not detected

Table 7: Summary of Soils Chemical Analysis Results – Residential without home-grown produce.

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Asbestos in soil	-	Detected	-	5	Detected	5
pH	-	9	7.96	18	5 – 9	0
Arsenic	$mg.kg^{-1}$	50	16.92	18	40	1
Cadmium	$mg.kg^{-1}$	1.1	0.32	18	85	0
Chromium (total)	$mg.kg^{-1}$	110	33.11	18	910	0
Hexavalent Chromium	$mg.kg^{-1}$	<4.0	<4.0	18	6	0
Lead	$mg.kg^{-1}$	850	200.5	18	310	3
Mercury	$mg.kg^{-1}$	1.3	0.41	18	56	0
Nickel	$mg.kg^{-1}$	87	33.5	18	180	0
Selenium	$mg.kg^{-1}$	2.7	1.21	18	430	0
TPH Aliphatic >EC_5 - EC_6	$mg.kg^{-1}$	<0.1	<0.1	18	160	0
TPH Aliphatic >EC_6 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	530	0
TPH Aliphatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	150	0
TPH Aliphatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	1.2	1.01	18	770	0
TPH Aliphatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	35	4.03	18	4400	0
TPH Aliphatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	62	11.18	18	110000	0
TPH Aliphatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	120	28.25	18	110000	0
TPH Aromatic >EC_5 - EC_7	$mg.kg^{-1}$	<0.1	<0.1	18	1400	0
TPH Aromatic >EC_7 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	3900	0
TPH Aromatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	270	0
TPH Aromatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	2.7	1.25	18	1200	0
TPH Aromatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	380	30.84	18	2500	0
TPH Aromatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	2200	217.33	18	1900	0
TPH Aromatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	2500	328.06	18	1900	1
Benzene	$mg.kg^{-1}$	<1.0	<1.0	18	1.4	0
Toluene	$mg.kg^{-1}$	<1.0	<1.0	18	440	0
Ethylbenzene	$mg.kg^{-1}$	<1.0	<1.0	18	3900	0

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Xylene	$mg.kg^{-1}$	<1.0	<1.0	18	430	0
Acenaphthene	$mg.kg^{-1}$	23	2.07	18	6000	0
Acenaphthylene	$mg.kg^{-1}$	4	0.9	18	6000	0
Anthracene	$mg.kg^{-1}$	53	5.48	18	37000	0
Benz(a)anthracene	$mg.kg^{-1}$	130	16.42	18	15	5
Benzo(a)pyrene	$mg.kg^{-1}$	91	13.29	18	3.2	11
Benzo(b)fluoranthene	$mg.kg^{-1}$	110	16.03	18	4	11
Benzo(ghi)perylene	$mg.kg^{-1}$	57	6.83	18	360	0
Benzo(k)fluoranthene	$mg.kg^{-1}$	56	7.72	18	110	0
Chrysene	$mg.kg^{-1}$	100	13.5	18	32	2
Dibenz(ah)anthracene	$mg.kg^{-1}$	11	1.58	18	0.32	11
Fluoranthene	$mg.kg^{-1}$	300	34.82	18	1600	0
Fluorene	$mg.kg^{-1}$	22	2.26	18	4500	0
Indeno(123-cd)pyrene	$mg.kg^{-1}$	50	7.61	18	46	0
Naphthalene	$mg.kg^{-1}$	1.2	0.29	18	13	0
Phenanthrene	$mg.kg^{-1}$	190	19.69	18	1500	0
Pyrene	$mg.kg^{-1}$	230	27.93	18	3800	0
Phenol	$mg.kg^{-1}$	<1.0	<1.0	18	1200	0
PHYTOTOXICITY RISK ASSESSMENT						
	Units	Max	Mean	No of Test	Screening Level (SL)	No > SL
Copper	$mg.kg^{-1}$	850	97.09	18	200	2
Nickel	$mg.kg^{-1}$	87	33.5	18	110	0
Zinc	$mg.kg^{-1}$	1200	279.11	18	300	4

Notes: * Number of samples exceeding screening level nd = not detected

Table 8: Summary of Soils Chemical Analysis Results – Residential with home-grown produce.

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Asbestos in soil	-	Detected	-	5	Detected	5
pH	-	9	7.96	18	5 – 9	0
Arsenic	$mg.kg^{-1}$	50	16.92	18	37	1
Cadmium	$mg.kg^{-1}$	1.1	0.32	18	11	0
Chromium (total)	$mg.kg^{-1}$	110	33.11	18	910	0
Hexavalent Chromium	$mg.kg^{-1}$	<4.0	<4.0	18	6	0
Lead	$mg.kg^{-1}$	850	200.5	18	200	4
Mercury	$mg.kg^{-1}$	1.3	0.41	18	40	0
Nickel	$mg.kg^{-1}$	87	33.5	18	130	0
Selenium	$mg.kg^{-1}$	2.7	1.21	18	250	0
TPH Aliphatic >EC_5 - EC_6	$mg.kg^{-1}$	<0.1	<0.1	18	78	0

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
TPH Aliphatic >EC_6 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	230	0
TPH Aliphatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	65	0
TPH Aliphatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	1.2	1.01	18	330	0
TPH Aliphatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	35	4.03	18	2400	0
TPH Aliphatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	62	11.18	18	92000	0
TPH Aliphatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	120	28.25	18	92000	0
TPH Aromatic >EC_5 - EC_7	$mg.kg^{-1}$	<0.1	<0.1	18	140	0
TPH Aromatic >EC_7 - EC_8	$mg.kg^{-1}$	<0.1	<0.1	18	290	0
TPH Aromatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<0.1	<0.1	18	83	0
TPH Aromatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	2.7	1.25	18	180	0
TPH Aromatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	380	30.84	18	330	1
TPH Aromatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	2200	217.33	18	540	1
TPH Aromatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	2500	328.06	18	1500	1
Benzene	$mg.kg^{-1}$	<1.0	<1.0	18	0.17	0
Toluene	$mg.kg^{-1}$	<1.0	<1.0	18	110	0
Ethylbenzene	$mg.kg^{-1}$	<1.0	<1.0	18	290	0
Xylene	$mg.kg^{-1}$	<1.0	<1.0	18	130	0
Acenaphthene	$mg.kg^{-1}$	23	2.07	18	510	0
Acenaphthylene	$mg.kg^{-1}$	4	0.9	18	420	0
Anthracene	$mg.kg^{-1}$	53	5.48	18	5400	0
Benz(a)anthracene	$mg.kg^{-1}$	130	16.42	18	11	5
Benzo(a)pyrene	$mg.kg^{-1}$	91	13.29	18	2.7	11
Benzo(b)fluoranthene	$mg.kg^{-1}$	110	16.03	18	3.3	11
Benzo(ghi)perylene	$mg.kg^{-1}$	57	6.83	18	340	0
Benzo(k)fluoranthene	$mg.kg^{-1}$	56	7.72	18	93	0
Chrysene	$mg.kg^{-1}$	100	13.5	18	22	3
Dibenz(ah)anthracene	$mg.kg^{-1}$	11	1.58	18	0.28	11
Fluoranthene	$mg.kg^{-1}$	300	34.82	18	560	0
Fluorene	$mg.kg^{-1}$	22	2.26	18	400	0
Indeno(123-cd)pyrene	$mg.kg^{-1}$	50	7.61	18	36	1
Naphthalene	$mg.kg^{-1}$	1.2	0.29	18	5.6	0
Phenanthrene	$mg.kg^{-1}$	190	19.69	18	220	0
Pyrene	$mg.kg^{-1}$	230	27.93	18	1200	0
Phenol	$mg.kg^{-1}$	<1.0	<1.0	18	200	0
PHYTOTOXICITY RISK ASSESSMENT						
	Units	**Max**	**Mean**	**No of Test**	**Screening Level (SL)**	**No > SL**
Copper	$mg.kg^{-1}$	850	97.09	18	200	2
Nickel	$mg.kg^{-1}$	87	33.5	18	110	0
Zinc	$mg.kg^{-1}$	1200	279.11	18	300	4

Notes: * Number of samples exceeding screening level nd = not detected

6.1.5 Zootoxic Metals (harmful to human health)

6.1.5.1 With reference to POSresi, two exceedances of lead were recorded in made ground samples at MTP2 (1.9-2.0 m) and MTP5 (1.5 m). Both were samples from within the landfill waste medium.

6.1.5.2 When compared to screening levels for residential without home-grown produce an additional exceedance with reference to lead was also recorded in shallower made ground at MWS2 (0.4-0.6 m). At MTP5 (1.5 m), an elevation of arsenic was also recorded based on a screening level of 40 mg/kg at 50 mg/kg.

6.1.5.3 When compared to screening levels for residential with home-grown produce an additional exceedance with reference to lead was also recorded in made ground at MTP3 (2.0-2.5 m).

6.1.6 Phytotoxic Metals (harmful to plant health)

6.1.6.1 Exceedances of copper and zinc were recorded in made ground across the site at depths ranging from 0.3 to 1.9 m bgl within MTP2, MTP5, MWS2 and MWS6 exploratory holes.

6.1.7 Organic Contaminants

6.1.7.1 Exceedances of polyaromatic hydrocarbons (PAH) were recorded in made ground samples in landfill waste across the site under both scenarios.

6.1.7.2 A sample of natural material tested (MWS2 2.5-2.8 m) immediately below made ground also recorded elevated concentrations of PAH above screening levels under all three scenarios. This contamination was consistent with the overlying made ground.

6.1.7.3 ElevatedTPH (aromatic C_{21}-C_{35}) was encountered at MWS1 1.4 – 1.7 m at a concentration of 2500 mg/kg, when compared to a residential without home-grown produce screening level. This material was above the perched groundwater level and was composed of ash and clinker.

6.1.7.4 When compared to screening levels for residential with home-grown produce additional exceedances with reference to TPH (aromatic C_{12}-C_{16} and aromatic C_{16}-C_{21}) were also recorded in made ground at MWS1 1.4 – 1.7 m.

6.1.8 Inorganic Contaminants

6.1.8.1 Five samples of made ground were tested for asbestos presence, all of which were positive. Asbestos presence was then quantified in three of the five samples tested from depths ranging from 0.3 to 0.9 m bgl. These recorded concentrations ranging from < 0.001 to 0.015 %.

6.1.9 Summary

6.1.9.1 The made ground across the site recorded concentrations of PAH exceeding relevant screening levels for all assessment criteria compared against. Localised metallic contamination (lead, arsenic, copper and zinc) was also encountered within the landfill waste made ground. Five out of five samples tested recorded asbestos presence however, where quantified were recorded at non-hazardous concentrations (< 0.1%). TPH concentrations in MWS1 1.4-1.7 m exceeded residential screening criteria with and without homegrown produce.

6.1.9.2 Two samples of natural strata were tested immediately below made ground. One sample at MWS2 recorded elevated concentrations when compared to all assessment criteria which suggest contamination has possibly leached to underlying natural geology. The sample was also collected just below where groundwater was encountered therefore it must be considered that contamination recorded could be associated with groundwater contamination.

6.2 GROUNDWATER

6.2.1 It is important to mention that although groundwater is likely to be tidally influenced, the adjacent Royal Military Canal to the north does not fluctuate with the tide which indicates the groundwater and the canal are not in hydraulic continuity.

6.2.2 It is considered that groundwater encountered during the site investigation was perched water. Groundwater was not encountered during any monitoring rounds to date. This included monitoring conducted during high summer tides. Further investigation is recommended once vegetation clearance has taken place.

6.2.3 Groundwater sampling conducted by GSG in 2002 did not encounter significant contamination.

6.3 HAZARDOUS GAS

6.3.1 Gas monitoring has been undertaken on four occasions (29 June 2015, 22 July, 31 August, 21 October 2016). Only MWS7 and MWS1 could be located during the monitoring conducted in 2016. Levels of methane, carbon dioxide and oxygen were recorded in each standpipe, together with associated parameters including borehole flow and ambient air pressure. The results of these gas monitoring rounds are contained in Appendix 5.

6.3.2 The monitoring rounds were undertaken at barometric pressures ranging from 1017 to 1022 mb. Positive flow was not recorded during the monitoring round. Methane (CH_4) was not detected during the monitoring rounds however carbon dioxide (CO_2) was detected to a maximum of 9.3 % v/v with a corresponding depleted oxygen concentration of 14.2 % v/v during the monitoring round in 2015.

6.4 WASTE CLASSIFICATION AND OFF-SITE DISPOSAL

6.4.1 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statues including the *Environmental Protection Act 1990*, *The Controlled Waste Regulations 2012* as amended, *The Waste Regulations 2011* as amended, *The List of Wastes Regulations 2005* as amended, *The Hazardous Waste Regulations 2005* as amended, *The Waste Management Regulations 2006* and *The Environmental Permitting Regulations 2010* as amended.

6.4.2 It is a requirement of these regulations that waste sent to landfill should have been subject to measures to reduce the amount of waste, reduce harmful or hazardous properties and facilitate recycling. These requirements may be satisfied by measures such as segregation and screening of wastes to recover suitable fill and material for crushing, segregation of inert materials and putrescible wastes.

SECTION 7 RISK ASSESSMENT

7.1 The potential sources of contamination at the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment.

7.2 The investigations demonstrate that the former uses of the site, particularly with reference to landfilling, have resulted in widespread contamination comprising metals, PAH, TPH and asbestos. These materials are considered for their potential to act as sources for a number of pollutant linkages.

7.3 The potential impacts of contamination sources have been considered with respect to the following receptors:

i. The general public and present site users,

ii. Residents of future development,

iii. Groundwater,

iv. Surface water,

v. Construction workers,

vi. Adjacent land, and

vii. Infrastructure.

7.4 In each case the existence of a pollutant linkage requires a pathway by which the receptor could be exposed to the source. A qualitative assessment of risk is thus considered in the first instance with respect to the site in its current condition and is summarised in the sections below.

7.5 **The general public and present site users**

7.5.1 As the majority of the site is heavily vegetated, potential exposure to underlying made ground is significantly reduced, therefore the risk to the general public and current site users is considered to be low.

7.6 **Residents of future development**

7.6.1 Soil contamination (chemical)

7.6.1.1 Soil contamination is widespread particularly within the made ground material. Elevated concentrations of PAH, lead, a single elevation of arsenic were recorded within the upper soil profile (upper 1.0 m) across the site. The cabinet report demonstrates the leisure centre development scenario is predominantly surrounded by hardstanding which would break pathways, reducing exposure. No outdoor pitches or play areas are proposed. The residential scenarios of the proposed development include areas of public open space and communal planting. It is likely that the final proposals will include private gardens. The risk of exposure for both scenarios is therefore considered to be low to moderate.

7.6.2 Asbestos

7.6.2.1 Asbestos was detected in all samples where tested both in upper and lower profiles. As all samples that were tested for asbestos presence were positive, asbestos is expected to be widespread within the made ground. Where concentrations have been quantified, low concentrations were recorded at non-hazardous levels. Due to the small amount of proposed landscaped areas the risk of exposure is considered to be low to moderate providing clean cover is used.

7.6.3 Hazardous Soil Gas/Vapours (including hydrocarbon vapours/radon)

7.6.3.1 The proposed development layout is likely to include both low-rise residential and medium-rise residential (of three stories and above). Therefore BS8485(2015) has been considered in the gas risk assessment.

7.6.3.2 Gas Screening Values (GSVs) for carbon dioxide and methane concentrations were calculated using the maximum recorded values throughout the monitoring period in association with the highest recorded flow rate.

7.6.3.3 Based on the ground gas monitoring data, the GSV for carbon dioxide was calculated as 0.009 $l.hr^{-1}$ and the GSV for methane was calculated as 0.0001 $l.hr^{-1}$. These GSVs have been assessed in accordance with BS8485(2015). Risk assessment calculations are presented in Appendix 7,

7.6.3.4 The GSV assessment would classify the site as a Characteristic Situation 1. These classifications indicate a negligible gassing regime and that no ground gas protection measures are required. However, carbon dioxide was recorded over 5 % (during one of the monitoring rounds), and therefore it is appropriate to consider increasing the risk level to characteristic situation (CS2).

7.6.3.5 Given the site history and geo-environmental setting, it is considered that Characteristic Situation 2 (low hazard potential) is appropriate and that gas protection is provided. This is considered suitably precautionary to mitigate the gas risk taking into account uncertainty introduced by the limited period of monitoring. BS 8485:2015 assigns a "gas protection score" that must be achieved, based on building type (Type A building - private ownership) in order to mitigate the gas risk. A CS2 classification would necessitate a gas protection score of 3.5 points. Indicative measures to achieve this score would include: the fitting of a gas resistant membrane (installed to the requirements of BS 8485:2015) and a passive sub floor dispersal layer.

7.6.3.6 With further gas monitoring (at least six additional visits over six months) it may be possible to negate the need for gas protection measures or limit the areas where it is required.

7.6.3.7 As mentioned in section 2.12.1, the Phase 1 Assessment undertaken by Ground Solutions Group Limited also recorded carbon dioxide levels above five percent at five locations.

7.7 Controlled waters

7.7.1 Although hydrocarbon contamination was recorded in made ground at concentrations which could pose a risk to human health, the concentrations were not sufficiently mobile to pose a risk to controlled waters. It is considered that groundwater is likely to be tidally influenced, but to date groundwater has not been encountered during any of the monitoring rounds (including in July during a period of high tide).

7.7.2 The Royal Military Canal to the north is contained and during the site works was observed to not be tidally influenced. The risk of leachable contaminants migrating to the canal is also considered to be low as it is not in hydraulic continuity with the groundwater. As groundwater is likely to be tidally influenced, this is a dynamic environment where leachate is unlikely to accumulate beneath the site preventing groundwater from being stagnant.

7.8 Construction workers

7.8.1 Potentially, construction workers are initially at the greatest risk from exposure to hazardous contamination due to excavation works and during the handling of materials including imported soils. Providing that dust levels are kept within statutory limits and appropriate health and safety procedures are adhered to during the construction phase, the levels of chemical contamination recorded to date are not considered to present an acute risk to human health.

7.9 Infrastructure

7.9.1 Phytotoxic metals were detected in excess of relevant screening levels across the site in made ground which may affect plant growth. Clean cover will be required in proposed landscaped areas to ensure an adequate growing medium is present.

7.9.2 Contamination with the potential to permeate polymeric services has been identified by this investigation, and it is recommended that the utility provider is consulted with respect to their requirements for water supply pipes.

7.9.3 Utility companies apply strict guideline levels on use of polymeric pipes and may consider all made ground unsuitable for typical plastic pipe materials to be used.

SECTION 8 UPDATED CONCEPTUAL MODEL

8.1 Following completion of phases 1 and 2 of the investigation and a qualitative risk assessment, the conceptual model for the site, with relation to pollutant linkages, has been updated. The revised model is presented in Table 9 below.

Table 9: Revised Conceptual Model

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	**PATHWAYS**	**RECEPTORS**	
Heavy metals and hydrocarbons (made ground)	Contact with contaminated soil	Human health (current users)	**Low risk identified** Although made ground does contain elevated metals and hydrocarbons the site is fenced and contained, covered by dense vegetation reducing risk of exposure.
	Ingestion and inhalation of contaminated soil and dust	Human health (current users)	
Heavy metals and hydrocarbons (made ground)	Contact with contaminated soil	Human health (future residents and construction workers)	**Low to Moderate risk identified** Although made ground does contain elevated metals and hydrocarbons, proposed scenarios suggest predominantly hard standing and limited landscaping areas thus reducing exposure risk. Mitigation measures will be required in areas of soft landscaping or private gardens to reduce the potential risk to future site users.
	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	
Asbestos (made ground)	Ingestion and inhalation of contaminated soil and dust	Human health (future residents and construction workers)	**Low to Moderate risk** Shallow contamination was recorded although limited landscaping is proposed. Providing clean cover is introduced in soft landscaping and private gardens will lower exposure.
Contamination (all forms)	Vertical migration to aquifer	Controlled waters	**Moderate risk identified** Given soil contamination has been detected, groundwater contamination is possible although species detected are not considered to be highly mobile. To date groundwater has not been detected during any monitoring round.
Contamination (all forms)	Horizontal migration to surface water	Controlled waters	**Low risk identified** The Royal Military Canal to the north is contained and is not tidally influenced.
Hydrocarbons	Direct contact	Plastic water pipes	**Moderate risk identified** Contamination with the potential to permeate polymeric pipes was detected across the site.

POSSIBLE POLLUTANT LINKAGE			RISK CHARACTERISATION
POTENTIAL SOURCES	PATHWAYS	RECEPTORS	
Hazardous Gas/Vapours In soil	Ingress into buildings and voids	Human health (future residents and construction workers)	**Low to Moderate risk identified** The site has been subject to significant infilling so there is a potential risk from hazardous gases. Elevated carbon dioxide (>5%v/v) at MWS1 (on one occasion) has indicated a potential risk.

SECTION 9 PRELIMINARY REMEDIATION STRATEGY

9.1 The identified risks at the site can be mitigated by removal of either; the source, pathway or receptor. With reference to the conceptual model for the site a remediation strategy, based on source or pathway removal, has been designed.

9.2 There are two proposed development scenarios comprising a leisure centre or residential land, both of which include limited landscaped areas, with the potential for private gardens in a residential scenario. Contamination has been identified within the made ground and locally in underlying natural ground. Groundwater was not encountered during any monitoring round.

9.3 Remedial measures will be required that are protective of human health and groundwater:

9.4 Human health – Clean cover will be required in areas of soft landscaping. This should comprise the following:

i. Private gardens with soil: 600 mm;

ii. Private gardens with shingle: 300 mm and a geotextile marker;

iii. Communal areas with soil: 300 mm;

iv. Communal layers of shingle: 150 mm and a geotextile marker; and

v. Public Open space: 150 mm of soil and a geotextile marker or 300 mm without.

9.5 Material imported for the formation of landscaped areas should be obtained from a validated source. The validation should incorporate an assessment of the provenance of the material and chemical analysis.

9.6 Based on monitoring data to date and the history of the site, basic ground gas protection measures will also be required in at least part of the development. Further monitoring is recommended over a range of atmospheric conditions.

9.7 Potential risks to construction workers have been identified and the adoption of appropriate Health and Safety procedures will ensure that risks to operatives from hazardous materials at the site are minimised. Operatives should not be allowed to eat, drink or smoke on site except in designated areas and should be required to wash all exposed skin at the end of each shift. Operatives should be informed of the potential hazards at the site and should be required to report any observations of suspect material.

9.8 Materials, including waste soils which are not to be retained on site, should be removed and disposed of in accordance with all relevant statues including the *Environmental Protection Act 1990*, *The Controlled Waste Regulations 2012* as amended, *The Waste Regulations 2011* as amended, *The List of Wastes Regulations 2005* as amended, *The Hazardous Waste Regulations 2005* as amended, *The Waste Management Regulations 2006* and *The Environmental Permitting Regulations 2010* as amended.

9.9 Further monitoring is recommended at the detailed design stage to assess the ground gas, groundwater and vapour risk from the site, as well as to ascertain precisely the underlying ground conditions.

9.10 Any observations of ground conditions atypical of those already described should be reported to Merebrook immediately so that an assessment of appropriate action can be made.

SECTION 10 CONCLUSIONS

10.1 The ground conditions encountered confirmed published geology along with expected made ground associated with former on site land filling.

10.2 Geotechnical recommendations comprised foundation solutions such as ground improvement (vibro stone / concrete columns) or a piled solution to be considered. Due to variable thicknesses of made ground it is recommended suspended floor slabs should be adopted.

10.3 A variety of clean cover scenarios have been recommended (including 600 mm clean cover in private gardens) to break linkages for human health and to supply a suitable growing medium.

10.4 Further site investigation is recommended once the vegetation across the site has been cleared.

APPENDIX 1 ▪ Drawings

Legend

- Site boundary
- MTPref — Merebrook trial pit with location reference
- MWSref — Merebrook window sample with location reference

Based on OS	14-07-2015		-
	PDT	-	-
Issue Details	Dwn	Chd	App'd

Client/Project

Shepway District Council
Princes Parade
Seabrook, Hythe

Dwg Title

Site Investigation Locations

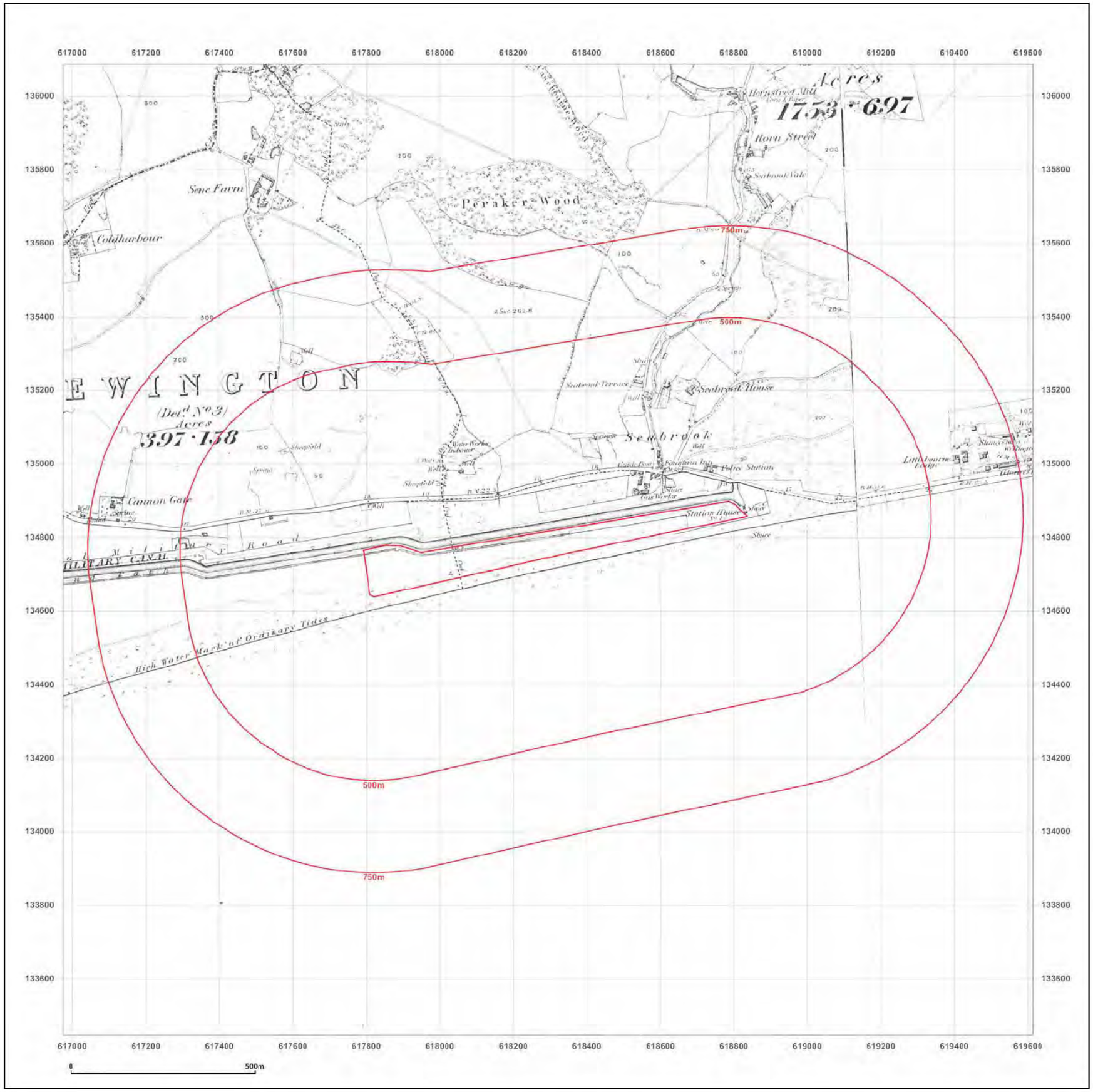
Job No.	Dwg No.	Revision
17436ai	304-001	-
Scale: NTS	Date: July 2015	Frame Dimensions mm: (A3) 400 x 280
Drawn: PDT	Checked: -	Approved: -

London
Kent
Derby
Cardiff
Manchester

idom merebrook

East Mill, Bridgefoot, Belper, Derbyshire, England. DE56 2UA
tel +44(0)1773 829988 fax +44(0)1773 829393 email info@merebrook.co.uk

APPENDIX 2 ▪ Historic Plans



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: County Series

Map date: **1872**

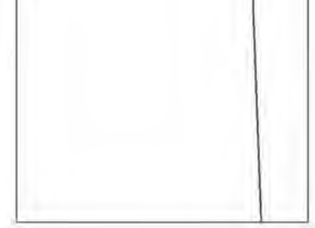
Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1872
Revised 1872
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1872
Revised 1872
Edition N/A
Copyright N/A
Levelled N/A

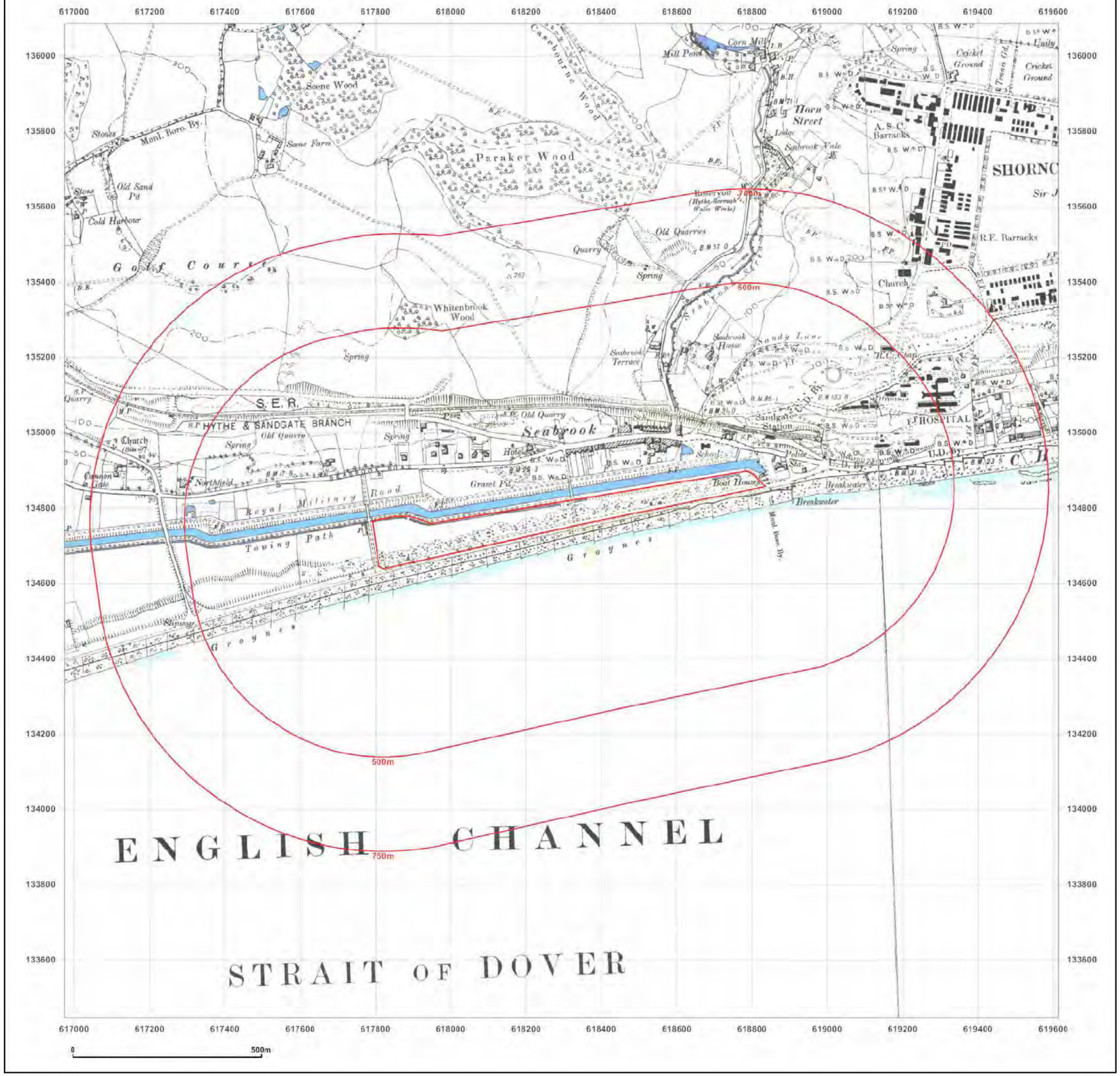


Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK,
HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

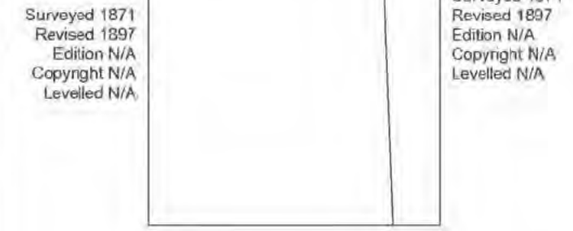
Map Name: County Series

Map date: **1897**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S



Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

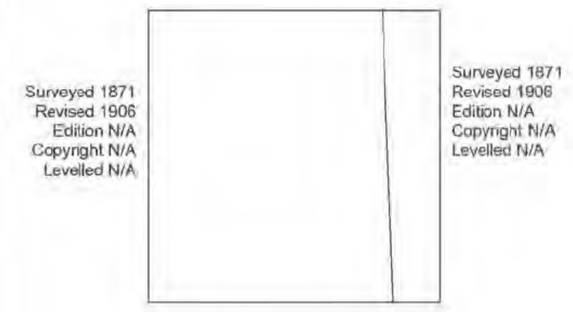
Map Name: County Series

Map date: **1906**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

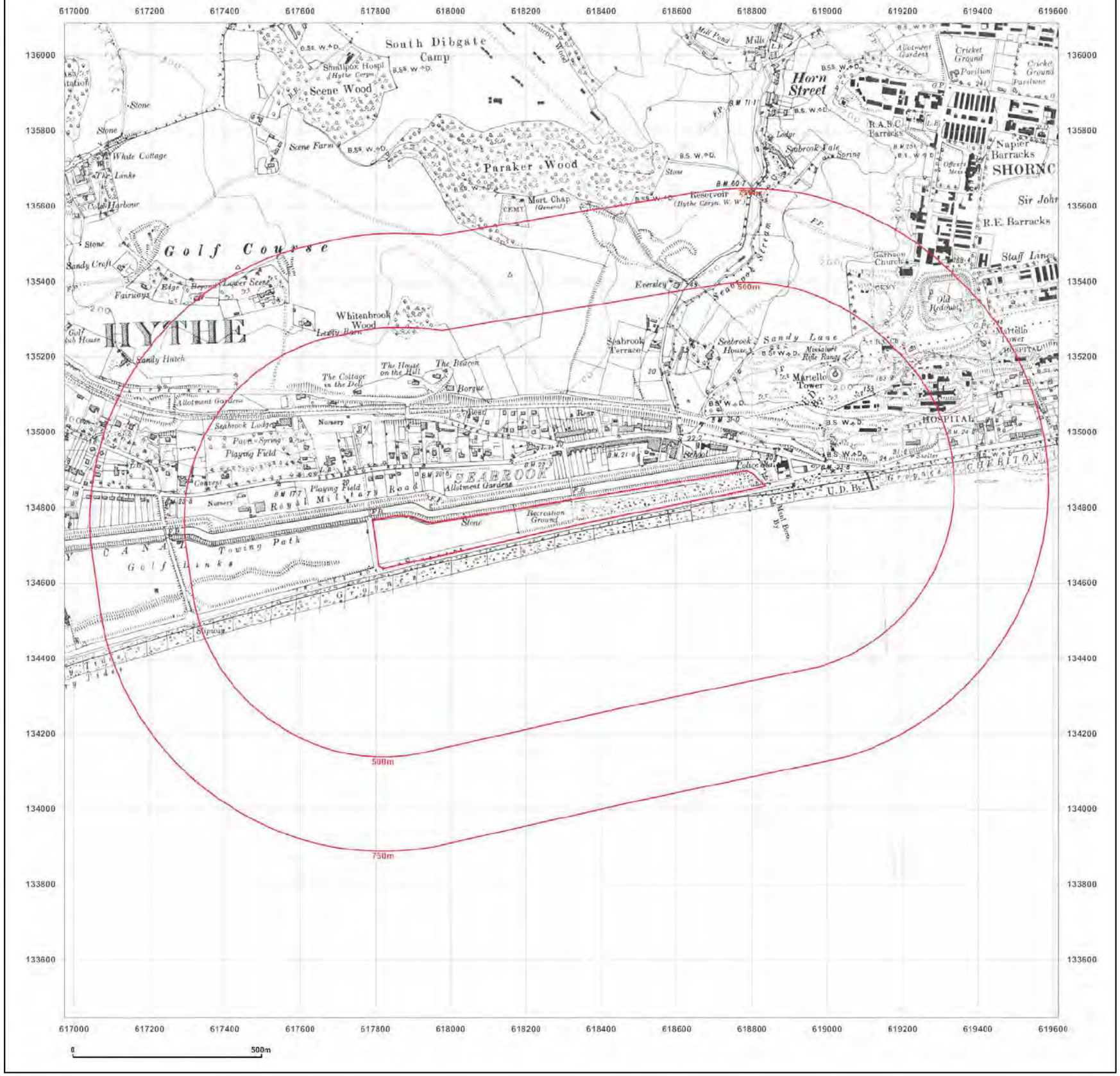


Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

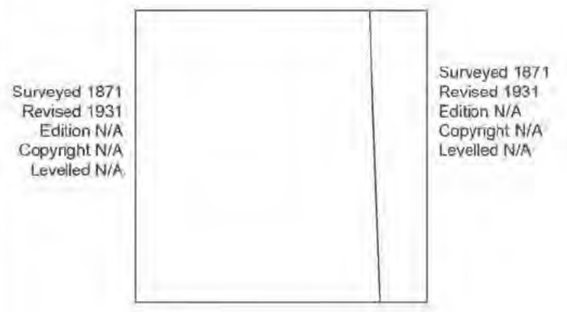
Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: County Series
Map date: **1931**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

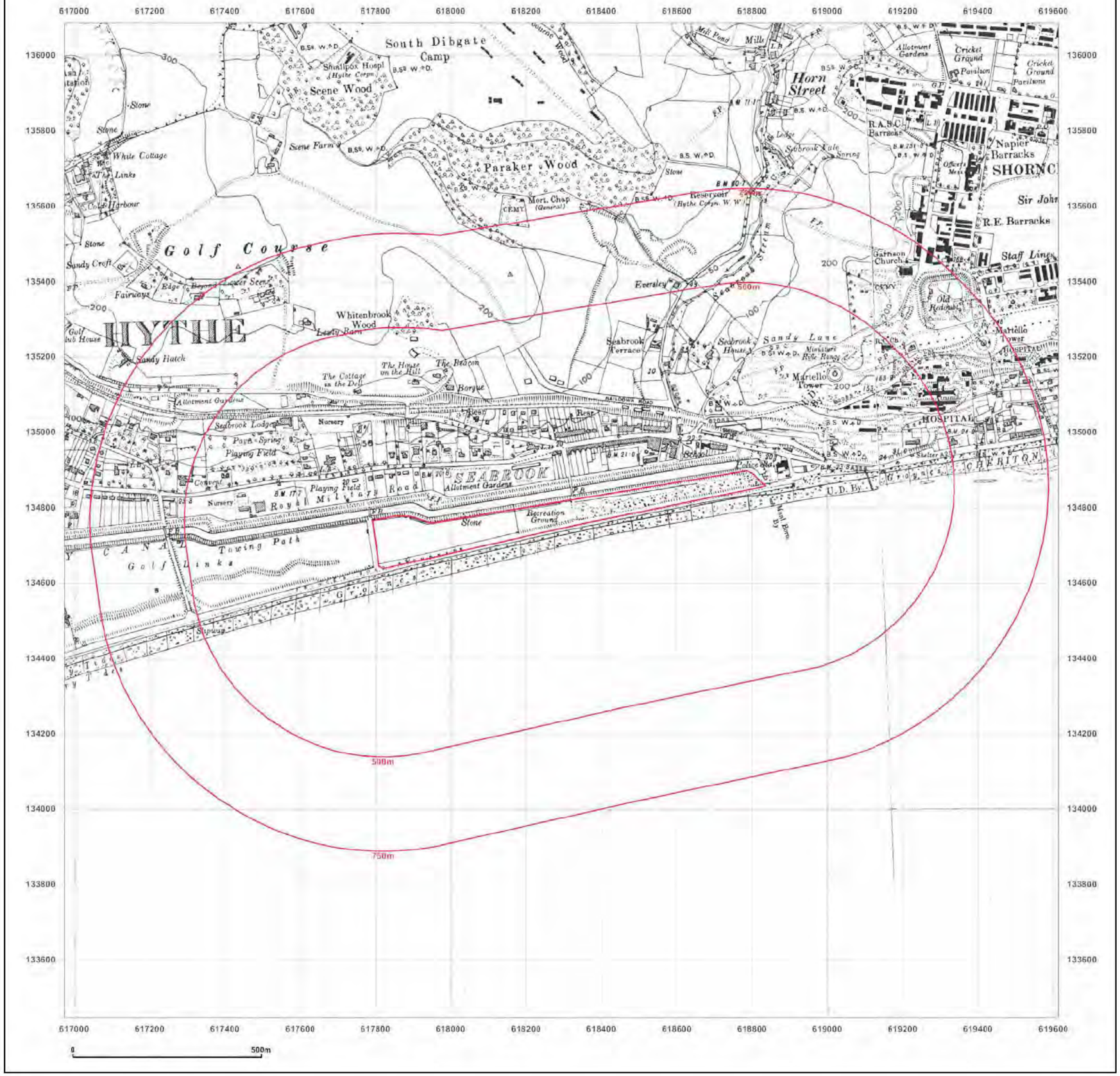


Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

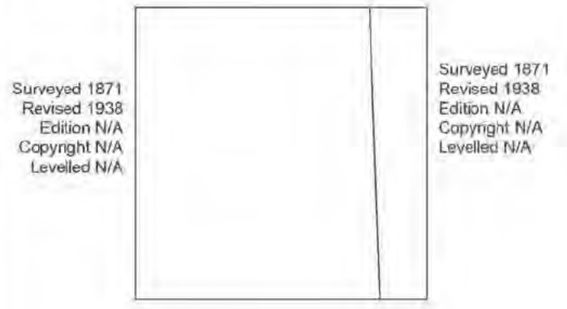
Map Name: County Series

Map date: **1938**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

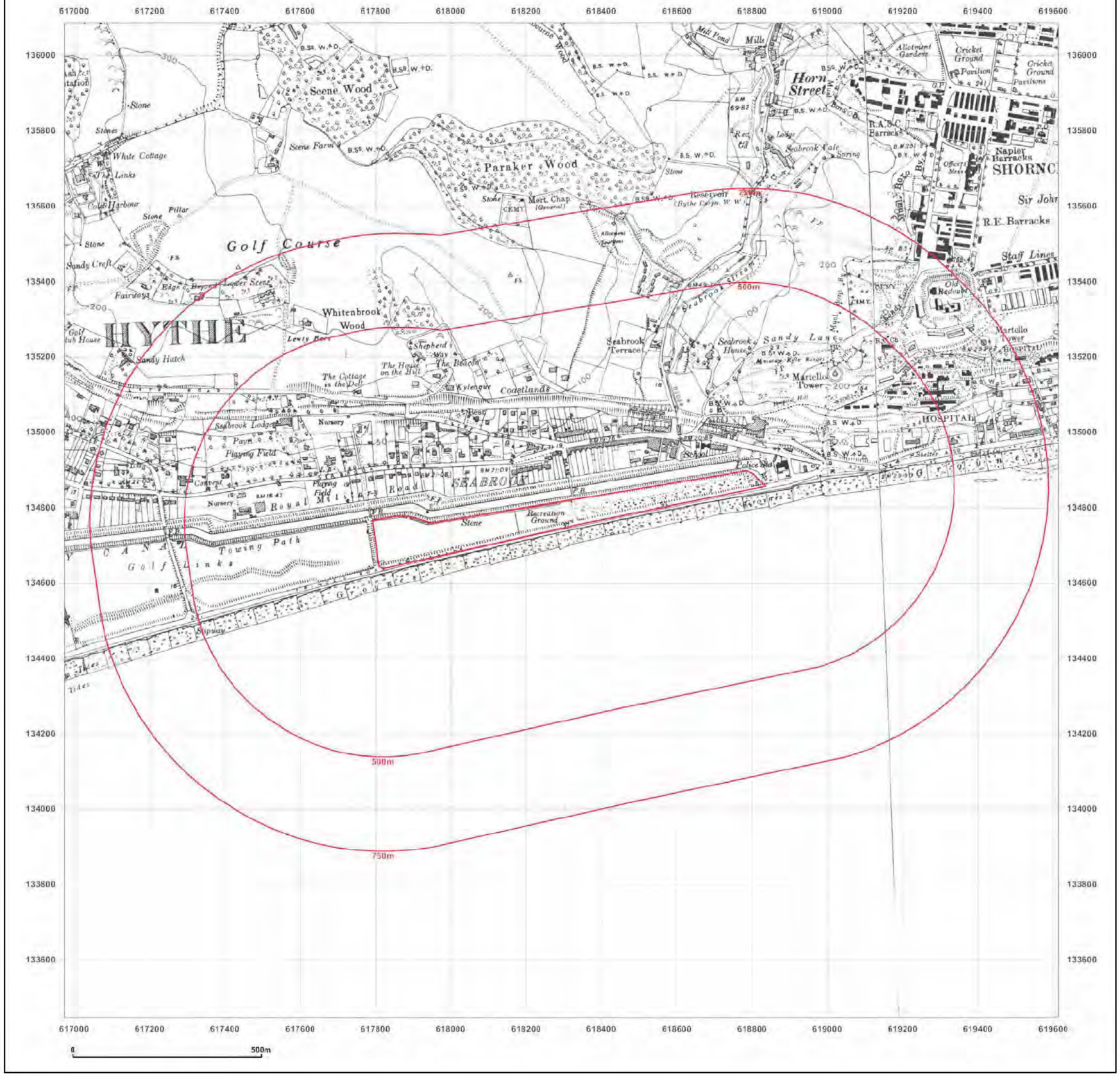


Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

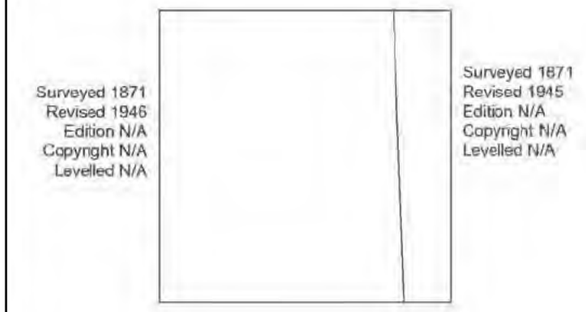
Map Name: County Series

Map date: **1945-1946**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

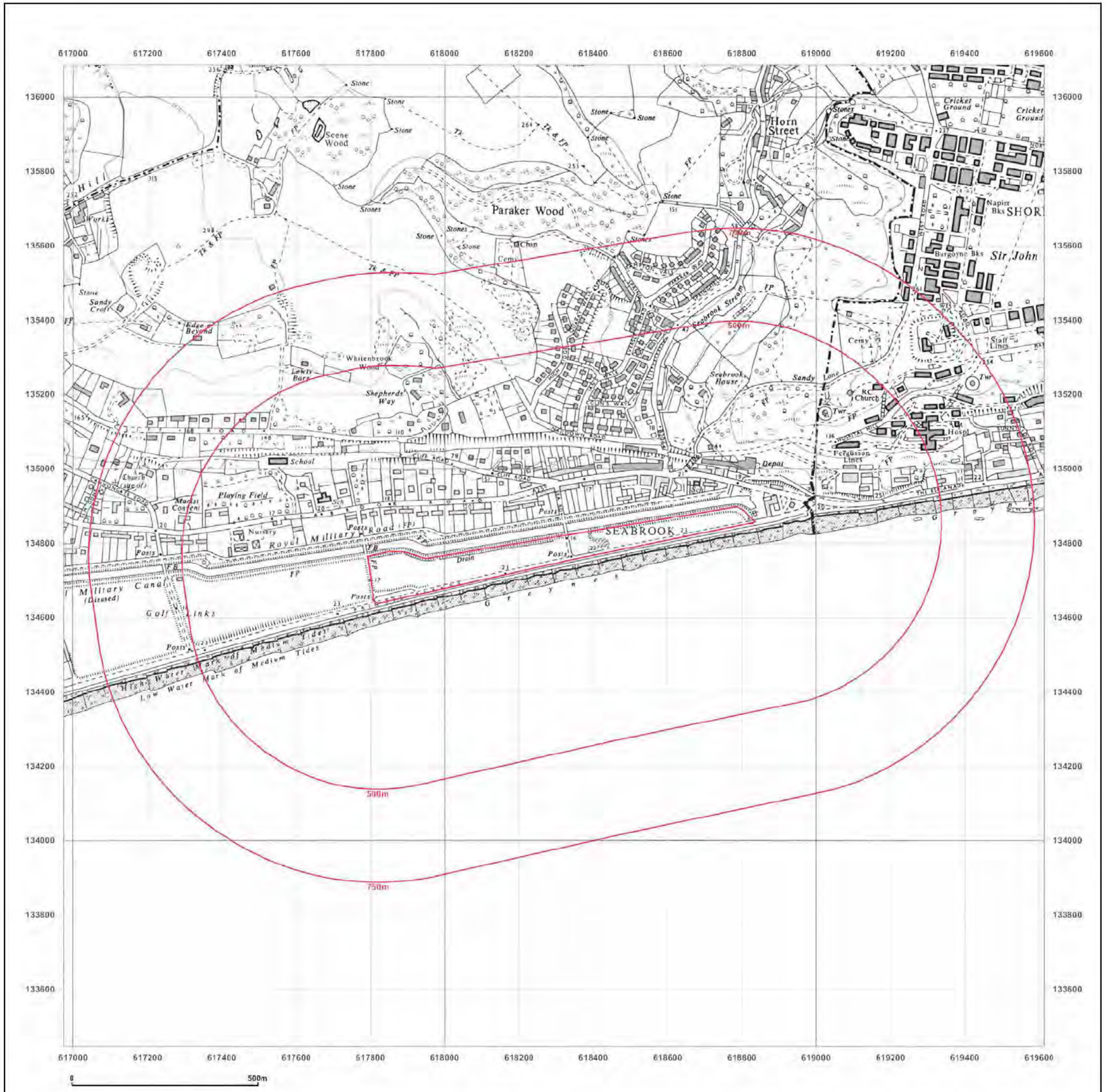


Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: Provisional
Map date: **1961**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1871
Revised 1961
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1961
Revised 1961
Edition N/A
Copyright N/A
Levelled N/A

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: Provisional
Map date: **1961**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

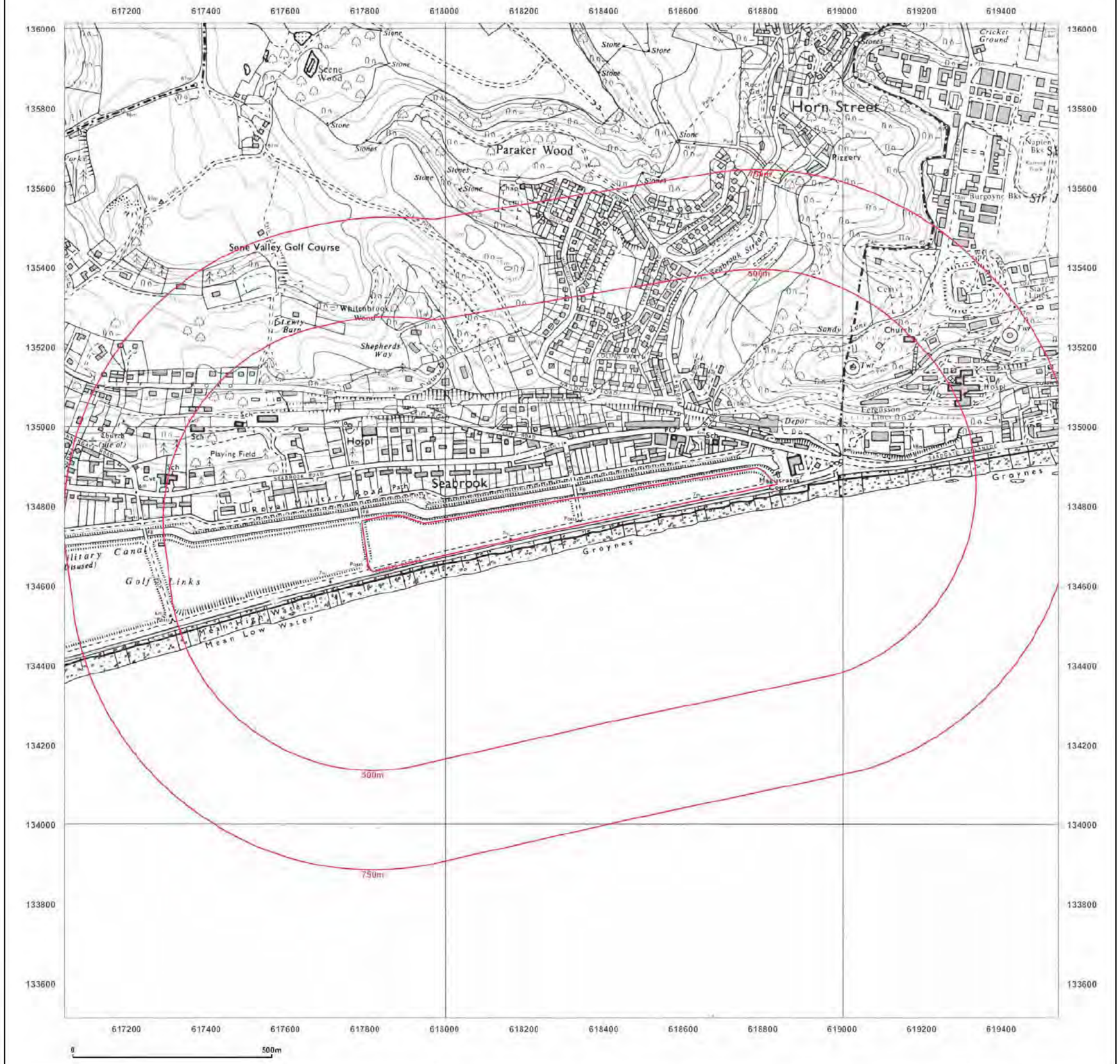
Surveyed 1872
Revised 1961
Edition N/A
Copyright N/A
Levelled N/A

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: National Grid

Map date: **1973-1975**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1973
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

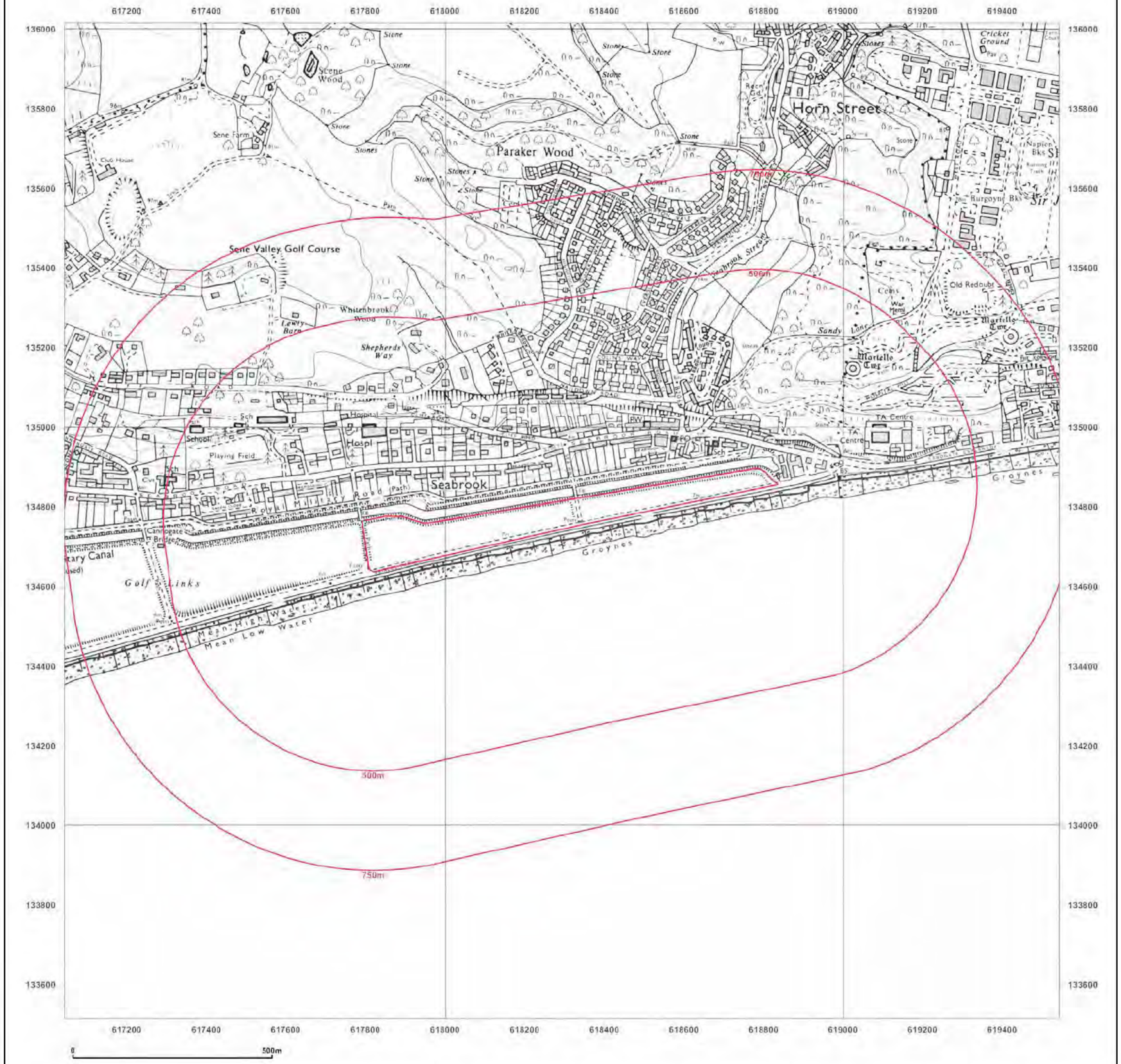
Surveyed 1974
Revised 1975
Edition N/A
Copyright N/A
Levelled N/A

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: National Grid

Map date: **1987-1989**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1984
Revised 1987
Edition N/A
Copyright N/A
Levelled N/A

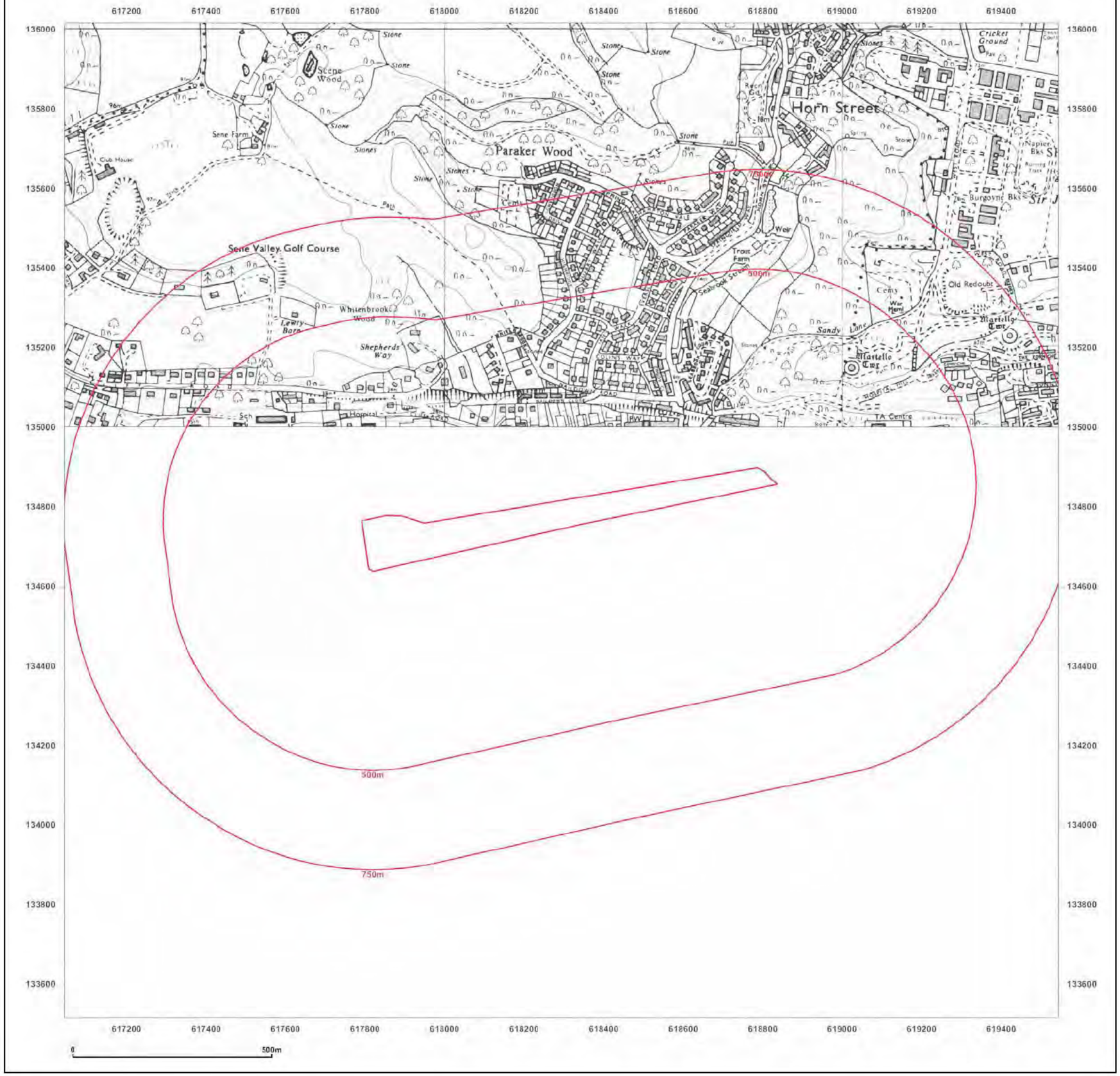
Surveyed 1987
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: National Grid

Map date: **1993**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1982
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Ordnance Survey Licensed Partner

Production date: 18 June 2015

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: 1:10,000 Raster
Map date: 2002
Scale: 1:10,000
Printed at: 1:10,000

N
W E
S

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Ordnance Survey Licensed Partner

Production date: 18 June 2015

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: National Grid
Map date: 2010
Scale: 1:10,000
Printed at: 1:10,000

N
W E
S

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*

Groundsure INSIGHTS

Site Details:

PRINCES PARADE, SEABROOK, HYTHE

Client Ref: 15-S642-FDO-17436ai
Report Ref: HMD-154-2188204
Grid Ref: 618293, 134766

Map Name: National Grid
Map date: 2014
Scale: 1:10,000
Printed at: 1:10,000

N
W E
S

Ordnance Survey Licensed Partner

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 June 2015

To view map legend click here *Legend*

APPENDIX 3

- Exploratory Hole Logs
- BGS Borehole Logs

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Plant: JCB Excavator

Co-ords: -

Trialpit No
MTP1
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Dimensions (m):
2.00 × 1.00
Depth (m) 2.60

Date
17/06/2015

Location: Hythe, Kent

Scale
1:25

Client: Shepway District Council

Logged By
GOB

Samples & In Situ Testing			Water Strike	Depth in metres (thickness)	Legend	Stratum Description
Depth (m)	Type	Results				
				0.20		Rough grasses over TOPSOIL composed of firm brown slightly sandy clayey SILT with frequent rootlets, gravels and occasional red brick fragments.
0.30-0.40	D,J			0.40		MADE GROUND composed of firm brown slightly sandy clayey SILT with frequent rootlets, gravels, red brick fragments, occasional plastic, glass, rubbish and rare shells and cobbles.
				0.60		MADE GROUND composed of dense brown silty sandy GRAVEL with frequent red brick fragments, concrete and rootlets.
1.00-1.20	D,J			(0.90)		MADE GROUND composed of firm brown silty gravelly CLAY with frequent whole brocks, concrete fragments, cobbles, plastic, glass and rubbish. Large concrete slabs at 0.7 m bgl. Large rusted electrical appliance encountered at 0.8 m bgl. Old wiring at 1.0 m bgl. Suspected asbestos pipe encountered at 1.1 m bgl. Large wooden fragments at 1.3 m bgl.
				1.50		MADE GROUND comprised dense brown gravelly clayey SAND with frequent landfill waste. Waste included rusted metals, red bricks, concrete fragments, glass bottles, wooden fragments, batteries, a wheel, textiles, plastic bottles (detergent, bleach, shampoo etc.), aerosol cans. Two large animal bones encountered at 1.9 m bgl
2.00-2.20	D,J			(1.10)		
				2.60		Trialpit Complete at 2.60 m

1 2 3 4

Remarks: Backfilled with arisings

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Plant: JCB Excavator

Co-ords: -

Trialpit No
MTP2
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Dimensions (m):
2.00 × 1.00

Depth (m)
2.60

Date
17/06/2015

Scale
1:25

Location: Hythe, Kent

Client: Shepway District Council

Logged By
GOB

Samples & In Situ Testing			Water Strike	Depth in metres (thickness)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30-0.50 0.40	D,J D			(0.50) 0.50		Rough grasses / thistles / nettles over TOPSOIL comprised of brown soft to firm clayey sandy slight gravelly SILT with frequent rootlets, occasional red brick fragmeents and glass. Possible asbestos cement fragment encountered at 0.4 m bgl.
				(0.40) 0.90		MADE GROUND composed of possibly medium dense brown clayey silty slightly sandy GRAVEL with occasional red brick, concrete and wooded fragments, occasional shells and plastics. Large concrete slab recovered at 0.8 m bgl.
1.00-1.20	D,J			1.10		MADE GROUND comprised brown clayey slightly sandy GRAVEL. Gravel fine to coarse sub angular to sub rounded of mixed lithologies.
				(0.90) 2.00		MADE GROUND composed of firm brown silty sandy gravelly CLAY with frequent landfill waste. Wastes included red bricks, plastics, slate, glass bottles and fragments, rusted metals pieces, plastic bottles (detergent, bleach, shampoo etc.). Wastes became more prominent at 1.5 m bgl. Silty ash and clinkers encountered at 1.8 m bgl.
				(0.60) 2.60		MADE GROUND composed of loose dark grey silty gravelly SAND with frequent red brick and concrete blocks and fragments and occasional glass, plastic and metals.
						Trialpit Complete at 2.60 m
3.00	D,J					

1 2 3 4

Remarks: Backfilled with arisings

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Plant: JCB Excavator

Co-ords: -

Trialpit No
MTP3
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Dimensions (m):
2.00
Depth (m) 3.00
1.00

Date
17/06/2015

Location: Hythe, Kent

Scale
1:25

Client: Shepway District Council

Logged By
GOB

Samples & In Situ Testing			Water Strike	Depth in metres (thickness)	Legend	Stratum Description
Depth (m)	Type	Results				
				(0.60) 0.60		Rough grasses / thistles / nettles over MADE GROUND comprised of brown soft to firm clayey sandy slight gravelly SILT with frequent rootlets and red brick fragments, occasional plastic, tarmac and glass fragmeents, ceramics and whole red bricks.
1.00-1.10	D,J			(0.90) 1.50		MADE GROUND composed of firm dark brown silty sandy gravelly CLAY with frequent landfill waste. Waste included rusted metals, red bricks, concrete, ceramics, glass bottles, wooden fragments, wiring, tarmac, plastic bags, plastic bottles (detergent, bleach, shampoo etc.) and textiles.
				1.60		MADE GROUND composed of firm grey reworked CLAY.
				(0.40) 2.00		MADE GROUND composed of firm dark brown silty sandy gravelly CLAY with frequent landfill waste. Waste included rusted metals, red bricks, concrete, ceramics, glass bottles, wooden fragments, wiring, tarmac, plastic bags, plastic bottles (detergent, bleach, shampoo etc.) and textiles.
2.00-2.20	D,J			(0.50) 2.50		MADE GROUND composed of dark brown sandy gravelly SILT with frequent red bricks, tarmac and wooden fragments and plastic landfill waste. Slight hydrocarbon odour.
				(0.50) 3.00		MADE GROUND composed of firm brown / dark grey silty gravelly CLAY with lenses of dark grey sandy silt and occasional landfill waste. Waste included glass bottles, ash, clinkers, red bricks, wooden fragments and plastics. Large concrete slab encountered at 2.2 m bgl.
						Trialpit Complete at 3.00 m

1
2
3
4

Remarks: Backfilled with arisings

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Plant: JCB Excavator

Co-ords: -

Trialpit No
MTP4
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Dimensions (m):
2.00 x 1.00

Depth (m)
2.70

Date
17/06/2015

Scale
1:25

Location: Hythe, Kent

Client: Shepway District Council

Logged By
GOB

Samples & In Situ Testing			Water Strike	Depth in metres (thickness)	Legend	Stratum Description
Depth (m)	Type	Results				
				(0.40)		Rough grasses / thistles / nettles over TOPSOIL composed of brown soft to firm clayey sandy slight gravelly SILT with frequent rootlets and occasional red brick fragmeents.
0.30-0.50	D,J			0.40		
				0.60		MADE GROUND composed of possibly medium dense clayey silty sandy GRAVEL with frequent red brick fragments, occasional glass, rootlets, plastics and wooden fragments.
				(0.50)		MADE GROUND composed of possibly loose silty gravelly SAND with frequent red brick fragments, occasional slate and glass.
0.90-1.00	D,J			1.10		MADE GROUND composed of brown silty sandy gravelly CLAY with frequent landfill waste. Waste included rusted metals, red bricks, concrete fragments, batteries, glass bottles, wooden fragments, tarmac fragments, plastic bags and bottles (detergent, bleach, shampoo etc.).
				(1.60)		
2.00-2.20	D,J			2.70		Trialpit Complete at 2.70 m

1
2
3
4

Remarks: Backfilled with arisings

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Plant: JCB Excavator

Co-ords: -

Trialpit No
MTP5
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Dimensions (m):
2.00 x 1.00

Depth (m)
1.70

Date
17/06/2015

Scale
1:25

Location: Hythe, Kent

Client: Shepway District Council

Logged By
GOB

Samples & In Situ Testing			Water Strike	Depth in metres (thickness)	Legend	Stratum Description
Depth (m)	Type	Results				
				(0.30)		Rough grass / nettles / weeds over TOPSOIL composed of brown soft to firm clayey sandy slight gravelly SILT with frequent rootlets and occasional red brick fragmeents.
				0.30		
0.40-0.60	D,J			(0.50)		MADE GROUND composed of firm brown silty sandy gravelly CLAY with occasional rootlets and bricks and rare shells and glass. Suspected asbestos cement fragment encountered at 0.6 m bgl.
0.60	D					
				0.80		MADE GROUND composed of brown / orange / light brown silty sandy GRAVEL with frequent landfill waste. Waste included red bricks and fragments, glass, metals, wood plastic bags and bottles.
				(0.90)		
1.50	D,J					
				1.70		Trialpit Complete at 1.70 m

Remarks: Excavator broke down during excavation. Backfilled with arisings

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook

Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS1
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type
WLS

Location: Hythe, Kent

Level
0.000

Scale
1:25

Client: Shepway District Council

Dates: 18/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					(0.40)		Rough grasses over TOPSOIL composed of firm brown dry slightly sandy gravelly clayey SILT with occasional glass and tarmac pieces.
		0.40-0.50	D,J		0.40		
					(0.30)		MADE GROUND composed of firm slightly sandy gravelly silty CLAY with frequent tarmac gravels, ash, clinkers red brick fragments and occasional ceramics
					0.70		MADE GROUND composed of loose black sandy GRAVEL [ash and clinkers].
					0.80		
		1.00	CPT	N=8 (2,2,2,2,2,2)	(0.50)		MADE GROUND composed of firm slightly sandy gravelly silty CLAY with frequent tarmac gravels, ash, clinkers red brick fragments and occasional ceramics
					1.30		MADE GROUND composed of loose black / dark brown sandy GRAVEL [ash and clinkers].
		1.40-1.70	D,J		(0.30)		
					1.60		MADE GROUND composed of soft to firm brownish grey mottled orange slightly sandy gravelly CLAY with occasional red brick fragments. Gravels medium to coarse sub angular to sub rounded.
		2.00	CPT	N=18 (1,0,1,0,1,16)	(0.60)		
					2.20		MADE GROUND composed of loose dark brown SAND AND GRAVEL with ash, clinkers and red brick fragments.
		2.50-2.80	D,J		(0.50)		
					2.70		CONCRETE LAYER
					2.80		Medium dense grey clayey sandy GRAVEL.
		3.00	CPT	N=10 (3,4,3,2,2,3)	(0.80)		
	▽				3.60		Medium dense brown wet sandy GRAVEL. Gravel is fine to coarse sub angular to sub rounded. Sand fine to coarse.
		4.00	CPT	N=4 (2,2,1,1,1,1)	(0.50)		
					4.10		Loose brown wet slightly sandy GRAVEL. Gravel fine to coarse rounded to sub rounded.
		4.50-4.80	D,J		(0.50)		
					4.60		Medium dense brown wet sandy GRAVEL. Gravel is fine to coarse sub angular to sub rounded. Sand fine to coarse.
					4.80		Grey silty gravelly fine SAND. Gravel fine to medium rounded to
			Type	Results			Continued next sheet

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS1
Sheet 1+ of 1

Project Name
Princes Parade

Project No.
17436A1

Location: Hythe, Kent

Co-ords
-

Level
0.000

Hole Type
WLS

Scale
1:25

Client: Shepway District Council

Dates: 18/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing			Depth in metres (thickness)	Legend	Stratum Description
		Depth (m)	Type	Results			
		5.00	CPT	N=14 (6,5,5,3,3,3)	5.00		sub angular. End of Window Sample at 5.00 m
			Type	Results			

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook	Offices: Belper: 01773 829988 Keston: 01689 889980 email: consulting@merebrook.co.uk	**Equipment and Methods** Premier windowless sample drilling rig	Window Sample No **MWS2** Sheet 1 of 1
Project Name Princes Parade	**Project No.** 17436A1	**Co-ords** -	**Hole Type** WLS
Location: Hythe, Kent		**Level** 1.000	**Scale** 1:25
Client: Shepway District Council		**Dates:** 19/06/2015	**Logged By** GOB

Well	Water Strike	Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					0.20		Rough grasses over TOPSOIL composed of firm brown dry slightly sandy gravelly clayey SILT.
					0.25		CONCRETE LAYER
		0.40-0.60	D,J		0.50		MADE GROUND composed of firm brown / grey friable slightly sandy gravelly CLAY with occasional rootlets, red brick and tarmac fragments. Gravels fine to medium sub angular to angular of mixed lithologies.
					(0.30) 0.80		MADE GROUND composed of dark brown / light brown silty gravelly SAND with frequent red brick and tarmac pieces, ash and cinders.
		1.00	CPT	N=4 (1,1,1,1,1,1)			MADE GROUND composed of soft to firm brownish grey mottled orange clayey SILT with occasional lenses of fine grey sand, gravels, rootlets, red brick fragments and rare tarmac gravels.
		1.00-1.50	D,J		(0.80) 1.60		
					(0.40) 2.00		Loose grey silty gravelly SAND with occasional red brick and tarmac fragments.
		2.00	CPT	N=16 (3,3,4,4,4,4)	(0.30) 2.30		Loose grey silty gravelly fine to coarse SAND. Gravels fine to coarse sub rounded.
	▽				(0.40) 2.70		Loose brown wet sandy GRAVEL. Gravels fine to coarse rounded to sub rounded.
		2.50-2.80	D,J				
		3.00	CPT	N=12 (5,3,3,3,3,3)	(1.30) 4.00		Medium dense brown wet sandy GRAVEL. Gravel is fine to medium sub angular to rounded, with occasional coarse gravels. Sand fine to coarse.
		4.00	CPT	N=35 (7,9,10,9,8,8)			End of Window Sample at 4.00 m

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

HoleBASE 3.1 (Bld 426.46) Standard Borehole Log v2 dated 27th Nov 03

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS3
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type
WLS

Location: Hythe, Kent

Level
2.000

Scale
1:25

Client: Shepway District Council

Dates: 20/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					(0.30)		Rough grasses over TOPSOIL composed of firm brown dry slightly sandy gravelly clayey SILT with frequent rootlets.
					0.30		
		0.40-0.50	D,J		(0.30)		MADE GROUND composed of loose light brown silty sandy GRAVEL with occasional red brick fragments and rare bituminous pieces. Large concrete fragment recovered at 0.5 m bgl.
					0.60		
		1.00	CPT	N=4 (1,1,1,1,1,1)	(1.20)		MADE GROUND composed of soft light brown sandy gravelly CLAY with occasional glass, red brick, clinkers and concrete fragments.
		1.50-2.00	D,J		1.80		
		2.00	CPT	N=5 (2,1,1,1,1,2)	(0.70)		MADE GROUND composed of loose light brown clayey gravelly SAND.
	▽				2.50		
					(0.40)		Loose greyish brown wet slightly sandy GRAVEL. Gravels fine to coarse rounded to sub rounded.
					2.90		
		3.00	CPT	N=28 (6,6,7,7,7,7)	(0.45)		Medium dense orangish grey sandy GRAVEL. Gravel fine to coarse rounded to sub rounded, fine is fine.
					3.35		End of Window Sample at 3.35 m
			Type	Results			

1
2
3
4

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook

Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS4
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type
WLS

Location: Hythe, Kent

Level
3.000

Scale
1:25

Client: Shepway District Council

Dates: 21/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					(0.30)		Rough grasses / thistles / nettles over TOPSOIL composed of firm brown dry slightly sandy gravelly clayey SILT.
					0.30		
		0.30-0.50	D,J				MADE GROUND composed of soft brown mottled orange and grey slightly gravelly silty CLAY [reworked] with occasional sandy, red brick and concrete fragments.
					(1.20)		
		1.00	CPT	N=9 (1,2,2,2,2,3)			
		1.00-2.00	D,J		1.50		
					(0.40)		MADE GROUND composed of soft brown / grey clayey SAND with rare red brick, concrete and tarmac fragments.
					1.90		
		2.00	CPT	N=6 (2,2,1,2,2,1)	(0.30)		Loose brown clayey sandy GRAVEL. Gravel fine to coarse sub angular to sub rounded.
		2.00-2.50	D,J		2.20		Loose brown sandy GRAVEL. Gravel fine to coarse sub angular to sub rounded.
					(0.90)		
	▽	3.00	CPT	N=15 (3,3,3,4,4,4)			
					3.10		Medium dense clayey slightly sandy GRAVEL. Gravel fine to coarse sub angular to sub rounded.
					(0.90)		
		4.00	CPT	N=9 (3,2,2,2,2,3)	4.00		End of Window Sample at 4.00 m
			Type	Results			

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS5
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type
WLS

Location: Hythe, Kent

Level
4.000

Scale
1:25

Client: Shepway District Council

Dates: 22/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					0.20		Rough grasses over TOPSOIL composed of firm brown slightly sandy gravelly clayey SILT with frequent rootlets.
					0.40		Firm brown silty sandy gravelly CLAY.
					0.60		Medium dense brown sandy GRAVEL. Gravel fine to coarse sub angular t sub rounded.
		1.00	CPT	N=9 (1,2,2,2,2,3)	(2.00)		Firm greyish brown mottled orange CLAY with occasional sand and gravels.
	▽	2.00	CPT	N=12 (1,1,1,1,3,7)	2.60		Medium dense brown wet silty sandy GRAVEL.
					2.80		Soft grey clayey SILT.
		3.00	CPT	N=5 (1,1,1,1,1,2)	3.00		End of Window Sample at 3.00 m

1 2 3 4

Type | Results

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS6
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type
WLS

Location: Hythe, Kent

Level
5.000

Scale
1:25

Client: Shepway District Council

Dates: 23/06/2015

Logged By
GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					0.10		Rough grasses / shrubs over TOPSOIL composed of firm brown slightly sandy gravelly clayey SILT with frequent rootlets and occasional red brick fragments.
					0.30		MADE GROUND composed of dense brown sandy silty GRAVEL with occasional red brick and bituminous fragments. Gravels fine to coarse angular to sub angular.
		0.40-0.50	D,J		0.50		
					0.55		MADE GROUND composed of dark brown / brown sandy gravelly CLAY with occasional red brick and bituminous fragments.
					(0.40)		TARMAC LAYER
							MADE GROUND composed of greyish brown clayey gravelly SAND with frequent red brick and bituminous fragments.
					0.95		
		1.00	CPT	N=7 (2,3,2,2,2,1)	1.00		CONCRETE COBBLE
							MADE GROUND composed of soft black / beige sandy gravelly SILT with frequent red brick fragments, glass, ash and clinkers.
					(0.60)		
					1.60		MADE GROUND composed of loose dark brown / grey sandy GRAVELS with frequent clinkers.
		2.00	CPT	N=4 (1,1,1,1,1,1)	(0.90)		
					2.50		MADE GROUND composed of loose beige / yellow gravelly SAND.
					(0.40)		
					2.90		MADE GROUND composed of loose brown sandy GRAVEL with occasional concrete and bituminous fragments. Gravels fine to coarse sub angular to sub rounded of mixed lithologies.
		3.00	CPT	N=4 (1,1,2,2,0,0)	(0.70)		
	▽				3.60		MADE GROUND composed of black / dark brown loose clayey sandy GRAVEL. Gravel fine to coarse sub angular to sub rounded.
					(0.40)		
		4.00	CPT	N=8 (4,3,2,2,2,2)	4.00		Loose brown sandy GRAVEL. Gravel fine to coarse sub rounded to rounded.
					(0.80)		
					4.80		Soft to firm dark grey clayey sandy SILT.
			Type	Results			End of Window Sample at 5.00 m

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods
Premier windowless sample drilling rig

Window Sample No
MWS7
Sheet 1 of 1

Project Name	**Project No.**	**Co-ords**	**Hole Type**
Princes Parade	17436A1	-	WLS
Location: Hythe, Kent		**Level** 6.000	**Scale** 1:25
Client: Shepway District Council		**Dates:** 24/06/2015	**Logged By** GOB

Well	Water Strike	Samples & In Situ Testing: Depth (m)	Type	Results	Depth in metres (thickness)	Legend	Stratum Description
					0.20		Rough grasses over TOPSOIL composed of firm brown slightly sandy gravelly clayey SILT with frequent rootlets.
					(0.70)		MADE GROUND composed of medium dense brown clayey sandy GRAVEL with occasional red brick fragments.
					1.10		MADE GROUND composed of firm dark grey gravelly CLAY with occasional red brick and bituminous fragments.
					(0.40)		MADE GROUND composed of soft brown / grey slightly sandy clayey SILT with red brick fragments, occasional bituminous fragments and lenses of clayey sand. Possible ashen odour.
					1.50		MADE GROUND composed of dark grey / dark brown clayey silty SAND with occasional gravels and red brick fragments.
					(2.00)		
					3.50		Soft dark grey slightly sandy clayey SILT.
					(0.30)		
					3.80		Medium dense dark brown clayey sandy GRAVEL. Gravel fine to coarse rounded to sub rounded, sand medium to coarse.
					(0.40)		
					4.20		Medium dense brown / dark brown sandy GRAVEL. Gravel fine to coarse rounded to sub rounded, sand medium to coarse.
					(0.80)		
			Type	Results			End of Window Sample at 5.00 m

1 2 3 4

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

idom merebrook
Offices:
Belper: 01773 829988
Keston: 01689 889980
email: consulting@merebrook.co.uk

Equipment and Methods

Window Sample No
MWS7A
Sheet 1 of 1

Project Name
Princes Parade

Project No.
17436A1

Co-ords
-

Hole Type

Location: Hythe, Kent

Level
-

Scale
1:25

Client: Shepway District Council

Dates: -

Logged By

Well	Water Strike	Samples & In Situ Testing			Depth in metres (thickness)	Legend	Stratum Description
		Depth (m)	Type	Results			
							End of Window Sample at 0.00 m
		1.00	CPT	N=4 (1,1,1,1,1,1)			
		2.00	CPT	N=4 (1,1,1,1,1,1)			
		3.00	CPT	N=5 (1,1,1,1,1,2)			
		4.00	CPT	N=18 (5,4,4,4,4,6)			
			Type	Results			

Remarks:

IVN - in-situ hand vane
IPP - in-situ pocket penetrometer
SPT - in-situ standard penetration test
PID - in-situ photoionization detector

D - small disturbed sample (tub)
J - amber glass jar (250ml)
V - amber glass jar (60ml)
B - bulk disturbed sample

APPENDIX 4

- Soil Chemistry
- Summary Spreadsheet
- Laboratory Analysis Certificates

Gareth O'Brien
Merebrook
First Floor
1 Leonard Place
Westerham Road
Keston
BR2 6HQ

t: 01689 889980
f: 01689 889981
e: gobrien@merebrook.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 : 15-74167

Replaces Analytical Report Number : 15-74167, issue no. 1

Project / Site name:	Princes Parade , Hythe	**Samples received on:**	24/06/2015
Your job number:	17436A1	**Samples instructed on:**	24/06/2015
Your order number:	15-S2-FDO-LABS	**Analysis completed by:**	08/07/2015
Report Issue Number:	2	**Report issued on:**	08/07/2015
Samples Analysed:	2 bulk samples - 18 soil samples		

Signed: [redacted]

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed: [redacted]

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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.

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458142	458143	458144	458145	458146
Sample Reference				MTP1	MTP1	MTP2	MTP2	MTP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.40	1.00-1.20	0.20-0.40	1.90-2.00	0.30-0.50
Date Sampled				17/06/2015	17/06/2015	17/06/2015	17/06/2015	17/06/2015
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	< 0.1	< 0.1	43
Moisture Content	%	N/A	NONE	6.0	7.1	9.6	20	9.0
Total mass of sample received	kg	0.001	NONE	1.1	1.3	1.1	0.89	1.2
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Amosite & Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	Detected
Asbestos Quantification	%	0.001	ISO 17025	-	-	-	-	0.002
General Inorganics								
pH	pH Units	N/A	MCERTS	7.9	7.7	7.3	7.7	8.0
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.16	0.12	0.044	0.87	0.13
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	160	120	44	870	130
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.079	0.060	0.022	0.44	0.067
Sulphide	mg/kg	1	MCERTS	19	1.6	2.8	2.8	3.5
Organic Matter	%	0.1	MCERTS	3.2	3.3	4.3	3.8	2.1
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.22	< 0.05	< 0.05	0.13
Acenaphthylene	mg/kg	0.1	MCERTS	0.38	0.42	0.18	< 0.10	0.41
Acenaphthene	mg/kg	0.1	MCERTS	0.17	0.55	< 0.10	< 0.10	0.17
Fluorene	mg/kg	0.1	MCERTS	0.17	0.83	< 0.10	< 0.10	0.24
Phenanthrene	mg/kg	0.1	MCERTS	2.2	7.6	1.1	0.99	2.6
Anthracene	mg/kg	0.1	MCERTS	0.62	2.2	0.26	0.29	0.96
Fluoranthene	mg/kg	0.1	MCERTS	7.2	14	2.9	2.2	8.8
Pyrene	mg/kg	0.1	MCERTS	6.6	12	2.5	1.9	7.8
Benzo(a)anthracene	mg/kg	0.1	MCERTS	3.5	7.1	1.4	1.3	5.9
Chrysene	mg/kg	0.05	MCERTS	4.4	6.8	1.6	1.5	4.4
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	4.2	7.8	1.7	0.94	5.7
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	3.4	4.5	0.82	0.66	4.0
Benzo(a)pyrene	mg/kg	0.1	MCERTS	4.5	7.5	1.6	0.93	5.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.6	3.7	0.80	0.50	3.1
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.22	0.40	< 0.10	< 0.10	0.75
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.4	4.9	1.1	0.59	3.7
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	43.5	79.9	15.8	11.8	54.2

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458142	458143	458144	458145	458146
Sample Reference				MTP1	MTP1	MTP2	MTP2	MTP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30-0.40	1.00-1.20	0.20-0.40	1.90-2.00	0.30-0.50
Date Sampled				17/06/2015	17/06/2015	17/06/2015	17/06/2015	17/06/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	14	13	35	9.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.8	< 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	35	24	25	36	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	46	45	27	850	30
Lead (aqua regia extractable)	mg/kg	1	MCERTS	150	190	91	150	82
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	22	25	72	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	150	130	710	120
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	52	< 8.0	< 8.0	48	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	52	< 10	< 10	48	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	2.6	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	44	46	< 10	14	31
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	170	100	18	50	67
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	220	150	18	64	98

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458147	458148	458149	458150	458151
Sample Reference				MTP3	MTP4	MTP5	MTP5	MWS1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.50	0.90-1.00	0.40-0.60	1.50	0.40-0.50
Date Sampled				17/06/2015	17/06/2015	17/06/2015	17/06/2015	18/06/2015
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	< 0.1	20	< 0.1
Moisture Content	%	N/A	NONE	12	15	16	16	9.4
Total mass of sample received	kg	0.001	NONE	1.5	1.2	1.0	0.60	1.2
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Amosite & Chrysotile	-	-	Amosite
Asbestos in Soil	Type	N/A	ISO 17025	-	Detected	-	-	Detected
Asbestos Quantification	%	0.001	ISO 17025	-	0.015	-	-	< 0.001
General Inorganics								
pH	pH Units	N/A	MCERTS	7.9	7.4	7.6	7.2	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	9	< 1
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.99	3.6	0.62	3.6	0.35
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	990	3600	620	3600	350
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.50	1.8	0.31	1.8	0.17
Sulphide	mg/kg	1	MCERTS	11	< 1.0	7.0	6.0	< 1.0
Organic Matter	%	0.1	MCERTS	1.0	2.4	3.8	4.1	1.8
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	1.2	< 0.05	0.07	0.16	0.85
Acenaphthylene	mg/kg	0.1	MCERTS	0.71	< 0.10	0.24	0.27	1.4
Acenaphthene	mg/kg	0.1	MCERTS	2.7	< 0.10	0.15	0.17	2.5
Fluorene	mg/kg	0.1	MCERTS	3.6	< 0.10	< 0.10	0.18	2.8
Phenanthrene	mg/kg	0.1	MCERTS	20	0.89	2.2	2.4	28
Anthracene	mg/kg	0.1	MCERTS	5.5	0.30	0.70	0.95	7.8
Fluoranthene	mg/kg	0.1	MCERTS	24	2.9	6.4	8.5	41
Pyrene	mg/kg	0.1	MCERTS	19	2.5	5.2	7.4	33
Benzo(a)anthracene	mg/kg	0.1	MCERTS	11	1.8	3.3	5.3	21
Chrysene	mg/kg	0.05	MCERTS	8.4	1.6	2.9	4.4	17
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	9.0	2.3	2.7	5.2	22
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	6.0	1.0	2.5	3.8	9.6
Benzo(a)pyrene	mg/kg	0.1	MCERTS	8.2	1.8	2.7	4.9	19
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	4.8	1.1	1.7	2.8	10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.97	0.22	0.35	0.66	2.0
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	5.0	1.2	1.9	3.3	12
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	129	17.7	33.1	50.4	230

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458147	458148	458149	458150	458151
Sample Reference				MTP3	MTP4	MTP5	MTP5	MWS1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00-2.50	0.90-1.00	0.40-0.60	1.50	0.40-0.50
Date Sampled				17/06/2015	17/06/2015	17/06/2015	17/06/2015	18/06/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	15	9.7	50	16
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.3	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	20	19	23	110	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	12	16	27	210	120
Lead (aqua regia extractable)	mg/kg	1	MCERTS	280	63	110	660	190
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.6	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	19	23	87	44
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	2.7	< 1.0	< 1.0	2.2
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	89	91	120	1100	230
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	2.7	< 2.0	< 2.0	< 2.0	2.2
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	19	55	16
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	19	55	18
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	2.7	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	28	2.4	< 2.0	< 2.0	28
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	150	17	23	19	210
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	180	39	47	31	260
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	360	58	70	49	500

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458152	458153	458154	458155	458156
Sample Reference				MWS1	MWS2	MWS2	MWS4	MWS6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40-1.70	0.40-0.60	2.50-2.80	0.30-0.50	0.30-0.50
Date Sampled				18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
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	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	6.9	4.3	3.8	11	7.5
Total mass of sample received	kg	0.001	NONE	1.3	1.3	1.2	0.87	1.3
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile- Loose fibres	-	-	Chrysotile- Loose fibres
Asbestos in Soil	Type	N/A	ISO 17025	-	Detected	-	-	Detected
Asbestos Quantification	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH	pH Units	N/A	MCERTS	8.5	8.5	8.6	7.8	9.0
Total Cyanide	mg/kg	1	MCERTS	< 1	2	1	< 1	< 1
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.37	0.29	0.25	0.055	0.54
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	370	290	250	55	540
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.18	0.15	0.13	0.027	0.27
Sulphide	mg/kg	1	MCERTS	1.1	81	11	< 1.0	9.8
Organic Matter	%	0.1	MCERTS	2.9	2.7	1.7	1.0	2.3
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.70	0.59	0.63	< 0.05	0.24
Acenaphthylene	mg/kg	0.1	MCERTS	3.4	1.9	4.0	< 0.10	1.8
Acenaphthene	mg/kg	0.1	MCERTS	23	2.2	3.0	< 0.10	1.9
Fluorene	mg/kg	0.1	MCERTS	22	2.5	5.0	< 0.10	2.6
Phenanthrene	mg/kg	0.1	MCERTS	190	30	41	0.21	21
Anthracene	mg/kg	0.1	MCERTS	53	6.0	12	< 0.10	6.8
Fluoranthene	mg/kg	0.1	MCERTS	300	76	73	0.54	45
Pyrene	mg/kg	0.1	MCERTS	230	63	61	0.48	38
Benzo(a)anthracene	mg/kg	0.1	MCERTS	130	41	32	0.27	24
Chrysene	mg/kg	0.05	MCERTS	100	33	30	0.31	18
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	110	46	34	0.28	28
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	56	20	12	0.15	9.1
Benzo(a)pyrene	mg/kg	0.1	MCERTS	91	37	26	0.24	21
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	50	23	15	< 0.10	13
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	11	4.4	3.0	< 0.10	3.0
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	57	24	17	< 0.05	15
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	1430	411	369	2.48	248

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458152	458153	458154	458155	458156
Sample Reference				MWS1	MWS2	MWS2	MWS4	MWS6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40-1.70	0.40-0.60	2.50-2.80	0.30-0.50	0.30-0.50
Date Sampled				18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	10	14	23	16
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	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	18	29	35	64	26
Copper (aqua regia extractable)	mg/kg	1	MCERTS	150	31	47	4.0	48
Lead (aqua regia extractable)	mg/kg	1	MCERTS	68	340	110	23	150
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.5	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	20	56	52	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.9	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	78	120	170	66	370
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	1.2	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	35	3.6	3.1	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	62	11	< 8.0	< 8.0	8.2
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	120	51	29	< 8.0	45
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	220	66	32	< 10	54
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	1.5	1.7	2.1	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	380	30	38	< 2.0	22
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	2200	470	340	< 10	250
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	2500	1200	550	12	490
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	5000	1700	930	12	760

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458157	458158	458159		
Sample Reference				MWS6	MWS7	MWS7		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				1.00-1.50	1.00-1.40	3.50-3.80		
Date Sampled				18/06/2015	18/06/2015	18/06/2015		
Time Taken				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	< 0.1		
Moisture Content	%	N/A	NONE	18	15	19		
Total mass of sample received	kg	0.001	NONE	1.2	1.1	1.1		
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-		
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-		
Asbestos Quantification	%	0.001	ISO 17025	-	-	-		
General Inorganics								
pH	pH Units	N/A	MCERTS	7.9	8.1	7.8		
Total Cyanide	mg/kg	1	MCERTS	2	< 1	< 1		
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	3.5	0.16	0.95		
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	3500	160	950		
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	1.8	0.080	0.47		
Sulphide	mg/kg	1	MCERTS	1.1	< 1.0	3.9		
Organic Matter	%	0.1	MCERTS	1.5	1.2	2.4		
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.11	< 0.05	< 0.05		
Acenaphthylene	mg/kg	0.1	MCERTS	0.52	< 0.10	0.23		
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10		
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10		
Phenanthrene	mg/kg	0.1	MCERTS	1.9	1.3	1.1		
Anthracene	mg/kg	0.1	MCERTS	0.53	0.34	0.30		
Fluoranthene	mg/kg	0.1	MCERTS	7.4	2.7	4.3		
Pyrene	mg/kg	0.1	MCERTS	6.4	2.2	3.7		
Benzo(a)anthracene	mg/kg	0.1	MCERTS	3.7	1.2	1.7		
Chrysene	mg/kg	0.05	MCERTS	4.8	1.1	2.7		
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	5.3	0.84	2.6		
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	3.7	0.51	1.3		
Benzo(a)pyrene	mg/kg	0.1	MCERTS	4.7	0.63	1.9		
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	3.1	0.30	1.3		
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.78	< 0.10	0.23		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.2	0.43	1.6		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	46.1	11.4	23.0		

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Your Order No: 15-S2-FDO-LABS

Lab Sample Number				458157	458158	458159		
Sample Reference				MWS6	MWS7	MWS7		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				1.00-1.50	1.00-1.40	3.50-3.80		
Date Sampled				18/06/2015	18/06/2015	18/06/2015		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	20	8.7	16		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.1	< 0.2	< 0.2		
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	27	25	34		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	40	8.6	36		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	840	39	73		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	< 0.3	< 0.3		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	21	26		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	1200	55	75		
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	9.5	< 8.0	< 8.0		
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10		
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	1.5	< 1.0		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	2.7	5.4	< 2.0		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	33	22	23		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	97	32	62		
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	130	62	85		

Analytical Report Number: 15-74167
Project / Site name: Princes Parade , Hythe
Your Order No: 15-S2-FDO-LABS

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.

Any material greater than 16mm is considered as Bulk sample and reported separately, asbestos content (if any) is not included in the final Quantitative analysis. 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
458146	MTP3	0.30-0.50	115	Insulation Lagging & Loose Fibres	**Amosite & Chrysotile**	0.002	**0.002**
458148	MTP4	0.90-1.00	103	Insulation Board/Tile & Loose Fibres	**Amosite & Chrysotile**	0.015	**0.015**
458151	MWS1	0.40-0.50	127	Loose Fibres	**Amosite**	< 0.001	**< 0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditatior

Analytical Report Number: 15-74167

Project / Site name: Princes Parade , Hythe

Lab Sample Number				458160	458161			
Sample Reference				MTP2	MTP5			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.40	0.60			
Date Sampled				17/06/2015	17/06/2015			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Bulk Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Asbestos Identification Name	Type	N/A	ISO 17025	Chrysotile-Hard/cement type material	Chrysotile-Hard/cement type material			

Analytical Report Number : 15-74167

Project / Site name: Princes Parade , Hythe

* 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 *
458142	MTP1	None Supplied	0.30-0.40	Beige loam and sand with gravel and vegetation.
458143	MTP1	None Supplied	1.00-1.20	Beige loam and sand with gravel and vegetation.
458144	MTP2	None Supplied	0.20-0.40	Beige loam and sand with gravel and vegetation.
458145	MTP2	None Supplied	1.90-2.00	Beige loam and sand with gravel and vegetation.
458146	MTP3	None Supplied	0.30-0.50	Beige loam and sand with gravel and vegetation.
458147	MTP3	None Supplied	2.00-2.50	Beige loam and sand with gravel and vegetation.
458148	MTP4	None Supplied	0.90-1.00	Beige loam and sand with gravel and vegetation.
458149	MTP5	None Supplied	0.40-0.60	Beige loam and sand with gravel and vegetation.
458150	MTP5	None Supplied	1.50	Beige loam and sand with gravel and vegetation.
458151	MWS1	None Supplied	0.40-0.50	Beige loam and sand with gravel and vegetation.
458152	MWS1	None Supplied	1.40-1.70	Beige loam and sand with gravel and vegetation.
458153	MWS2	None Supplied	0.40-0.60	Beige loam and sand with gravel and vegetation.
458154	MWS2	None Supplied	2.50-2.80	Beige loam and sand with gravel and vegetation.
458155	MWS4	None Supplied	0.30-0.50	Beige loam and sand with gravel and vegetation.
458156	MWS6	None Supplied	0.30-0.50	Beige loam and sand with gravel and vegetation.
458157	MWS6	None Supplied	1.00-1.50	Beige loam and sand with gravel and vegetation.
458158	MWS7	None Supplied	1.00-1.40	Beige loam and sand with gravel and vegetation.
458159	MWS7	None Supplied	3.50-3.80	Beige loam and sand with gravel and vegetation.

Analytical Report Number : 15-74167

Project / Site name: Princes Parade , Hythe

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Bulks	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	W	ISO 17025
Asbestos Quantification	The analysis was carried out using documented in-house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006	D	ISO 17025
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
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
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	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 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
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

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.

APPENDIX 5

- Field Monitoring Records
- Groundwater Level Data
- Hazardous Soil Gas Data

MODIFIED WILSON AND CARD GAS CHARACTERISTIC SITUATION

SITE: Princes Parade JOB NUMBER: 17436ai 04/11/2016

Carbon Dioxide			Methane		
Maximum Gas Concentration	9.30 %	carbon dioxide concentration greater than 5% consider Characteristic Situation 2	Maximum Gas Concentration	0.10 %	
Maximum Measured Steady Flow	0.10 L hr^{-1}		Maximum Measured Peak Flow	0.10 L hr^{-1}	
Gas Screening Value	0.01 L hr^{-1}		Gas Screening Value	0.00 L hr^{-1}	
Characteristic Situation	1		Characteristic Situation	1	

if measured values are zero then resolution limit of instrument is used for calculation of GSV
worst case carbon dioxide or methane characteristic situation value defines overall characterstic situation for the site

Modified Wilson and Card Classification

					BS 8485:2015 Gas Protection Scores - refer to standard for full guidance			
					Minimum Gas Protection Score Required			
Characteristic Situation	Risk Classification	Gas Screening Value Threshold (L hr^{-1})	Additional Factors	Typical Source of Generation	Type A Building	Type B Building	Type C Building	Type D Building
1	very low risk	<0.07	typically methane not to exceed 1% and/or carbon dioxide 5% otherwise consider increase to situation 2	natural soils with low organic content; 'typical' made ground	0	0	0	0
2	low risk	0.07 to <0.7	borehole air flow rate not to exceed 70 L hr^{-1} otherwise consider increase to situation 3	natural soils with high peat/organic content; 'typical' made ground	3.5	3.5	2.5	1.5
3	moderate risk	0.7 to <3.5		old landfill, inert waste, mineworking flooded	4.5	4	3	2.5
4	moderate to high risk	3.5 to <15	quantitative risk assessment required to evaluate scope of protective measures	mineworking susceptible to flooding, completed landfill	6.5 A)	5.5 A)	4.5	3.5
5	high risk	15 to <70		mineworking unflooded inactive with shallow workings near surface	hazard too high for this method to define protection measures	6.5 A)	5.5	4.5
6	very high risk	>70		recent landfill site	hazard too high for this method to define protection measures	hazard too high for this method to define protection measures	7.5	6.5

BS 8485:2015 Gas Protection Measures - refer to standard for full guidance
Select two or more elements from the following three types of protection to achieve score (only one element per type permitted)

Structural Barrier	Score B)	Ventilation Measures		Score	Gas Resistant Membrane	Score
Precast suspended segmental subfloor (i.e. beam and block)	0	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	Gas resistant membrane meeting all of the following criteria: 1. sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method) 2. sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions 3. sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab) 4. 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, etc) 5. capable, after installation, of providing a complete barrier to the entry of the relevant gas 6. verified in accordance with CIRIA C735	2
Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)	0.5	Passive sub floor dispersal layer	Very good performance E)	2.5		
			Good performance E)	1.5		
Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations	1 or 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 E)		1.5 to 2.5		
Basement floor and walls conforming to BS 8102:2009, Grade 2 waterproofing D)	2	Active positive pressurization 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 E)		1.5 to 2.5		
Basement floor and walls conforming to BS 8102:2009, Grade 3 waterproofing D)	2.5	Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park) F)		4		

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 scores are conditional on breaches of floor slabs, etc., being effectively sealed

C) 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

D) The score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product

E) Refer to BS 8485:2015 Annex B to determine performance and assign score

F) Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F

Building Types

Type A
Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.

FOR TYPE A BUILDINGS ACTIVE VENTILATION MEASURES ARE INAPPROPRIATE

Type B
Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.

Type C
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
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 categorized as Type B or Type C).

GAS MONITORING RECORD ROUND 1

idom merebrook

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		$l\ hr^{-1}$		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS1	10:00	0	0	1021	0	0	0	9.3	14.2	0	0	0.007	nr	nd	4.05	-
MWS4	10:15	0	0	1022	0	0	0	3.7	16.3	0	0	0.017	nr	nd	3.95	-
MWS6	10:30	0	0	1022	0	0	0	2.1	18.4	0	0	0.007	nr	nd	4.04	-
MWS7	10:45	0	0	1022	0	0	0	1	20.5	0	0	0.011	nr	nd	4.08	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Weather:	Hot and sunny	nr = not recorded	**Gas Analyser**	**PID**	**Site:**	Princes Parade
		Model:	GFM436	-	**Project Number:**	17436AI
		Serial Number:	12228	-	**Monitored By:**	Gareth O'Brien
		Date of Last Calibration:	15/06/2016	-	**Date:**	29/06/2015

GAS MONITORING RECORD ROUND 2

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		$l\ hr^{-1}$		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS1	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS4	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS6	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS7	12:20	0	0	1017	0	0	0	0	20.8	0	0	0.035	nr	DRY	4.15	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Weather:	Sunny with the occasional cloud and light winds (Pressure rose 1016-1017 in previous 24hrs).	nr = not recorded	Gas Analyser	PID	Site:	Princes Parade
		Model:	GFM436	-	Project Number:	17436AI
		Serial Number:	12228	-	Monitored By:	Jessica Susan Smith
		Date of Last Calibration:	15/06/2016	-	Date:	22/07/2016

GAS MONITORING RECORD ROUND 3

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		$l\ hr^{-1}$		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS1	11:08	0	0	1021	0	0	0	3.6	16.9	0	0	0.018	nr	nd	4.12	A further dip was carried out (11:50) after high tide - the installation was still dry. High tide was at 11:10.
MWS4	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS6	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS7	10:56	0	0	1020	0	0	0	0.1	20.8	0	0	0.025	nr	nd	4.12	A further dip was carried out (11:45) after high tide - the installation was still dry. High tide was at 11:10.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Weather:	Warm and sunny. Pressure falling (1026 to 1020 in previous 24hrs).	nr = not recorded	Gas Analyser	PID	Site:	Princes Parade
		Model:	GM436	-	Project Number:	17436AI
		Serial Number:	42536	-	Monitored By:	Nathan Dellow
		Date of Last Calibration:	23/03/2016	-	Date:	31/08/2016

GAS MONITORING RECORD ROUND 4

Location Reference	Time	Flow and Pressure Measurements				Gas Measurements						VOC Measurements		Dip Measurements		Comments
		Flow		Atmospheric Pressure	Differential Pressure	Methane	Methane LEL	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Hexane	PID	Depth to Water	Depth to Base	
		max	steady													
		$l\ hr^{-1}$		mb	Pa	%	%	%	%	ppm	ppm	%	ppm	m	m	
MWS1	15:45	0	0	1018	0	0	0	3.1	16.7	-10	0	0.008	nr	nd	4.12	High tide was at 15:13.
MWS4	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS6	-	-	-	-	-	-	-	-	-	-	nr	-	nr	-	-	Installation could not be located.
MWS7	15:35	0	0	1018	0	0	0	0	20.2	0	0	0.008	nr	nd	4.12	High tide was at 15:13.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Weather:	Cloudy with sunny spells. Pressure steady.	nr = not recorded	Gas Analyser	PID	Site:	Princes Parade
		Model:	GFM436	-	Project Number:	17436AI
		Serial Number:	12228	-	Monitored By:	Nathan Dellow
		Date of Last Calibration:	15/06/2016	-	Date:	21/10/2016

APPENDIX 6

- Previous Investigations
- Ground Solutions Group Limited – Phase 1 Report (ref: 44518_1/OJR)
- Ground Solutions Group Limited – Phase 2 Geo-Environmental Investigation (ref: 44518/1/OJR)

Shepway District Council

PRINCES PARADE, SEABROOK KENT

Phase 1 Desk Study and Site Walkover

Ground Solutions Group Limited
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Telephone: 01233 658270
Fax: 01233 658299

June 2002
44518/AMM

CONTENTS

1. INTRODUCTION

Ground Solutions Group Limited (GSG) were instructed by Shepway District Council (SDC) to proceed with a Geo-Environmental Investigation at a site off Princes Parade, Seabrook Road, Hythe, Kent.

The aim of the geo-environmental project being to examine existing ground conditions and investigate the potential and implications of developing the site for residential and leisure/open space uses. The study has been split into two distinct phases: Phase 1, Desk Study and Site Walkover, and Phase 2, Preliminary Intrusive Ground Investigation.

This document reports the findings of Phase 1, which included the following core components:

- Desk study research;
- Site walkover;
- Soil gas survey.

We understand that it is proposed to redevelop the area under investigation to residential/flat accommodation, with public open space. We further understand that at present the planned area for the proposed development is the eastern end of the site.

2. SITE LOCATION AND DESCRIPTION

The site is located off Princes Parade, Hythe and is centred on approximate Ordnance Survey grid reference TR 180 347 as shown on Figure 1 (Site Location Plan). The site is triangular in shape and tapers to an apex at its eastern most point (Figures 2a and 2b). The site is bounded by Princes Parade, which runs along the sea front, to the south, by the Royal Military Canal to the north and The Imperial Hotel links golf course to the west. The eastern most point of the site abuts a children's play area.

Beyond the Royal Military Canal runs the A259 (Seabrook Road), beyond which are residential properties, including guesthouses and hotels. South of Princes Parade is the English Channel.

The total length of the site is approximately 1.5 km. The site is divided in its length into two parts by a footpath leading from Princes Parade to a bridge crossing the Military Canal. In general, the site is generally level although the western end is slightly higher (between 0.5 m to 1 m) than the eastern end.

The site is, for the most part, covered with grass and occasional scrubs. However, in the north eastern corner of the site the vegetation is overgrown with small trees and large scrubs.

3. ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey 1:50000 Series, Sheet 305 and 306 Folkestone and Dover A, indicated that the site lies to the south of the scarp slope of the Hythe Beds escarpment, a feature susceptible to land instability. The site its self comprised an area of generally level ground between the escarpment and the sea, made up predominantly of Storm Beach Gravels.

The Storm Beach Gravels consist of gravels with some sand which have been thrown up into ridges by wave action. Where there has been a ready supply of shingle the beach accretes seaward by the addition of sub parallel ridges.

Thin bands of marine alluvium are shown in the area and which generally comprise brown and blue clays. These were probably formed in slight depressions and hollows between shingle ridges. A thin band of clay coinciding within the easternmost section of the Royal Military Canal is believed to be alluvium associated with the Seabrook Stream which formerly flowed into a harbour at Hythe.

Underlying the Storm Beach Gravels and Marine Alluvium is the Weald Clay which typically comprises cyclic sequences of dark grey silts with subordinate siltstones, sandstones, shelly limestones and clay ironstones. The Weald Clay is often weathered to light grey and yellow mottled high plasticity clays near surface.

3.2 GROUNDWATER

Reference to the Environment Agency's 1:100 000 scale Groundwater Vulnerability map of the area, Sheet 47, East Kent, indicated that the strata underlying the site are classified as a Minor Aquifer.

Minor Aquifers (variably permeable) can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable variability including unconsolidated deposits. Although these aquifers will seldom produce large quantities of water for abstraction, they are important both for local supplies and in supplying base flow to rivers. Major Aquifers may occur beneath Minor Aquifers.

The soils are indicated to be of high leaching potential (HU), with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater. However, this is a worse case classification due to the sparse data available for urban areas.

The site is not situated within a groundwater Source Protection Zone (SPZ).

The close proximity of the site to the sea would result in groundwater beneath it being strongly influenced by tidal variation. Tidal variations are likely to affect both groundwater levels and quality.

3.3 SURFACE WATER

The nearest surface water course to the site is the Royal Military Canal, which is located immediately to the north of the site. The canal has a sluice at the eastern end of the site.

The Environment Agency's General Quality Assessment Scheme provided a measure of both chemical and biological water quality for rivers and canals in England and Wales. One of the six grades, A to F is allocated.

On the basis of the 2000 data, water quality for the Seabrook Sluices, is as follows:

Parameter	Grade
Chemistry	Fairly good
Biology	Very good
Nitrate	Moderately Low
Phosphate	Low
Aesthetics	Fair

3.4 RADON ASSESSMENT

Reference to the National Radiological Protection Board's "Radon Atlas of England and Wales" indicated that less than 1% of houses within the 5 km square which included the site have radon concentrations above the action level of 200 Bq/m^3. The site is therefore not located within a "Radon Affected Area" which would otherwise require buildings to incorporate appropriate radon control measures.

3.5 ADDITIONAL INFORMATION

Reference was made to the environmental database Sitescope, extracts from which are provided in Appendix 1. Relevant information relating to the sites environmental sensitivity is summarised as follows:

The British Geological Survey classify the area as being susceptible to landslip or land instability, however, this classification is related to areas north of the Royal Military Canal where steep slopes and rock faces are present.

Two water abstraction licences were recorded between 250 m and 500 m of the site with six being recorded within a 1000 m radius of the site.

A single discharge consent was recorded between 500 m and 1000 m radius of the site.

There were four former landfill sites recorded within a 1000 m radius of the site.

No pollution incidents were recorded within a 250 m radius of the site. Two Category 3 (Minor) pollution incidents were recorded within a 500 m radius of the site, with 30 pollution accidents recorded within a 2000 m radius of the site. All these 30 incidents were either Category 3 (Minor) or Category 4 (Unsubstantiated).

There were no Site of Special Scientific Interest recorded within a 1000 m radius of the site, although two were recorded between 1000 m and 2000 m.

A single industrial land use was recorded within a 250 m radius of the site with Chapel laboratories noted to the northwest of the site.

No mines and quarries, IPC Part B authorisations, chemical releases, operational landfills, waste treatment sites, National Nature Reserves, Environmentally Sensitive Areas, Nitrate Sensitive Areas or Nitrate Vulnerable Zones were recorded near the site.

4. SITE HISTORY

4.1 HISTORIC MAPS

A map search was carried out for the site and the extracts of the following Ordnance Survey maps were obtained:

YEAR	SCALE	SHEET REFERENCE
1875	6 inch (extract not to scale)	KENT 74
1899	6 inch	KENT 74 SE
1908	6 inch	KENT 74 SE
1931	6 inch	KENT 74 SE
1938	6 inch	KENT 74 SE
1946	6 inch	KENT 74 SE
1958	1:2500	TR 1834
1958	1:2500	TR 1834
1959	1:2500	TR 1834
1961	1:10560	TR 13 SE
1976	1:10000	TR 13 SE
1990	1:10560	TR 13 SE

These are presented in Appendix 2 and the relevant historic details are summarised as follows:

1872

The general outline of the site was shown, with the north boundary formed by the Royal Military Canal (The Canal was constructed between 1804 and 1804), which was raised above surrounding ground level. The south side of the site was not shown and in 1875 the land sloped towards the English Channel. The High Water Mark was shown.

A road was shown forming the western boundary of the site and a station House, and Sluice for the canal shown at the eastern end of the site. To the north of the canal the Royal Military Road was shown, beyond which the land was primarily open space, with a small number of woodlands and residential properties also shown. A gas works was shown to the north of the canal, at the eastern end of the site. The town of Hythe was shown to the north west of the site.

The site and land to the west were shown as open spaces. The site is split into two areas by a footpath.

1899

The general outline of the site had been clearly formed with Princes Road shown running along the southern boundary of then site. A number of Groynes were shown extending from this road into the beach.

General residential and industrial development was shown to the north of the Royal Military Canal, which included the Hythe and Sandgate Branch of South Eastern Railways (SER), quarries, a gravel pit and buildings.

Boat Houses and a Police Station were indicated at the eastern end of the site, and the gas works was no longer shown.

1908

The western half of the site has been levelled and remnants of the beach were no longer shown. Beach was still indicated on the eastern part of the site. No other significant changes were shown on the site. The surrounding area has undergone general development including housing and commercial properties.

1931

Part of the site had been designated a Recreational Ground. No other significant changes were shown on the site. The surrounding area has undergone general development including housing and commercial properties. The open land immediately west of the site was designated a Golf Links.

1938

No significant changes are shown to the site or the surrounding area.

1958/9

The large-scale (1:2500) maps indicated that the site was generally flat. In the eastern part of the site a small gravel pit was shown. A drain was also shown running the length of the north side of the western part of the site and the Recreation Ground was no longer indicated. The Royal Military canal was shown as disused. No significant changes are shown to the site or the surrounding area.

1961

No significant changes are shown to the site or the surrounding area.

1976

The Gravel Pit and Drain were no longer shown, and the ground appears to be flat. No other significant changes are shown to the site or the surrounding area.

1990

No significant changes are shown to the site or the surrounding area.

4.2 ADDITIONAL INFORMATION

A children's play area has been constructed immediately beyond the extreme eastern point of the site. Prior to the development of this play area an intrusive investigation was carried out by Weeks Consulting, which was made available by SDC prior to this current study.

The Weeks investigation comprised the drilling of two boreholes using shell and auger techniques, logging of the ground conditions encountered and the collection of samples for laboratory analysis. The boreholes were fitted with standpipes for groundwater and landfill gas monitoring purposes.

The ground conditions reported were Made Ground to depths of between 4.3 m and 4.6 m below ground level (bgl) overlying Storm Beach Gravel. The Made Ground was described as consisting of clay, sand and gravel (flint, brick, concrete, ash and clinker) with deposits of rubber tubing, rope, wood leather etc. The Storm Beach Gravel consisted of flint gravel with some sand and clay.

Elevated concentrations of potentially toxic (to humans) and phytotoxic metals were recorded in a sample recovered from a depth of 2 m bgl in one of the boreholes. No methane was detected at the site although carbon dioxide was. Flow rates of carbon dioxide were reported as variable and this was assigned to pressure changes due to tidal action. The Weeks report concluded that the site did not pose a risk to future users given the proposed end use.

No significant testing was carried out relation to geotechnical aspects of the development and it was concluded that, given the low loadings likely, they would be within the bearing capacity of the Made Ground.

The letter giving the results of a search of Kent's landfill sites was also provided by SDC. This identified a landfill site at Princes Parade that was closed in 1975 that received Category B and C wastes. Category B wastes included Slowly Degradable Waste (B1) and Scrap Metal (B2), whilst Category C Wastes are those that are Putrescible or Difficult. The depth of the landfill was reported to be 5 m.

It is also understood that dredgings from the canal are likely to have been disposed of onto the site. No data exists in relation to the quantity or the quality of these dredging, although recent analytical data (1998), which was supplied by SDC, from tests carried out on samples of the canal sediment indicate that the concentrations of potential contaminants were generally low.

5. SOIL GAS SPIKE SURVEY

A soil gas survey was carried out on 7th June 2002 at 87 positions across the site. The soil gas survey comprised monitoring of soil gases within narrow diameter holes up to 1 m deep, formed using an impact searcher at the locations shown on Figures 2a and 2b. The atmosphere within the resultant voids was monitored for concentrations of carbon dioxide, methane and oxygen using portable equipment. The results of the soil gas survey are tabulated in Appendix 3.

The concentrations of methane measured were consistently less than instrument detection limits (< 0.25% v/v). Carbon dioxide concentrations varied from less than instrument detection limits (< 0.25% v/v) to maximum concentrations of 7% v/v. 37 monitoring locations recorded carbon dioxide concentrations of between 1.5% v/v and 5% v/v, with only 5 locations recording concentrations greater than 5% v/v.

Methane was not detected in measurable concentrations across the site, and therefore it is considered that there is unlikely to be a significant risk posed to any future development of the site from this gas, although pockets of the gas may exist at depth.

The Building Research Establishment (BRE) guideline "BRE 212, Construction of New Buildings on Gas-Contaminated Land" provides advice on building on land where land fill gas may be present. The guidance recommends that if the concentration of CO_2 in the ground is greater than 1.5% v/v then the incorporation of gas control measures should be considered, and if the concentration of CO_2 is above 5% v/v then gas control measures should be incorporated in designs.

It is likely that much of the carbon dioxide was from natural biological processes including soil microbial activity and root respiration. However, the additional monitoring and analytical works (assessment of gas generating potential) will provide additional data to fully assess any risks that may be posed by landfill gases.

6. ECOLOGICAL CONSIDERATIONS

Although a detailed ecological assessment of the site was not undertaken as part of the general Site Walkover the possibility that the overgrown areas of vegetation may support protected species was noted. Many animals and their habitats are afforded some level of protection under the Wildlife and Countryside Act 1981 (as amended). This legislation makes it illegal to intentionally, deliberately or recklessly kill, injure or capture many animals, as well as prohibiting or disturbance, damage, destruction of habitat.

Any significant intrusive investigation could be deemed a contravention of the Wildlife and Countryside Act 1981 (as amended) were such species/habitats present at the site. It is therefore recommended that an Ecological Assessment of the site in general, but focusing on the northeastern area in order to confirm, or otherwise, the presence of protected species be undertaken prior to any intrusive works.

7. CONTAMINATION CONSIDERATIONS

The investigation into the sites history indicates that it was used for the disposal of waste and canal dredgings. The categories of wastes accepted were such that a potential contamination risk is present. The nature and distribution of any potential sources of pollution would be determined by Phase 2 investigations.

We would however note that the chemical and biological quality of the Royal Military Canal waters are classified as fairly good and very good respectively which indicates that no significant mobile source of contamination is impacting on the canal.

The Minor Aquifer in strata beneath the site has not resulted in the site being classified as being in a Source Protection Zone (i.e. no abstraction nearby). This would suggest that the groundwater in the area is not a significantly sensitive receptor of any contamination that may be present.

Future site occupants could be exposed via ingestion, inhalation or direct contact to contaminated soils should they be present. The risk of exposure will depend upon a number of factors including the source and bioavailability of the contamination, potential pollutant pathways and the layout of buildings and hardstanding area in relation to any contamination.

Remedial options would be dependent upon the outcome of site-specific risk assessment but are likely to be limited to the incorporation of clean topsoil layers in gardens and open spaces. However, if significant hotspots of contamination were encountered then excavation and offsite disposal may be required, although based on the findings of the desk study, this is considered unlikely.

8. GEOTECHNICAL CONSIDERATIONS

The desk study research for the site has indicated that there a number of potential geotechnical hazards. These have been given careful consideration in the design of the intrusive ground investigation phase of works in order to obtain appropriate site sampling and testing coverage together with soil parameters for use in the design and construction of appropriate foundations. The principal geotechnical hazards include:

- The history of previous excavation on site and their subsequent backfilling with domestic waste during the operation of the landfill - this would have resulted in the presence of low strength and highly compressible material near the surface. The nature of the near surface soils will influence the depth and type of foundations that can be used.

- Variable soil type and locally low strength of the near surface natural deposits and the unknown but potentially variable depth to solid geology in this locality. This would influence depth and type of foundations that can be used.

- An anticipated high, and tidally influenced groundwater level, with groundwater quality likely to have been affected by saline intrusion - the groundwater level variation will have to be taken into consideration in the design of any foundations as it could have an influence on soil strength and compressibility. The saline nature of groundwater must be considered with respect to aggressive chemical attack on buried concrete.

- Stability issues and foundation performance associated with any construction that may be planned close to the site boundary with the Royal Military Canal. This would influence depth and type of foundations and requirements for canal bank stabilisation.

9. CONCLUSIONS AND RECOMMENDATIONS

The conclusions that may be drawn from this desk study, site walkover and soil gas survey:

- The Royal Military Canal and Princes Parade have enclosed the site since the late 1800's. In general the historic maps indicate that little potentially contaminative activities have taken place at the site although a gravel pit was present in 1961. The Gravel Pit was no longer present on the 1976 map. This corresponds to other data, which suggests the presence of a landfill on the site, which was formally closed in 1975.

- Superficial deposits of Marine Alluvium clays and Storm Beach Gravels underlie the site. These in turn are underlain by solid formation of Weald Clay and possibly Atherfield Clay.

- The strata beneath the site are classified as a Minor Aquifer, and the site is not situated in a groundwater Source Protection Zone.

- A previous investigation at the site recorded concentrations of potential contaminants which could be prejudicial to site redevelopment. However, the sample recording elevated concentrations was recovered from a depth of 2 m and no significant risk was considered present.
- The site is well vegetated across much of its area which suggests an absence of phytotoxic metals and/or elevated concentrations of land fill gases.
- The former uses of the site as a landfill, coupled with the results of previous works undertaken at part of the site, suggest that there is a possibility for contamination to be present at the site. The contamination could be prejudicial to the proposed redevelopment. The intrusive works currently planned, coupled with a site-specific risk assessment, are considered adequate to fully characterise the site in terms of contamination.
- The vegetated areas could represent important habitats for protected animal and plant species, and a more detailed ecological assessment of the site is considered necessary.
- During the soil gas survey no significant concentrations of methane were recorded across the site.
- Elevated concentrations of carbon dioxide were detected across much of the site, and at levels which would require consideration to be given to the incorporation of gas control measures in any buildings constructed on the site.
- It is likely that much of the carbon dioxide was from natural biological processes including soil microbial activity and root respiration. However, the assessment of gas generating potential will provide the additional data to fully assess any risks that may be posed by landfill gases.

Our recommendations for the intrusive works are provided in Appendix 4. These recommendations have been based upon the original scope of works and modified, where necessary, based on the findings of the desk study and discussions held between SDC and GSG.

GSG GROUND SOLUTIONS GROUP LTD	Scale: NTS	Princes Parade, Seabrook
	Source: OS LANDRANGER Sheet 179 Reproduced from the Ordnance Survey's 1:50,000 map of 1999 with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright. AL550426. Ground Solutions Group Ltd., Station Road, Ashford, Kent, TN23 1PP.	Project No.: 44518
	Date: 11th May 2002	SITE LOCATION PLAN FIGURE 1.

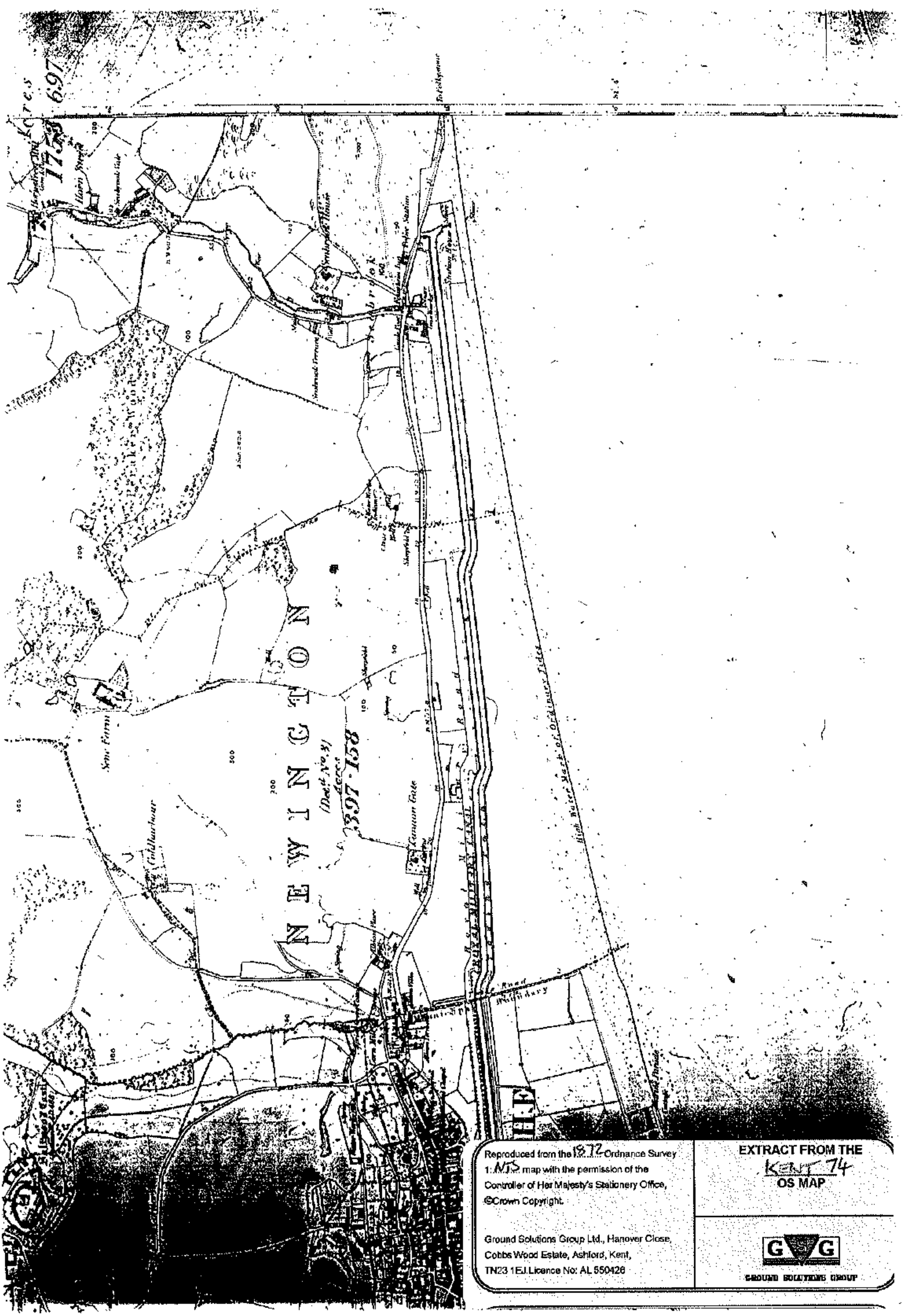
APPENDIX 1
Sitescope Survey Results

Seabrook Road
Hythe
Kent
CT21 5QN

Number of hits per search band

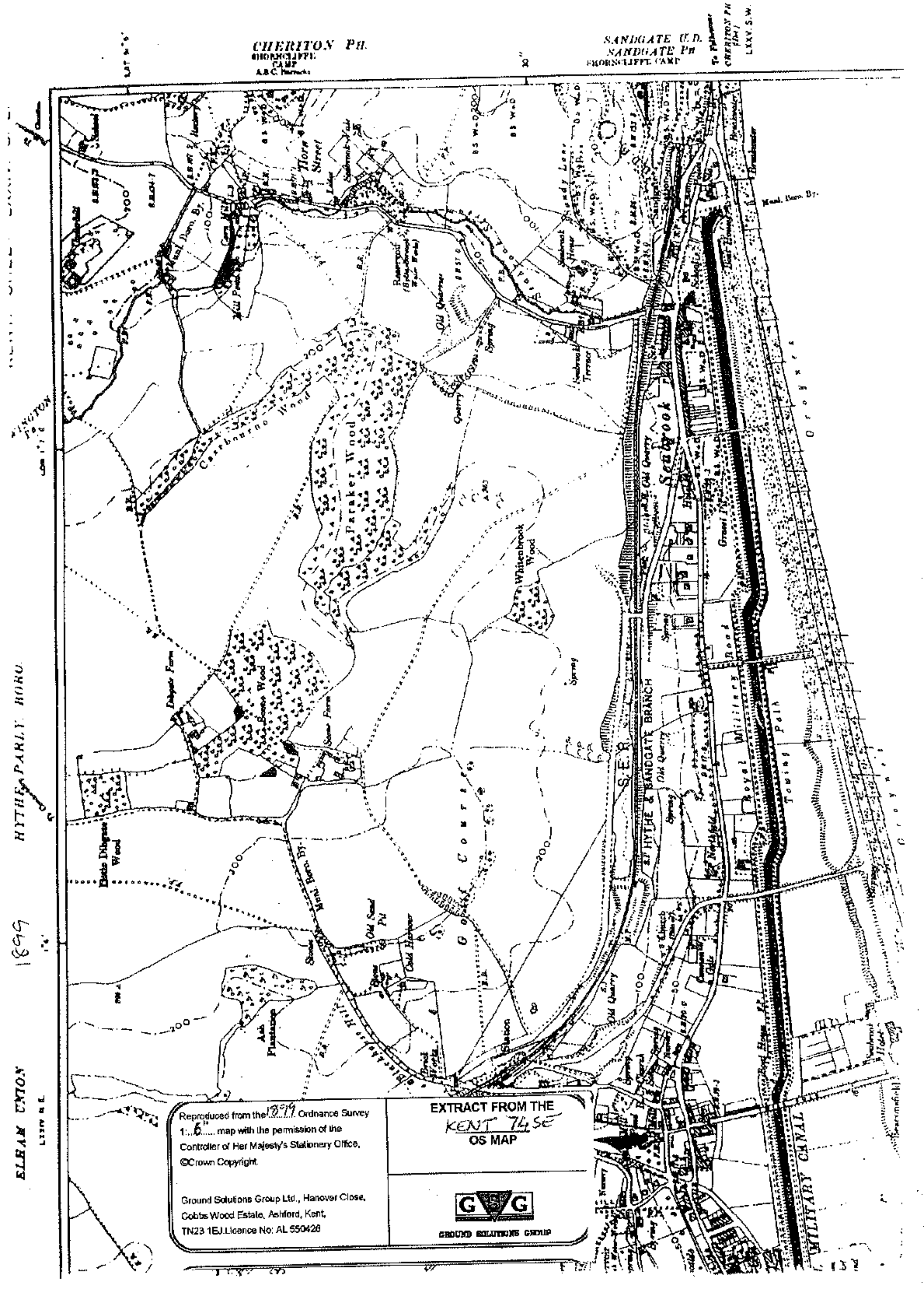
Provider	Dataset	Postcode	0-250m	251-500m	501-1000m	1001-2000m
BGS	1:250,000 Solid Geology	--	1	2	3	4
BGS	Landfill Survey	--	1	1	1	0
BGS	Landslip	--	1	1	1	1
CONT	Historical Industrial Landuse	--	1	0	1	3
EA	Abstractions Licences	--	0	2	2	6
EA	Discharge Consents	--	0	0	1	1
EA	Former Landfill	--	2	2	1	0
EA	Pollution Incidents	--	0	2	2	29
EA	River Quality Survey	--	1	1	1	1
EN	Sites of Special Scientific Interest	--	0	0	0	2
GWV	Groundwater Vulnerability	--	1	2	4	5
HC	Current Industrial Land Use	--	1	0	0	7

APPENDIX 2
Historic Maps



EXTRACT FROM THE
KENT 74
OS MAP

GROUND SOLUTIONS GROUP

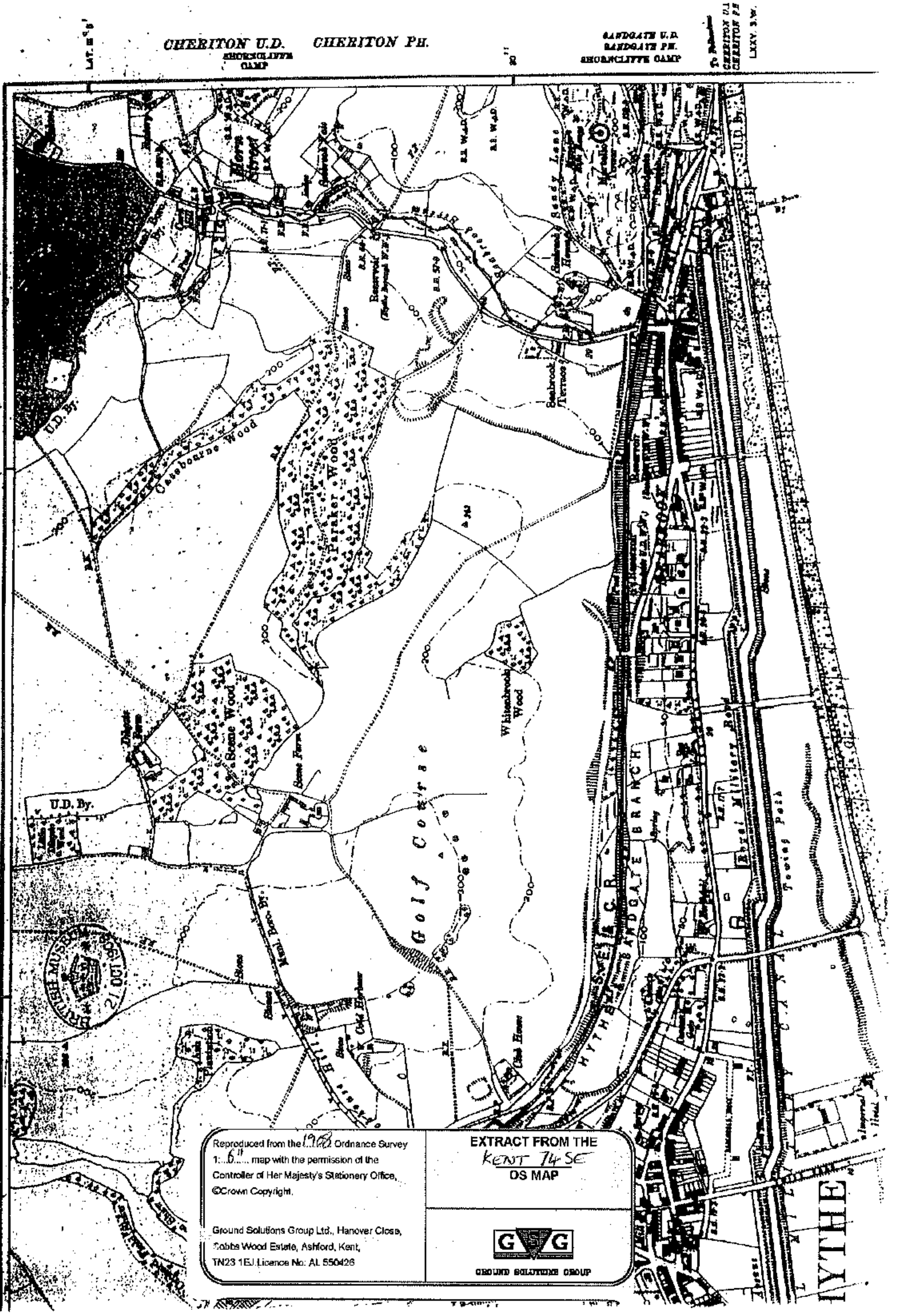


Reproduced from the 1899 Ordnance Survey 1:6" map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ.Licence No: AL 550426

EXTRACT FROM THE KENT 74SE OS MAP

GROUND SOLUTIONS GROUP

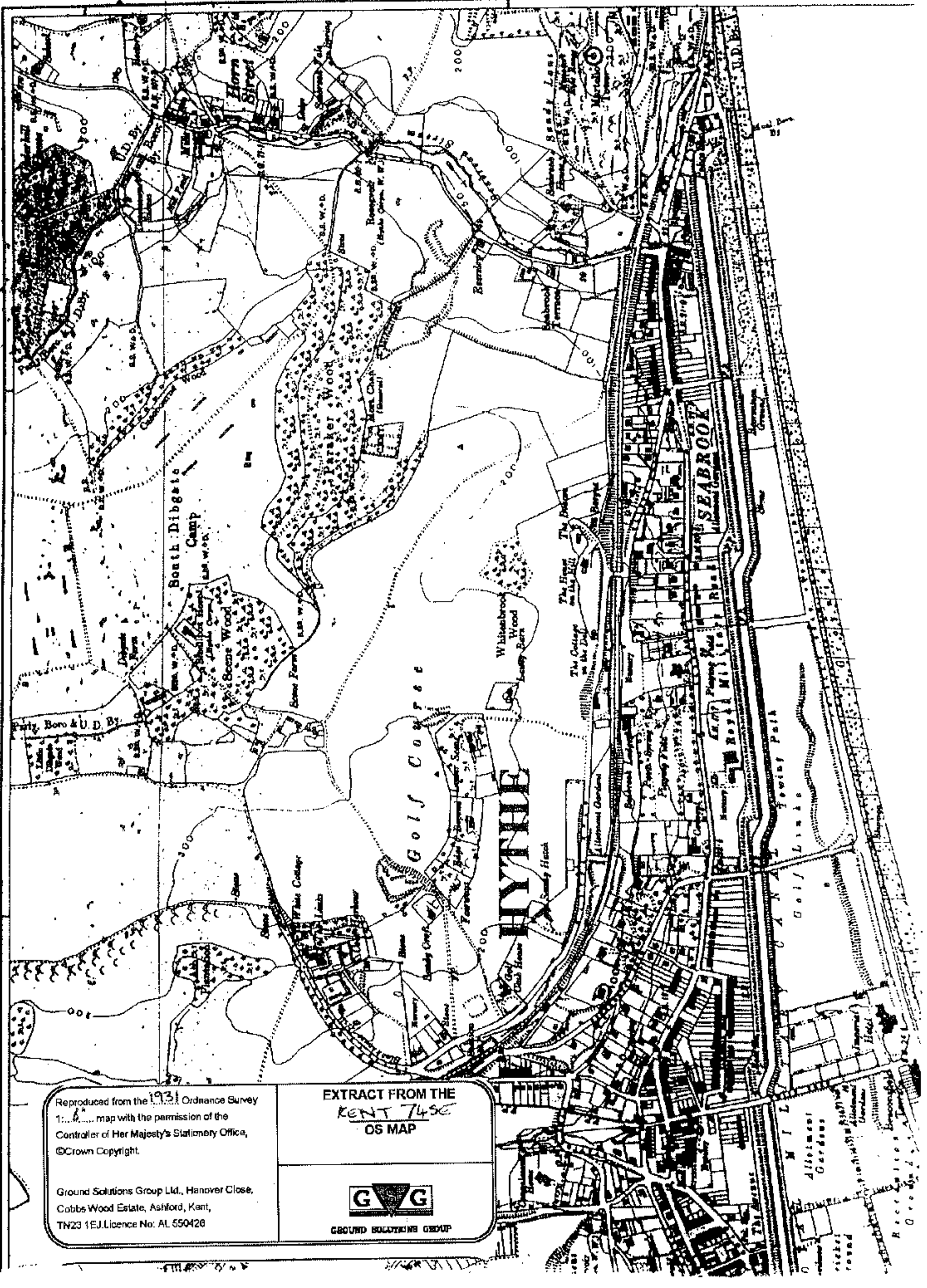


Reproduced from the 1908 Ordnance Survey 1:6" map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

EXTRACT FROM THE KENT 74 SE OS MAP

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ Licence No: AL 550426

GROUND SOLUTIONS GROUP

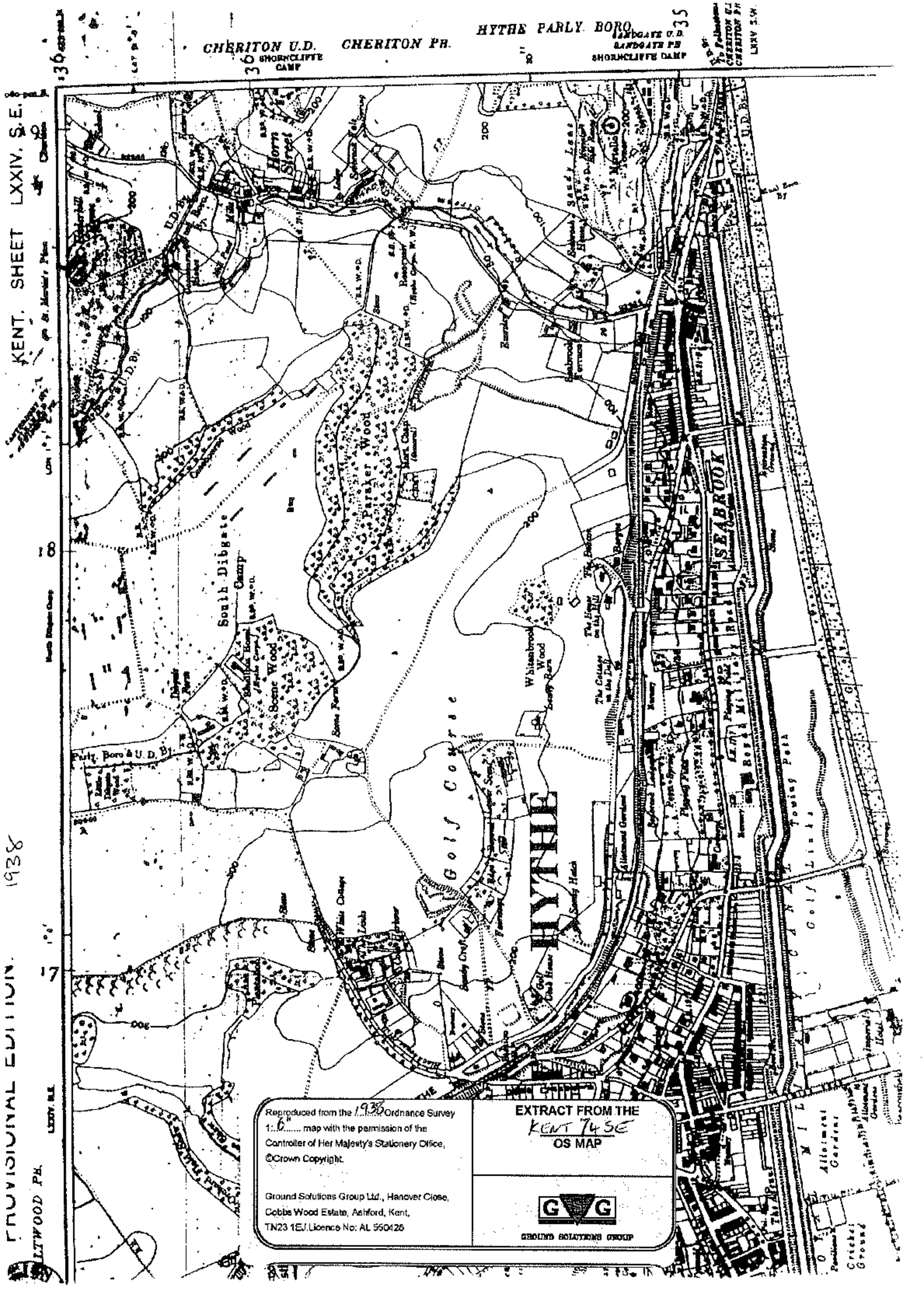


Reproduced from the 1931 Ordnance Survey 1:...6"... map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ.Licence No: AL 550426

EXTRACT FROM THE KENT 74SE OS MAP

GSG
GROUND SOLUTIONS GROUP

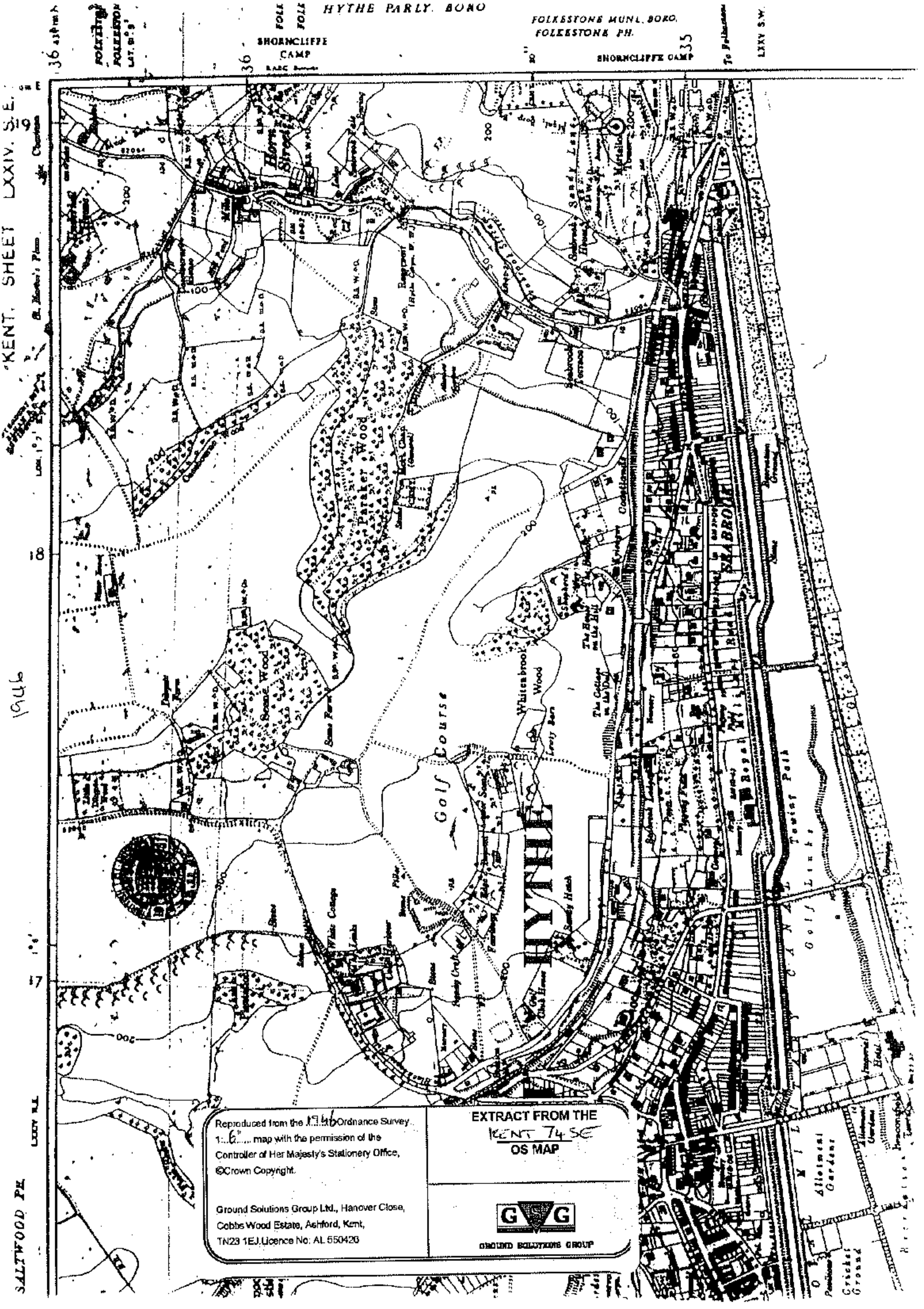


Reproduced from the 1938 Ordnance Survey 1:6" map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ.Licence No: AL 550426

EXTRACT FROM THE
KENT 74 SE
OS MAP

GSG
GROUND SOLUTIONS GROUP



Reproduced from the 1946 Ordnance Survey 1:6" map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ. Licence No: AL 550420

EXTRACT FROM THE
KENT 74 SE
OS MAP

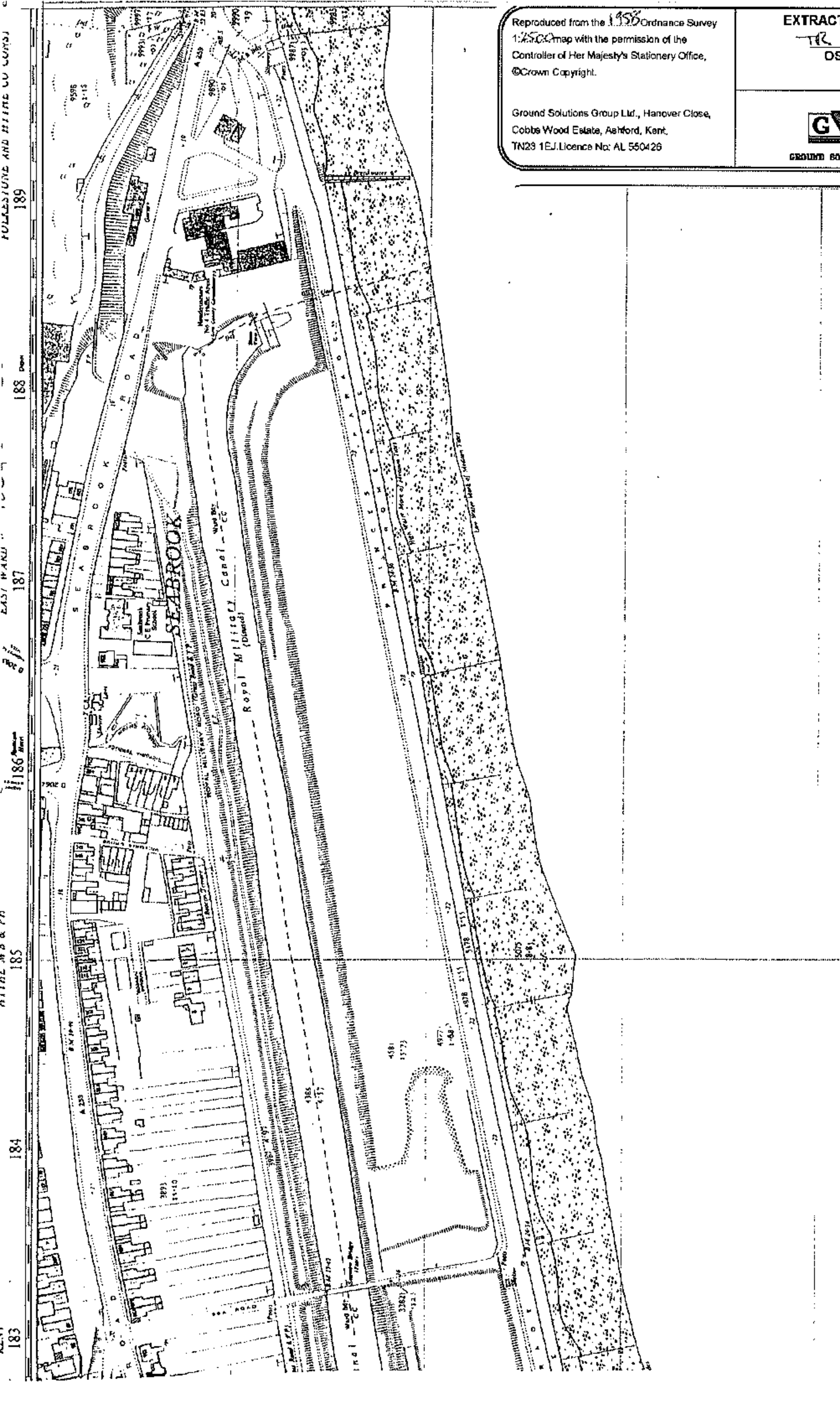
GSG
GROUND SOLUTIONS GROUP

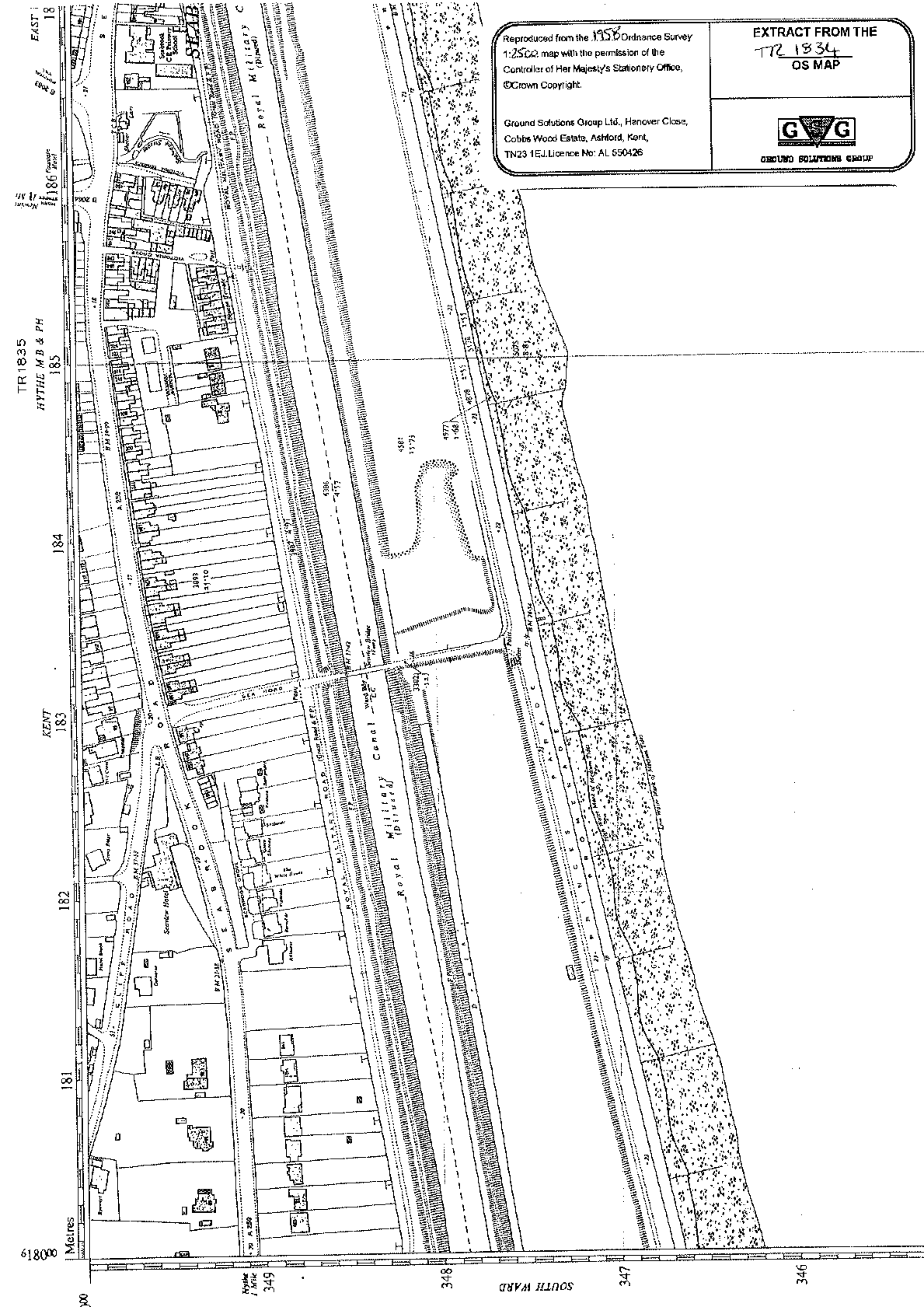
Reproduced from the 1958 Ordnance Survey 1:2500 map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ.Licence No: AL 550426

EXTRACT FROM THE TR 1834 OS MAP

GROUND SOLUTIONS GROUP





Reproduced from the 1958 Ordnance Survey 1:2500 map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ. Licence No: AL 550426

EXTRACT FROM THE TR 1834 OS MAP

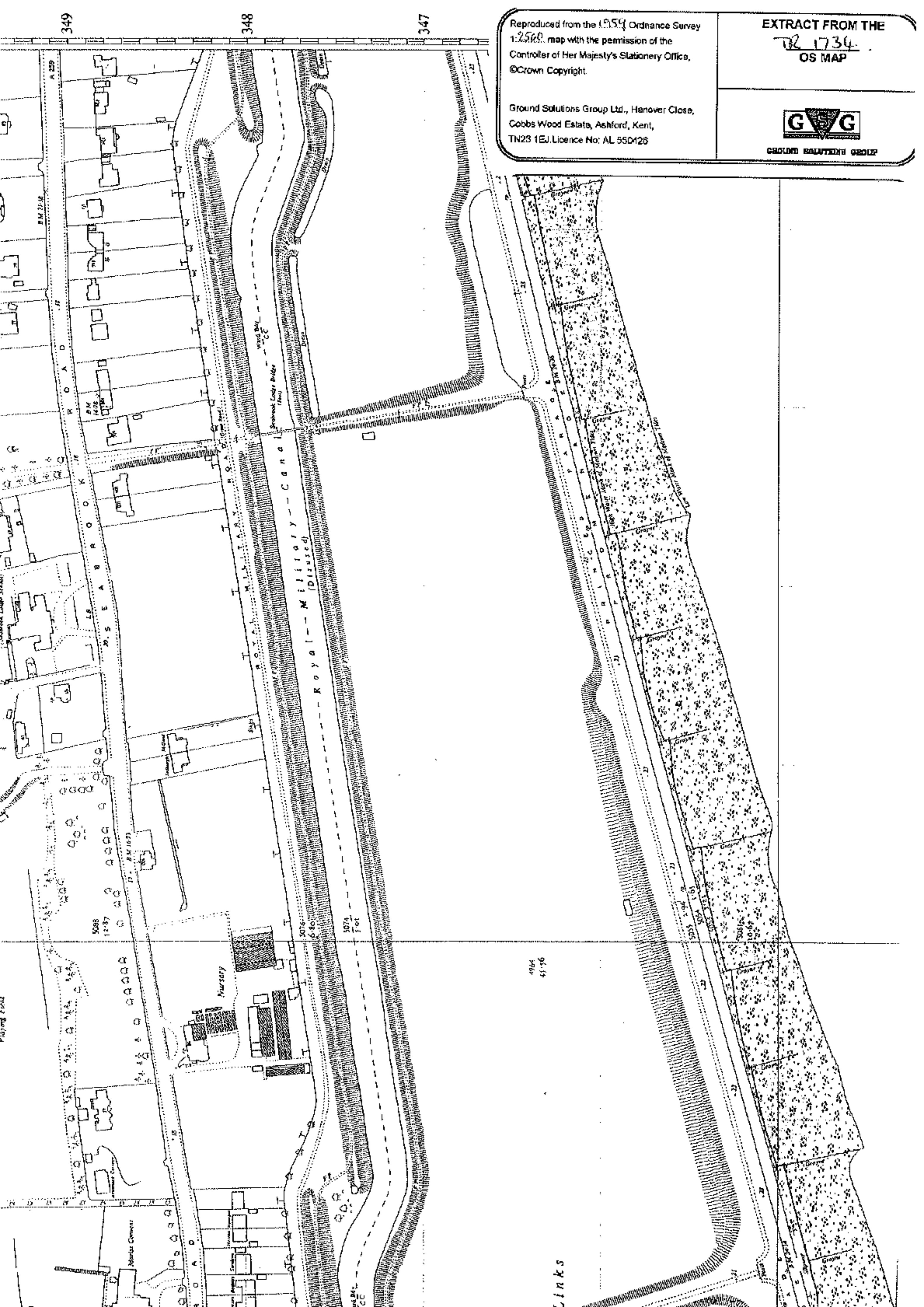
GSG
GROUND SOLUTIONS GROUP

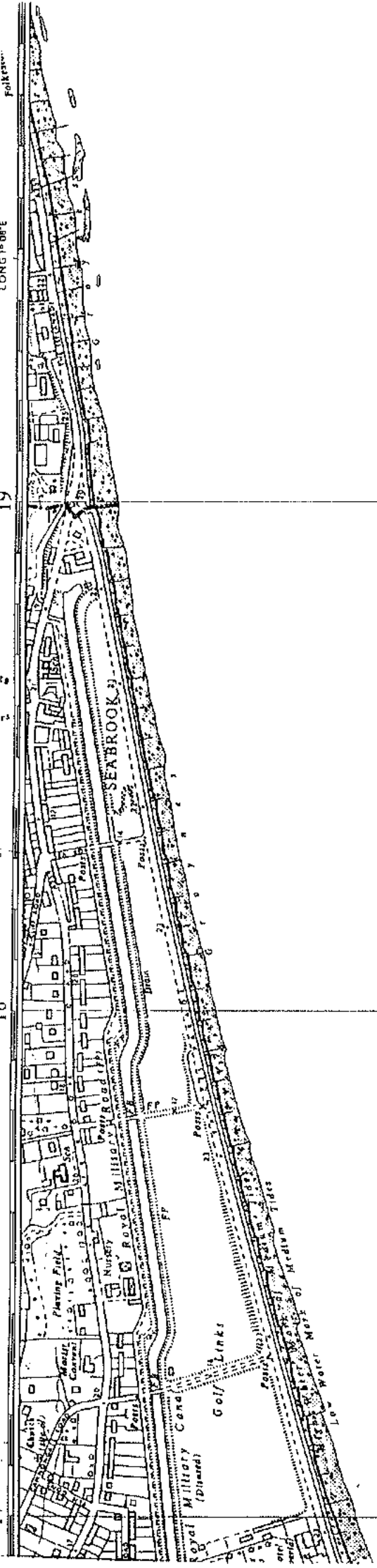
Reproduced from the 1959 Ordnance Survey 1:2500 map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ. Licence No: AL 550126

EXTRACT FROM THE TR 1734. OS MAP

GROUND SOLUTIONS GROUP





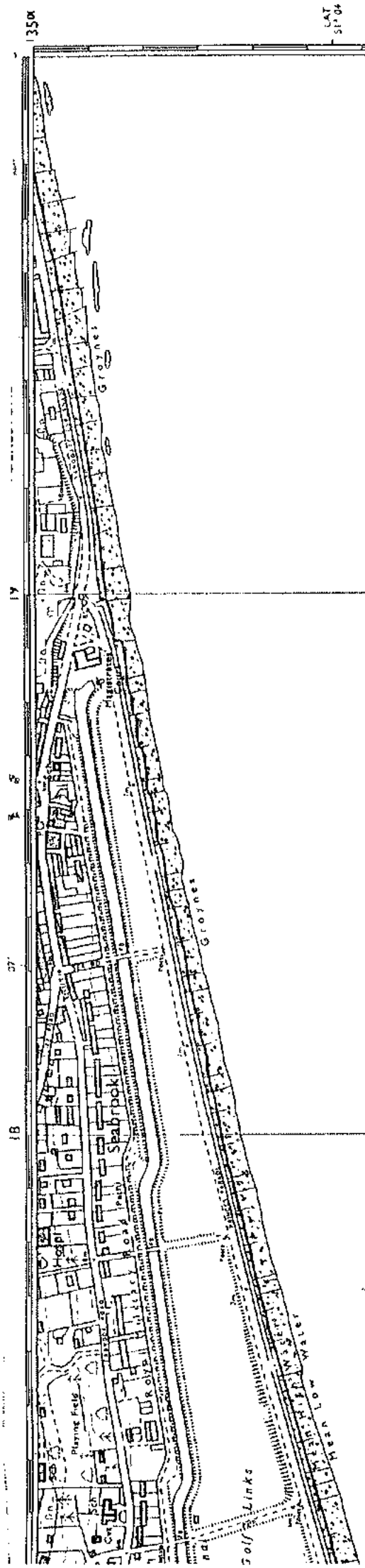
Reproduced from the 1961 Ordnance Survey 1:10560 map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ. Licence No: AL 550426

EXTRACT FROM THE
TR13SE
OS MAP

GROUND SOLUTIONS GROUP

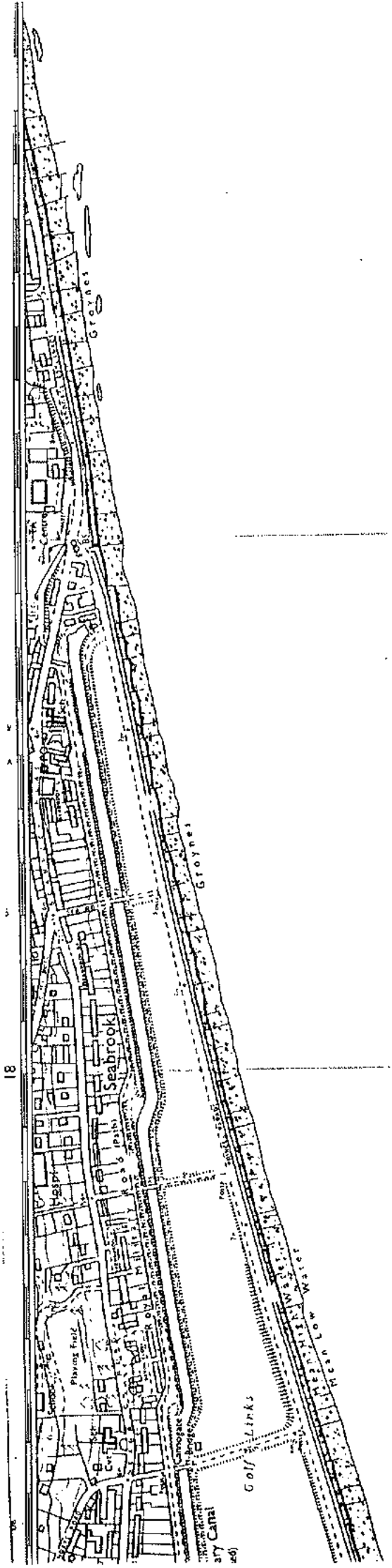
TR 13 SE 1976



EXTRACT FROM THE TR 13 SE OS MAP

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ Licence No: AL 550426

GSG GROUND SOLUTIONS GROUP



Reproduced from the 1990 Ordnance Survey 1:10000 map with the permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright.

Ground Solutions Group Ltd., Hanover Close, Cobbs Wood Estate, Ashford, Kent, TN23 1EJ. Licence No: AL 550426

EXTRACT FROM THE
TL 13 SE
OS MAP

GSG
GROUND SOLUTIONS GROUP

APPENDIX 3
Soil Gas Survey Results

GAS MONITORING RESULTS

Project: Princes Parade, Seabrook
Location: Princes Parade, Seabrook
Job No. 44518
Date: 07/06/02
Weather: Overcast, windy 8/8 cloud.
Temp: 10°C (am) - 16°C (pm)
Equipment Used: Landsurveyor 2 (SN 404887)

Monitoring Point No.	Methane (% v/v)	Oxygen (% v/v)	Carbon Dioxide (% v/v)	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
SP1	< 0.25	17.4	2.9		
SP2	< 0.25	20.7	0.7		
SP3	< 0.25	14.4	5.2		
SP4	< 0.25	19.1	1.4		
SP5	< 0.25	19.4	1.8		
SP6	< 0.25	17.6	3.0		
SP7	< 0.25	19.7	2.4		
SP8	< 0.25	19.5	1.2		
SP9	< 0.25	20.2	0.9		
SP10	< 0.25	20.3	0.9		
SP11a	< 0.25	16.6	1.3		
SP11b	< 0.25	14.3	6.0		
SP12	< 0.25	21.0	0.6		
SP13	< 0.25	20.6	1.3		
SP14	< 0.25	19.2	2.1		
SP15	< 0.25	18.4	1.8		
SP16	< 0.25	15.0	3.5		
SP17	< 0.25	18.9	5.1		
SP18	< 0.25	17.2	2.7		
SP19	< 0.25	10.6	4.5		
SP20	< 0.25	20.6	0.8		

Site Observations/ Comments

Time	Barometric Pressure
	1002 mBar

Datum Description:
Elevation of datum wrt ground level:

Tested by: JLM
Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP LIMITED

Notes: * For indicative purposes only

Accuracy of Readings:-

Landsurveyor 1: **0-100% CH_4**: 1% Nominal or 1.5% gas
0-25% O_2: 1% reading
CO_2 Portable: **0-100% CO_2**: 10% reading

GAS MONITORING RESULTS

Project:	Princes Parade, Seabrook	Date: 07/06/02	Equipment Used: Landsurveyor 2 (SN 404887)
Location:	Princes Parade, Seabrook	Weather: Overcast, windy 8/8 cloud.	
Job No.	44518	Temp: 10°C (am) - 16°C (pm)	

Monitoring Point No.	Methane (% v/v)	Oxygen (% v/v)	Carbon Dioxide (% v/v)	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
SP21	< 0.25	20.3	0.9		
SP22a	< 0.25	20.7	0.4		
SP22b	< 0.25	20.9	< 0.25		
SP23	< 0.25	20.7	1.3		
SP24	< 0.25	20.7	0.9		
SP25	< 0.25	20.9	< 0.25		
SP26	< 0.25	20.9	< 0.25		
SP27	< 0.25	20.9	< 0.25		
SP28	< 0.25	20.9	0.3		
SP29	< 0.25	20.6	2.4		
SP30	< 0.25	19.3	2.2		
SP31	< 0.25	20.9	< 0.25		
SP32	< 0.25	20.8	< 0.25		
SP33	< 0.25	20.5	1.1		
SP34	< 0.25	20.8	2.8		
SP35	< 0.25	20.8	0.4		
SP36	< 0.25	19.8	1.0		
SP37	< 0.25	20.8	1.8		
SP38	< 0.25	20.3	2.2		
SP39	< 0.25	18.3	1.2		
SP40	< 0.25	17.7	1.8		

Site Observations/ Comments

Time	Barometric Pressure
	1002 mBar

Datum Description:

Elevation of datum wrt ground level:

Tested by: JLM

Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP LIMITED

Notes: * For indicative purposes only

Accuracy of Readings:-

Landsurveyor 1: **0-100% CH_4**: 1% Nominal or 1.5% gas

0-25% O_2: 1% reading

CO_2 Portable: **0-100% CO_2:** 10% reading

GAS MONITORING RESULTS

Project:	Princes Parade, Seabrook	Date: 07/06/02	Equipment Used: Landsurveyor 2 (SN 404887)
Location:	Princes Parade, Seabrook	Weather: Overcast, windy 8/8 cloud.	
Job No.	44518	Temp: 10°C (am) - 16°C (pm)	

Monitoring Point No.	Methane (% v/v)	Oxygen (% v/v)	Carbon Dioxide (% v/v)	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
SP41	< 0.25	18.7	0.6		
SP42	< 0.25	18.5	2		
SP43	< 0.25	18.8	1.1		
SP44	< 0.25	19.7	0.7		
SP45	< 0.25	18.8	2.4		
SP46	< 0.25	18.9	1.6		
SP47	< 0.25	20.4	0.4		
SP48	< 0.25	20.0	0.7		
SP49	< 0.25	16.7	2.8		
SP50	< 0.25	19.6	1.1		
SP51	< 0.25	16.4	2.9		
SP52	< 0.25	18.7	1.4		
SP53	0.7	18.9	1.0		
SP54	< 0.25	18.1	2.4		
SP55	< 0.25	15.3	4.5		
SP56	< 0.25	19.4	0.9		
SP57	< 0.25	17.5	2.6		
SP58	< 0.25	19.9	1.4		
SP59	< 0.25	18.5	1.4		
SP60	< 0.25	19.8	1.3		
SP61	< 0.25	19.3	1.2		

Site Observations/ Comments

Time	Barometric Pressure
	1002 mBar

Datum Description:

Elevation of datum wrt ground level:

Tested by: JLM

Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP LIMITED

Notes: * For indicative purposes only

Accuracy of Readings:-

Landsurveyor 1: **0-100% CH_4**: 1% Nominal or 1.5% gas

0-25% O_2: 1% reading

CO_2 Portable: **0-100% CO_2:** 10% reading

GAS MONITORING RESULTS

Project:	Princes Parade, Seabrook	Date: 07/06/02	Equipment Used: Landsurveyor 2 (SN 404887)
Location:	Princes Parade, Seabrook	Weather: Overcast, windy 8/8 cloud.	
Job No.	44518	Temp: 10°C (am) - 16°C (pm)	

Monitoring Point No.	Methane (% v/v)	Oxygen (% v/v)	Carbon Dioxide (% v/v)	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
SP62	< 0.25	18.8	2.2		
SP63	< 0.25	19.5	1.4		
SP64	< 0.25	19.5	1.4		
SP65	< 0.25	19.4	1.2		
SP66	< 0.25	19.5	1.5		
SP67	< 0.25	18.4	1.8		
SP68	< 0.25	18.0	2.1		
SP69	< 0.25	18.3	2.2		
SP70	< 0.25	15.9	4.5		
SP71	< 0.25	14.4	4.8		
SP72	< 0.25	15.3	5.0		
SP73	< 0.25	19.8	4.3		
SP74	< 0.25	12.0	7.0		
SP75	< 0.25	15.4	6.0		
SP76	< 0.25	18.1	2.7		
SP77	< 0.25	19.4	3.0		
SP78	< 0.25	18.0	2.7		
SP79	< 0.25	19.4	1.4		
SP80	< 0.25	20.8	0.4		
SP81	< 0.25	19.4	1.5		
SP82	< 0.25	19.7	1.3		

Site Observations/ Comments

Time	Barometric Pressure
	1002 mBar

Datum Description:

Elevation of datum wrt ground level:

Tested by: JLM

Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP LIMITED

Notes: * For indicative purposes only

Accuracy of Readings:-

Landsurveyor 1: **0-100% CH_4**: 1% Nominal or 1.5% gas

0-25% O_2: 1% reading

CO_2 Portable: **0-100% CO_2:** 10% reading

GAS MONITORING RESULTS

Project:	Princes Parade, Seabrook	Date: 07/06/02	Equipment Used: Landsurveyor 2 (SN 404887)
Location:	Princes Parade, Seabrook	Weather: Overcast, windy 8/8 cloud.	
Job No.	44518	Temp: 10°C (am) - 16°C (pm)	

Monitoring Point No.	Methane (% v/v)	Oxygen (% v/v)	Carbon Dioxide (% v/v)	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
SP83	< 0.25	18.2	3.0		
SP84	< 0.25	20.5	1.2		
SP85	< 0.25	20.4	1.3		
SP86	< 0.25	19.1	1.8		
SP87	< 0.25	19.2	1.9		

Site Observations/ Comments

Time	Barometric Pressure
	1002 mBar

Datum Description:

Elevation of datum wrt ground level:

Tested by: JLM

Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP LIMITED

Notes: * For indicative purposes only

Accuracy of Readings:-

Landsurveyor 1: **0-100% CH_4**: 1% Nominal or 1.5% gas

0-25% O_2: 1% reading

CO_2 Portable: **0-100% CO_2:** 10% reading

APPENDIX 4

Recommendations for Phase 2 Preliminary Intrusive Ground Investigation

RECOMMENDATIONS FOR PHASE 2
PRELIMINARY INTRUSIVE GROUND INVESTIGATION

These recommendations are based on the original scope of works and modified, where necessary, based on the findings of the desk study and discussions held between SDC and GSG. The scope of the Phase 2 Preliminary Intrusive Ground Investigation has been designed to confirm or otherwise the findings, recommendations and conclusions reached in the Phase 1 Desk Study.

Ecological Assessment

The Phase 1 Desk Study and Site Walkover identified areas of the site, notable the north eastern corner which have the potential to provide suitable habitats for protected animal species. Any significant intrusive investigation could be deemed a contravention of the Wildlife and Countryside Act 1981 (as amended) where such habitats be present. We therefore propose to undertake an Ecological Assessment of the site in general, but focusing on the north eastern area in order to confirm, or otherwise, the presence of protected species.

A suitably qualified and experienced Chartered Biologist will undertake the assessment. The findings of the assessment will be reported to Shepway District Council prior to the execution of any intrusive site works.

Intrusive Works

Trial Pitting

Ground investigation by trial pitting will be carried out in order to examine near surface in situ conditions and to recover samples for subsequent chemical laboratory inspection and testing. Trial pit locations will be on an approximate 50 m grid across the site, although any site evidence of potential contamination may result in modification to the intrusive locations as and when required. It is estimated that the excavation of approximately 30 trial pits will provide sufficient site coverage. All trial pits will be backfilled with arisings upon completion.

Trial pitting will be undertaken across the whole of the site since the presence, or absence, of contamination will influence both residential and open space redevelopment strategies.

Gas Monitoring Standpipes

The presence of up to 7% (v/v) carbon dioxide recorded during the soil gas survey, undertaken as part of Phase 1, has confirmed that there is a potential for landfill gas generation. Therefore, based on observations during the trial pit excavations, up to 10 trial pits will be fitted with gas monitoring standpipes.

Boreholes

The geotechnical element of the investigation is looking to establish whether or not shallow foundations are viable on this site or if a combination of shallow and deep foundation solutions will be required and if so in which broad areas of the site. We understand that the proposed redevelopment plan for site involves built structure on only part of the site. We have therefore modified our geotechnical related intrusive works to focus on this area and provide a limited coverage of the rest of the site to provide preliminary data should the redevelopment plans be modified. The main modifications to our original scope is that we will drill only three boreholes, to a maximum depth of 20 m, in the proposed development area, and undertake 1 day of Cone Penetration Testing (CPT friction and piezo cone) across the site.

Disturbed samples would be taken at regular intervals for logging purposes. Undisturbed sampling and in-situ testing would be carried out at regular intervals throughout the boreholes as appropriate to ground conditions. Standard Penetration Tests will also be undertaken, as appropriate, during the excavation of the boreholes.

The CPT work will provide detailed information on the strength/density profile of the ground and, given its speed of operation will allow a more detailed ground model to be developed across the site as a whole, necessary for meeting the objective of the study.

Each borehole will be fitted with gas monitoring standpipes which will comprise a 50 mm slotted tube, fitted with a cap and protected by a lockable cover.

At the time of preparing this proposal anticipated layout of roads and car parking areas are not known. However, CBR values can be estimated based on the findings of the intrusive works and these values will be suitable for preliminary design purposes.

Monitoring

One week after the completion of the site works an environmental scientist/technician will revisit the site and undertake gas monitoring and groundwater sampling. Groundwater samples will be collected and subjected to chemical analysis.

Gas Emission Rate Assessment

The concentrations of carbon dioxide, with a maximum of 7% (v/v) are not considered high enough to undertake meaningful gas emission rate testing. Therefore we propose not to undertake this testing but increase the number of samples scheduled for the assessment of gas generation potential (see Laboratory Testing below).

Laboratory Testing

Contamination

All samples collected during the intrusive investigation will be screened on site using a portable PID to identify whether volatile organic compounds are present. The results will be used to assist in the selection of samples for subsequent laboratory analysis. Up to 100 samples will be scheduled for laboratory analysis.

The analytical suite will be based upon the findings of the desk study and potential sources of contamination identified, but is likely to include ICRCL (59/83) Tables 3 and 4. Any groundwater encountered during the trial pit excavations will also be sampled and subjected to the same analytical suite to test for soluble and mobile contaminant species.

It is possible that significant gas concentrations may not be found but that significant biodegradable material is encountered in the trial pits. In this event and following major ground disturbance as may occur during any redevelopment it is possible that conditions within the waste mass could change giving rise to methane generation. Therefore we have included for the testing of up to 40 samples of fill material for gas generation potential as outlined in Waste Management Paper 26a (Landfill Completion). This will involve the determination of the Acid Digestible Fibre/Volatile Solids ratio for the selected samples.

Geotechnical

Laboratory geotechnical work will include the following tests on selected samples:

- moisture content determination;
- atterberg limits;
- particle size distribution;
- water soluble sulphate of soils;
- chloride content of groundwater;
- sulphate content of groundwater sample;
- pH value of soil or groundwater;
- undrained triaxial compression;
- consolidation tests in an oedometer.

Reporting

Phase 2

Following completion of Phase 2 a final report would be produced. This would include an outline of the works carried out and an interpretation of the results gathered from the desk study, site investigation and analytical works.

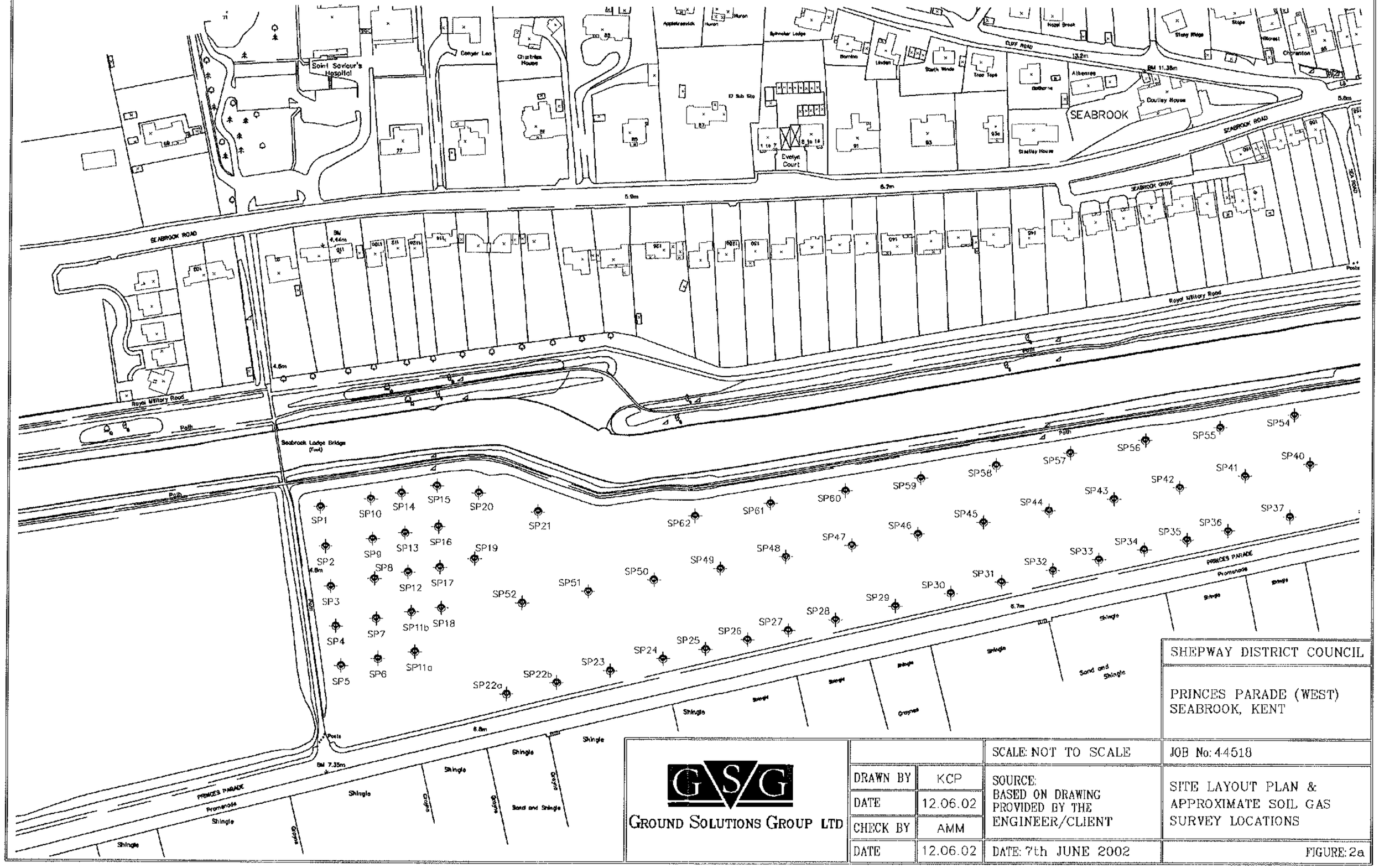
The potential liabilities associated with any contamination will be presented within the context of the risk assessment procedures set out in the Statutory Guidance on Contaminated Land enacted in April 2000.

The report will be presented to address issues of future development with respect to building foundations, ground floors, site roads and hard standing. If necessary, it will make recommendations and outline remedial options to address any contamination. The report would also outline any additional works that may be required prior to final design of a redevelopment scheme.

Summary of Costs

Our revised costs, based on the findings of Phase 1 works, for the Phase 2 investigation and reporting are outlined below:

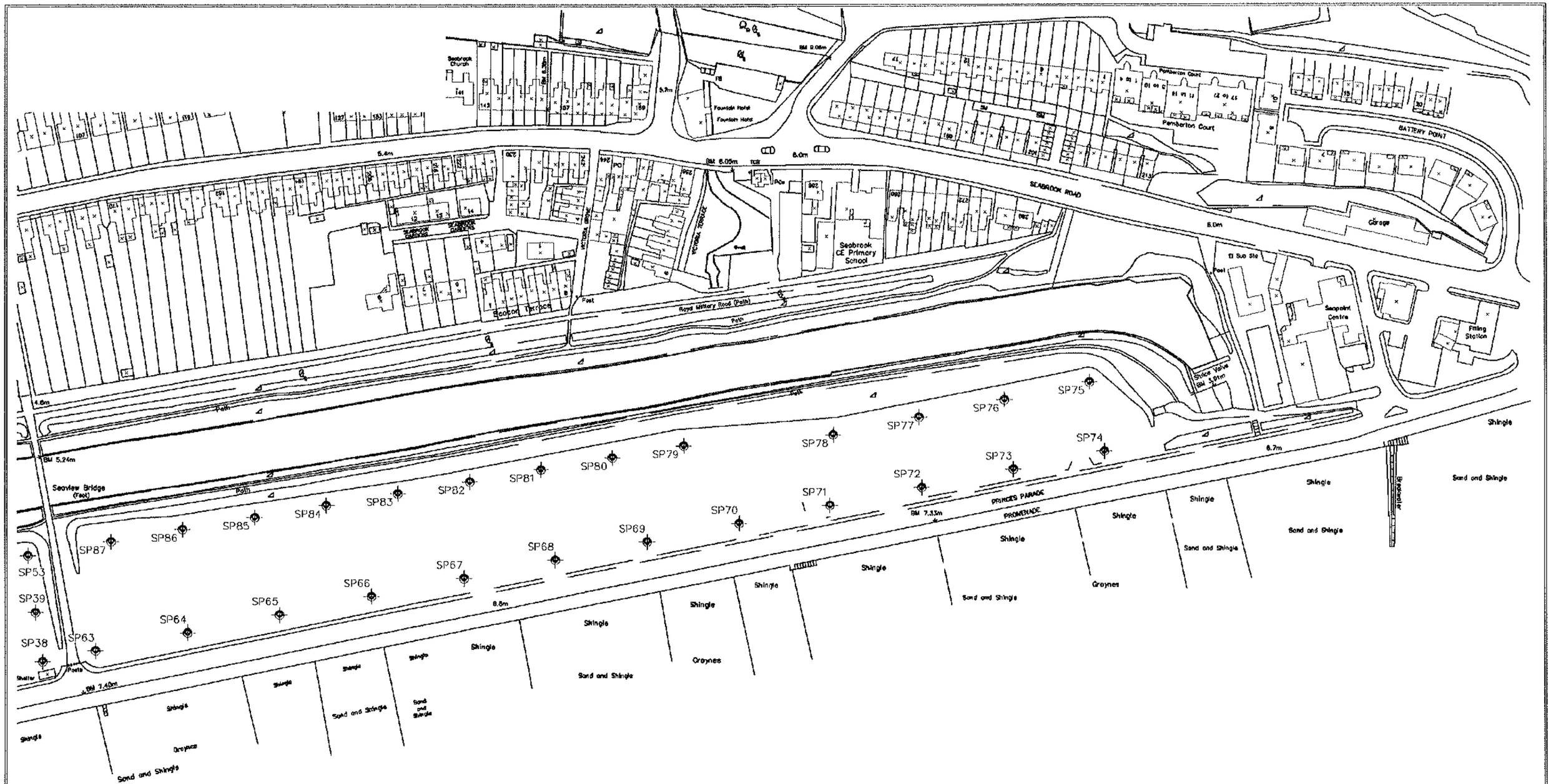
Ecological Assessment	£1,400.00
Site works, inc monitoring visit	£8,550.00
Analytical testing (contamination)	£8,600.00
Analytical testing (geotechnical)	£1,150.00
Reporting	£2,000.00
TOTAL PHASE 2	**£21,700.00**



GROUND SOLUTIONS GROUP LTD		SCALE: NOT TO SCALE	JOB No: 44518
	DRAWN BY: KCP	SOURCE: BASED ON DRAWING PROVIDED BY THE ENGINEER/CLIENT	SITE LAYOUT PLAN & APPROXIMATE SOIL GAS SURVEY LOCATIONS
	DATE: 12.06.02		
	CHECK BY: AMM		
	DATE: 12.06.02	DATE: 7th JUNE 2002	FIGURE: 2a

SHEPWAY DISTRICT COUNCIL

PRINCES PARADE (WEST)
SEABROOK, KENT



SHEPWAY DISTRICT COUNCIL	
PRINCES PARADE (EAST) SEABROOK, KENT	
GROUND SOLUTIONS GROUP LTD	SCALE: NOT TO SCALE — JOB No: 44518
DRAWN BY: KCP DATE: 12.06.02 CHECK BY: AMM DATE: 12.06.02	SOURCE: BASED ON DRAWING PROVIDED BY THE ENGINEER/CLIENT DATE: 7th JUNE 2002
	SITE LAYOUT PLAN & APPROXIMATE SOIL GAS SURVEY LOCATIONS FIGURE: 2b

Detailed Disclosure Report

Site description:	***Reference:***
Seabrook Road Hythe Kent CT21 5QN	***Grid Ref:*** 617948E 134877N

British Geological Survey

1:250,000 Solid Geology

Records within 0-250m

Grid Reference	618000E 134874N
Direction	..
Formation Name	Weald clay formation
Rock Type	Argillaceous rocks, undifferentiated
Date Stamp	As at January 1999

1:250,000 Solid Geology

Records within 251-500m

Grid Reference	617999E 135125N
Direction	North
Formation Name	Lower greensand group
Rock Type	Sandstone
Date Stamp	As at January 1999

Grid Reference	617999E 134707N
Direction	South
Formation Name	Weald clay formation
Rock Type	Argillaceous rocks, undifferentiated
Date Stamp	As at January 1999

1:250,000 Solid Geology

Records within 501-1000m

Grid Reference	618624E 135125N
Direction	East
Formation Name	Lower greensand group
Rock Type	Argillaceous rocks, undifferentiated
Date Stamp	As at January 1999

Grid Reference	617858E 135408N
Direction	North
Formation Name	Lower greensand group
Rock Type	Sandstone
Date Stamp	As at January 1999

Grid Reference	617660E 134731N
Direction	South-West
Formation Name	Weald clay formation
Rock Type	Argillaceous rocks, undifferentiated
Date Stamp	As at January 1999

Landfill Survey

Records within 0-250m

Grid Reference	618013E 134808N
Direction	-
OS Map Sheet	TR13SE
Easting	618100
Northing	134700
Environment Agency Region	Southern Region
Waste Types	N/A
Site Location	Princes Parade, Hythe, Kent
Date Stamp	As at 1973 (Survey not updated)

Landfill Survey

Records within 251-500m

Grid Reference	618154E 134630N
Direction	South-East
OS Map Sheet	TR13SE
Easting	618100
Northing	134700
Environment Agency Region	Southern Region
Waste Types	N/A
Site Location	Princes Parade, Hythe, Kent
Date Stamp	As at 1973 (Survey not updated)

Landfill Survey

Records within 501-1000m

Grid Reference	618300E 134500N
Direction	South-East
OS Map Sheet	TR13SE
Easting	618100
Northing	134700
Environment Agency Region	Southern Region
Waste Types	N/A
Site Location	Princes Parade, Hythe, Kent
Date Stamp	As at 1973 (Survey not updated)

Landslip

Records within 0-250m

Grid Reference	618000E 134874N
Direction	-
Landslide	Susceptible to landslip or land instability
Date Stamp	As at March 1999

Landslip

Records within 251-500m

Grid Reference	618031E 134999N
Direction	-
Landslide	Susceptible to landslip or land instability
Date Stamp	As at March 1999

Landslip

Records within 501-1000m

Grid Reference	618046E 135203N
Direction	North
Landslide	Susceptible to landslip or land instability
Date Stamp	As at March 1999

ContamiCheck

Historical Industrial Landuse

Records within 0-250m 

Grid Reference	618050E 135050N
Direction	North
Current Map Reference	TR 180 350
Map Edition	OS County Series Survey
Scale of Map	6"
Use Recorded	Pumping Station / Waterworks / Tanks

Historical Industrial Landuse

Records within 501-1000m 

Grid Reference	618650E 134950N
Direction	East
Current Map Reference	TR 186 349
Map Edition	OS County Series Survey
Scale of Map	6"
Use Recorded	Gas Works

Environment Agency

Abstractions Licences

Records within 251-500m 

Grid Reference	618100E 135100N
Direction	North-East
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	Seabrook Springs
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	2273
Annual Rate (m3)	1659290
Region	Southern Region
Date Stamp	31 December 1998

Grid Reference	618100E 135100N
Direction	North-East
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	The Cherry Garden, Cherry Garden Lane, Folkestone
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	2273
Annual Rate (m3)	831918
Region	Southern Region
Date Stamp	30 June 1999

Abstractions Licences

Records within 501-1000m

Grid Reference	618500E 135500N
Direction	North-East
License Number	5/0067/ /I
Operator	P J Bradley
Location	Hythe
Abstraction Purpose	Impounding
Abstraction Status	Not Stated
Aquifer	Not stated
Abstraction Source	Impounding - Seabrooke Stream
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	0
Annual Rate (m3)	0
Region	Southern Region
Date Stamp	31 December 1998

Grid Reference	618500E 135500N
Direction	North-East
License Number	5/0067/ /I
Operator	P J Bradley
Location	Missingham Farm, East Braebourne, Ashford, Kent, Tn25 5lu
Abstraction Purpose	Impounding
Abstraction Status	Current
Aquifer	Not stated
Abstraction Source	Impounding - Seabrooke Stream
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	0
Annual Rate (m3)	0
Region	Southern Region
Date Stamp	31 December 1999

Abstractions Licences

Records within 1001-2000m

Grid Reference	618700E 136600N
Direction	North-East
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	Blackrock Spring
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	455
Annual Rate (m3)	1659290
Region	Southern Region
Date Stamp	31 December 1998

Grid Reference	616400E 135000N
Direction	West
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	Hythe Town Spring
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	227
Annual Rate (m3)	1659290
Region	Southern Region
Date Stamp	31 December 1998

Grid Reference	616970E 134520N
Direction	West
License Number	5/0028/ /GR
Operator	Hotel Imperial [Hythe] Ltd
Location	Hythe
Abstraction Purpose	Spray irrigation
Abstraction Status	Not Stated
Aquifer	Not stated
Abstraction Source	Ground - S2 Alluvium
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	55
Annual Rate (m3)	4546
Region	Southern Region
Date Stamp	31 December 1998

Grid Reference	618700E 135600N
Direction	North-East
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	The Cherry Garden, Cherry Garden Lane, Folkestone
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	455
Annual Rate (m3)	166929
Region	Southern Region
Date Stamp	30 June 1999

Grid Reference	616400E 135000N
Direction	West
License Number	5/0006/ /GR
Operator	Folkestone & Dover Water Services Ltd
Location	The Cherry Garden, Cherry Garden Lane, Folkestone
Abstraction Purpose	Public water supply
Abstraction Status	Status uncertain - possibly revoked
Aquifer	Not stated
Abstraction Source	Ground - H2 Lower Greensand
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	227
Annual Rate (m3)	83192
Region	Southern Region
Date Stamp	30 June 1999

Grid Reference	616970E 134520N
Direction	West
License Number	5/0028/ /GR
Operator	Hotel Imperial [hythe] Ltd
Location	Hotel Imperial, Hythe, Kent, Ct21 6ae
Abstraction Purpose	Spray irrigation
Abstraction Status	Current
Aquifer	Not stated
Abstraction Source	Ground - S2 Alluvium
License Date	-
Expiry Date	-
Activity Type	Not stated
Daily Rate (m3)	55
Annual Rate (m3)	4546
Region	Southern Region
Date Stamp	31 December 1999

Discharge Consents

Records within 501-1000m

Grid Reference	618850E 134850N
Direction	East
Operator	Southern Water Services Ltd (k)
Property Type	Not stated
Location	Seabrook Storm Sewage Hythe Kent
Catchment Area	Not stated
Discharge Reference	A94/K/87
Date Issued	01/04/91
Discharge Type	Sewage - storm effluent
Discharge Environment	Coastal
Receiving Watercourse	Not Stated
Status	Current
Region	Southern Region
Date Stamp	31 December 1998

Discharge Consents

Records within 1001-2000m

Grid Reference	616650E 135430N
Direction	North-West
Operator	Mrs D V Prior
Property Type	Not stated
Location	Meadowview Blackhouse Hill Hythe Kent
Catchment Area	Not stated
Discharge Reference	P4630/S/R/92
Date Issued	15/12/92
Discharge Type	Sewage - treated effluent
Discharge Environment	Into Land/Soakaway
Receiving Watercourse	Not Stated
Status	Current
Region	Southern Region
Date Stamp	31 December 1998

Former Landfill

Records within 0-250m

Grid Reference	617974E 134730N
Direction	South
Licence Number	SH6
Site Address	Beacon Terrace Hythe Kent CT215RE
EA Region	Southern Region (01903) 820692
EA Area	Kent - Southern (01732) 875 587
Local Authority	Shepway District Council
Geology	Argillaceous rocks, undifferentiated
Soil Type	The site is located in an area where there is the possibility of soils of high leaching potential with little ability attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Waste Type	Waste type unknown

Data Quality	The location and boundary for this landfill have been drawn from plans of the site and other sources by Homecheck but the small scale of the maps and inevitable transposition errors make it difficult to be 100% accurate. Generally, the boundaries follow other features, such as field boundaries or roads or the outlines of quarries and other holes and in most cases will be within 25 metres of the actual boundary. As this is an older landfill site the licence may only relate to part of the area shown on the map with other portions having been filled under separate licence.
Size Band	Not Available

Grid Reference	617973E 134730N
Direction	South
Site Address	Seabrook Road Hythe Kent CT215QN
EA Region	Southern Region (01903) 820692
EA Area	Kent - Southern (01732) 875 587
Local Authority	Shepway District Council
Geology	Argillaceous rocks, undifferentiated
Soil Type	The site is located in an area where there is the possibility of soils of high leaching potential with little ability attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Waste Type	Waste type unknown
Data Quality	The location and boundary for this landfill have been drawn from plans of the site and other sources by Homecheck but the small scale of the maps and inevitable transposition errors make it difficult to be 100% accurate. Generally, the boundaries follow other features, such as field boundaries or roads or the outlines of quarries and other holes and in most cases will be within 25 metres of the actual boundary. As this is an older landfill site the licence may only relate to part of the area shown on the map with other portions having been filled under separate licence.
Size Band	Not available

Former Landfill

Records within 251-500m

Grid Reference	618241E 134767N
Direction	East
Licence Number	SH6
Site Address	Beacon Terrace Hythe Kent CT215RE
EA Region	Southern Region (01903) 820692
EA Area	Kent - Southern (01732) 875 587
Local Authority	Shepway District Council
Geology	Argillaceous rocks, undifferentiated
Soil Type	The site is located in an area where there is the possibility of soils of high leaching potential with little ability attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Waste Type	Waste type unknown

Data Quality	The location and boundary for this landfill have been drawn from plans of the site and other sources by Homecheck but the small scale of the maps and inevitable transposition errors make it difficult to be 100% accurate. Generally, the boundaries follow other features, such as field boundaries or roads or the outlines of quarries and other holes and in most cases will be within 25 metres of the actual boundary. As this is an older landfill site the licence may only relate to part of the area shown on the map with other portions having been filled under separate licence.
Size Band	Not Available

Grid Reference	618202E 134754N
Direction	East
Site Address	Seabrook Road Hythe Kent CT215QN
EA Region	Southern Region (01903) 820692
EA Area	Kent - Southern (01732) 875 587
Local Authority	Shepway District Council
Geology	Argillaceous rocks, undifferentiated
Soil Type	The site is located in an area where there is the possibility of soils of high leaching potential with little ability attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Waste Type	Waste type unknown
Data Quality	The location and boundary for this landfill have been drawn from plans of the site and other sources by Homecheck but the small scale of the maps and inevitable transposition errors make it difficult to be 100% accurate. Generally, the boundaries follow other features, such as field boundaries or roads or the outlines of quarries and other holes and in most cases will be within 25 metres of the actual boundary. As this is an older landfill site the licence may only relate to part of the area shown on the map with other portions having been filled under separate licence.
Size Band	Not available

Former Landfill

Records within 501-1000m

Grid Reference	618631E 134857N
Direction	East
Licence Number	SH6
Site Address	Beacon Terrace Hythe Kent CT215RE
EA Region	Southern Region (01903) 820692
EA Area	Kent - Southern (01732) 875 587
Local Authority	Shepway District Council
Geology	Argillaceous rocks, undifferentiated
Soil Type	The site is located in an area where there is the possibility of soils of high leaching potential with little ability attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Waste Type	Waste type unknown

Data Quality	The location and boundary for this landfill have been drawn from plans of the site and other sources by Homecheck but the small scale of the maps and inevitable transposition errors make it difficult to be 100% accurate. Generally, the boundaries follow other features, such as field boundaries or roads or the outlines of quarries and other holes and in most cases will be within 25 metres of the actual boundary. As this is an older landfill site the licence may only relate to part of the area shown on the map with other portions having been filled under separate licence.
Size Band	Not Available

Pollution Incidents

Records within 251-500m

Grid Reference	617730E 134450N
Direction	South-West
Location	Stewart Cottage, Frogholt, Folkestone
Date	18/07/1994
Incident Number	CD/249/94
Notes	Builders sand restricting flow in Seabrook stream
Pollutant	Metals & Scrap - Ferrous metal - Iron
Source	Sewage & Water (Wsplc) - Water Distribution System
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618300E 134800N
Direction	East
Location	Seabrook Stretch +1, Royal Military Canal
Date	24/05/1999
Incident Number	1501
Water Course	Source Of The Royal Military Canal
Effect	Water affected - Land affected - Air affected
Cause	Other
Pollutant	No Pollutant
Source	No premises identified
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	31 December 1999

Pollution Incidents

Records within 501-1000m

Grid Reference	618700E 134900N
Direction	East
Location	Royal Military Canal (100 Metres From Seabrook Sluices).
Date	27/03/1998
Incident Number	29118
Notes	Hydraulic oil spillage from weed cutting boat.
Pollutant	Oils - not specified
Source	Transport - Ships / Boats
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	617050E 134470N
Direction	South-West
Location	Imperial Hotel Golf Course
Date	27/04/1995
Incident Number	295048
Notes	Saltwater being pumped into rmc
Source	Restaurants / Hotels / Pubs
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Pollution Incidents

Records within 1001-2000m

Grid Reference	616900E 134800N
Direction	West
Location	Earlsfield Road, Hythe, Kent
Date	25/01/1996
Incident Number	296026
Notes	House fire
Source	Sewage & Water (Wsplc)
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618790E 136180N
Direction	North-East
Location	Rear Of 64 Valebrook Close, Folkestone
Date	22/04/1996
Incident Number	296143
Notes	Sewage in stream
Pollutant	Sewage - crude sewage
Source	Domestic / residential
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616510E 134210N
Direction	South-West
Location	Hythe And Saltwood Sailing Club
Date	26/08/1996
Incident Number	296358
Notes	Sewage coming out of outfall
Pollutant	Sewage - storm sewage
Source	Sewage & Water (Wsplc) - Storm Tank
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616350E 134080N
Direction	South-West
Location	Hythe And Saltwood Sailing Club Next To Lso
Date	01/04/1997
Incident Number	297119
Notes	Sewage in sea
Pollutant	Sewage - crude sewage
Source	Unknown
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	619500E 135800N
Direction	North-East
Location	Sir John Moore Barracks, Shorncliffe, N. Road, Folkestone
Date	03/02/1997
Incident Number	297028
Notes	Pipe broken while pumping out hydrochloric acid
Pollutant	Chemical - acid
Source	Crown Exempt
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618400E 136300N
Direction	North
Location	Horn Street, Seabrook
Date	27/05/1998
Incident Number	29170
Notes	Sand reported seabrook stream
Pollutant	Metals & Scrap - Ferrous metal - Iron
Source	Transport - Road
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616090E 134600N
Direction	West
Location	West Of Bridge At Slade Street
Date	17/03/1998
Incident Number	29075
Notes	Oil on R. m. c.
Pollutant	Oils - unknown oil
Source	Unknown
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616500E 134200N
Direction	South-West
Location	South Road, Hythe
Date	07/04/1998
Incident Number	29138
Pollutant	Oils - petrol
Source	Transport - Road
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616780E 134770N
Direction	West
Location	Small Subsidiary Canal Linking To Military Canal At Hythe
Date	15/05/1992
Incident Number	CD/095/92
Notes	Diesel on canal at Hythe
Pollutant	Oil - diesel
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618950E 135950N
Direction	North-East
Location	Seabrook Stream Opposite Brittania Pub, Horn Street,
Date	21/10/1992
Incident Number	CD/209/92
Notes	Very strong smell of diesel coming from stream
Pollutant	Oil - diesel
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616150E 134700N
Direction	West
Location	Portex Limited, Hythe
Date	28/11/1992
Incident Number	CD/226/92
Notes	45 gallons of chemicals reacting making gas
Pollutant	Chemical - not specified
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618700E 136150N
Direction	North-East
Location	Caseborn Cottage
Date	27/04/1993
Incident Number	CD/076/93
Notes	Seabrook stream polluted and foaming
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618700E 136150N
Direction	North-East
Location	Underhill Road, Shornecliffe
Date	02/08/1993
Incident Number	CD/164/93
Notes	Large quantity of sand in Seabrook stream
Pollutant	General - suspended solids - inert
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616700E 134800N
Direction	West
Location	Royal Military Canal At Twiss Road Bridge
Date	01/09/1993
Incident Number	CD/185/93
Notes	8-9 dead bream
Pollutant	Not known
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	619500E 135500N
Direction	East
Location	Sir John Moore Barracks, Shornecliff, Folkestone
Date	09/09/1993
Incident Number	CD/234/93
Notes	100 litres of gas oil discharge d into sw system
Pollutant	Oil - gas oil
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618600E 136100N
Direction	North-East
Location	Casebrook Cottages, Folkstone
Date	28/07/1994
Incident Number	CD/257/94
Notes	Foam on the Seabrook stream
Pollutant	Unspecified - foam
Source	Unknown
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	619000E 136100N
Direction	North-East
Location	Sandgate
Date	18/08/1994
Incident Number	CD/313/94
Notes	Chemical spill phosclear
Pollutant	Chemicals - not specified
Source	Transport - Road
Severity	Category 4 - Unsubstantiated Incident

Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618900E 135950N
Direction	North-East
Location	Garden Of 74 Horn Street, Hythe
Date	07/10/1994
Incident Number	CD/367/94
Notes	Stream running bright green
Pollutant	Chemicals - paints / dyes
Source	Unknown
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618700E 136150N
Direction	North-East
Location	Caseborn Cottage
Date	22/12/1994
Incident Number	CD/457/94
Notes	Seabrook stream coloured yellow and cloudy
Pollutant	Metals & Scrap - Ferrous metal - Iron
Source	Mining - aggregate (sand / gravel)
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618700E 136150N
Direction	North-East
Location	Caseborn Cottage
Date	28/12/1994
Incident Number	CD/460/94
Notes	Seabrook stream, yellow and cloudy
Pollutant	Metals & Scrap - Ferrous metal - Iron
Source	Mining - aggregate (sand / gravel)
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616100E 134590N
Direction	West
Location	Royal Military Canal, Stade Street Bridge, Hythe
Date	23/03/1995
Incident Number	CD/078/95
Notes	Sewage in stream and water milky brown in colour
Pollutant	Unspecified - natural
Source	Unknown
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616100E 134690N
Direction	West
Location	Stade Bridge, Hythe
Date	31/03/1995
Incident Number	CD/093/95
Notes	Raw sewage going into canal
Pollutant	Unspecified - natural
Source	Unknown
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618800E 135500N
Direction	North-East
Location	Seabrook Trout Farm
Date	06/07/1995
Incident Number	295127
Notes	Trout dying
Pollutant	Unspecified - natural
Source	Agriculture - Fish Farms
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618100E 136800N
Direction	North
Location	Dollands Moor Sidings, Folkestone
Date	19/09/1995
Incident Number	295331
Notes	Oil leak discharging to motorway lagoon
Pollutant	Oils - waste oil
Source	Transport - Rail
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618900E 136000N
Direction	North-East
Location	Garden At 74 Horn Street, Hythe
Date	22/11/1995
Incident Number	295343
Notes	Oil in stream
Pollutant	Oils - unknown oil
Source	Unknown
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	619100E 136000N
Direction	North-East
Location	Off Horn Street Behind Britannia Ph, Sea Brook
Date	24/11/1995
Incident Number	295338
Notes	Diesel in stream
Pollutant	Oils - diesel (derv)
Source	Unknown
Severity	Category 3 - Minor Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	616100E 134900N
Direction	West
Location	Hythe
Date	12/10/1998
Incident Number	29336
Notes	Land being sprayed.
Source	Agriculture - Arable
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	618800E 135600N
Direction	North-East
Location	Horn Street, Seabrook Trout Farm.
Date	26/10/1998
Incident Number	29328
Notes	Pollution to Seabrook stream.
Source	Unknown
Severity	Category 4 - Unsubstantiated Incident
Region	Southern Region
Date Stamp	1 January 1992 - 31 December 1998

Grid Reference	617600E 136400N
Direction	North
Location	Close To Seabrook Stream Sssi
Date	01/12/1999
Incident Number	4376
Effect	Water affected - Land affected - Air affected
Cause	Human Actions - Operator error
Pollutant	General Biodegradable - Agricultural - Slurry
Source	Agriculture
Severity	No Impact Category 4
Region	Southern Region
Date Stamp	31 December 1999

River Quality Survey

Records within 0.250m

Grid Reference	617945E 134757N
Direction	
River Name	Royal Military Canal
Reach	SeaBrooj Sluices - West Hythe
Length of Reach (km)	7.52423

Grade (Chemical)	C
Grade Meaning (Chemical)	Fairly Good
Grade (Biological)	a
Grade Meaning (Biological)	Very Good
BOD	6 (mg/l) 90-percentile
Ammonia	1.3 (mg n/l) 90-percentile
Dissolved Oxygen	60 (% saturation) 10-percentile
Ecological Quality Index (TAXA)	0.85
Ecological Quality Index (ASPT)	1.00
Flow (over survey period)	>80 (cumecs)
Flow (long term estimation)	<80 (cumecs)
Flow Type	Canal
Chemistry Upgrade	Same
Biology Upgrade	Same
Significant Differences	Biology Higher
Phosphate Level (mg/l);	0.1 Mg/l Phosphate
Nitrate Level (mg/l)	10.5
Population Within 300m	8119
Population Within 600m	11613
Date Stamp	1993 to 1998 (Annual Survey)

River Quality Survey

Records within 251-500m

Grid Reference	617998E 134753N
Direction	-
River Name	Royal Military Canal
Reach	SeaBrooj Sluices - West Hythe
Length of Reach (km)	7.52423
Grade (Chemical)	C
Grade Meaning (Chemical)	Fairly Good
Grade (Biological)	a
Grade Meaning (Biological)	Very Good
BOD	6 (mg/l) 90-percentile
Ammonia	1.3 (mg n/l) 90-percentile
Dissolved Oxygen	60 (% saturation) 10-percentile
Ecological Quality Index (TAXA)	0.85
Ecological Quality Index (ASPT)	1.00
Flow (over survey period)	>80 (cumecs)
Flow (long term estimation)	<80 (cumecs)
Flow Type	Canal
Chemistry Upgrade	Same
Biology Upgrade	Same
Significant Differences	Biology Higher
Phosphate Level (mg/l);	0.1 Mg/l Phosphate
Nitrate Level (mg/l)	10.5
Population Within 300m	8119
Population Within 600m	11613
Date Stamp	1993 to 1998 (Annual Survey)

River Quality Survey

Records within 501-1000m

Grid Reference	618031E 134779N
Direction	-
River Name	Royal Military Canal
Reach	SeaBrooj Sluices - West Hythe
Length of Reach (km)	7.52423

Grade (Chemical)	C
Grade Meaning (Chemical)	Fairly Good
Grade (Biological)	a
Grade Meaning (Biological)	Very Good
BOD	6 (mg/l) 90-percentile
Ammonia	1.3 (mg n/l) 90-percentile
Dissolved Oxygen	60 (% saturation) 10-percentile
Ecological Quality Index (TAXA)	0.85
Ecological Quality Index (ASPT)	1.00
Flow (over survey period)	>80 (cumecs)
Flow (long term estimation)	<80 (cumecs)
Flow Type	Canal
Chemistry Upgrade	Same
Biology Upgrade	Same
Significant Differences	Biology Higher
Phosphate Level (mg/l);	0.1 Mg/l Phosphate
Nitrate Level (mg/l)	10.5
Population Within 300m	8119
Population Within 600m	11613
Date Stamp	1993 to 1998 (Annual Survey)

River Quality Survey

Records within 1001-2000m

Grid Reference	616696E 134648N
Direction	West
River Name	Royal Military Canal
Reach	Seabrooj Sluices West Hythe
Length of Reach (km)	7.52423
Grade (Chemical)	C
Grade Meaning (Chemical)	Fairly Good
Grade (Biological)	a
Grade Meaning (Biological)	Very Good
BOD	6 (mg/l) 90-percentile
Ammonia	1.3 (mg n/l) 90-percentile
Dissolved Oxygen	60 (% saturation) 10-percentile
Ecological Quality Index (TAXA)	0.85
Ecological Quality Index (ASPT)	1.00
Flow (over survey period)	>80 (cumecs)
Flow (long term estimation)	<80 (cumecs)
Flow Type	Canal
Chemistry Upgrade	Same
Biology Upgrade	Same
Significant Differences	Biology Higher
Phosphate Level (mg/l);	0.1 Mg/l Phosphate
Nitrate Level (mg/l)	10.5
Population Within 300m	8119
Population Within 600m	11613
Date Stamp	1993 to 1998 (Annual Survey)

English Nature

Sites of Special Scientific Interest

Records within 1001-2000m

Grid Reference	617696E 136589N
Direction	North
Site Name	Seabrook Stream

Authority	English Nature
Date Stamp	Survey as at February 1999

Grid Reference	618249E 136499N
Direction	North
Site Name	Seabrook Stream
Authority	English Nature
Date Stamp	Survey as at February 1999

Groundwater

Groundwater Vulnerability

Records within 0-250m

Grid Reference	618000E 134874N
Direction	-
Aquifer Type	Minor Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Groundwater Vulnerability

Records within 251-500m

Grid Reference	617750E 134749N
Direction	South-West
Aquifer Type	Non aquifer
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	617999E 134999N
Direction	-
Aquifer Type	Minor Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Groundwater Vulnerability

Records within 501-1000m

Grid Reference	617249E 134874N
Direction	West
Aquifer Type	Non aquifer
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	618099E 135124N
Direction	North-East
Aquifer Type	Minor Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	617589E 135482N
Direction	North-West
Aquifer Type	Major Aquifer
Soil Permeability	Soils of intermediate leaching potential (I1) which can possibly transmit a wide range of pollutants
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	618124E 135208N
Direction	North-East
Aquifer Type	Major Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Groundwater Vulnerability

Records within 1001-2000m

Grid Reference	616902E 135652N
Direction	North-West
Aquifer Type	Non aquifer
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	617505E 134993N
Direction	West
Aquifer Type	Minor Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	617514E 136184N
Direction	North
Aquifer Type	Major Aquifer
Soil Permeability	Soils of intermediate leaching potential (I1) which can possibly transmit a wide range of pollutants
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	617593E 136155N
Direction	North
Aquifer Type	Minor Aquifer
Soil Permeability	Soils of intermediate leaching potential (I1) which can possibly transmit a wide range of pollutants
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Grid Reference	618603E 135711N
Direction	North-East
Aquifer Type	Major Aquifer
Soil Permeability	Soils of high leaching potential (U) with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater.
Drift Deposits	No drift deposits present
Date Stamp	November 1999 (One-off Survey)

Sitescope

Current Industrial Land Use

Records within 0-250m

Grid Reference	617749E 135027N
Direction	North-West
Organisation	Chapel Laboratories
Property	Chapel House
Street	Cliff Road
Town	Hythe
Postcode	CT215XP

Return to summary

GROUND SOLUTIONS GROUP LTD

44518_1
OJR\kmd

21 October 2002

Shepway District Council
Civic Centre
Castle Hill Avenue
FOLKESTONE
Kent
CT20 2QY

For the attention of Ms C Elliot

Dear Ms Elliot

RE: PRINCESS PARADE, SEABROOK, HYTHE

We are pleased to enclose two copies of our report relating to the above location.

We trust that these are satisfactory, but should you have any queries please do not hesitate to contact this office.

Yours faithfully

one copy to SEEDA
one copy to chris.

[redacted]

O J Raisbeck
Senior Environmental Scientist
GROUND SOLUTIONS GROUP LIMITED

Enc: Report x Two Copies

ECONOMIC DEVELOPMENT SERVICES
22 OCT 2002
SHEPWAY DISTRICT COUNCIL

Hanover Close, Cobbs Wood Estate, Ashford, Kent TN23 1EL (Regd Office) Tel: 01233 658270/277 Fax: 01233 658299
Registered in England No: 3036576 Email: ggg@groundsolutions.co.uk Associated Office at Derby

Shepway District Council

PRINCES PARADE, SEABROOK KENT

Phase 2 Geo-Environmental Investigation

Ground Solutions Group Limited
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Telephone: 01233 658270
Fax: 01233 658299

October 2002
44518_1/OJR

CONTENTS

FIGURES:

APPENDICES:

1. INTRODUCTION

Ground Solutions Group Limited (GSG) were instructed by Shepway District Council (SDC) to proceed with a Geo-Environmental Investigation at a site off Princes Parade, Seabrook Road, Hythe, Kent.

The aim of the geo-environmental project being to examine existing ground conditions and investigate the potential and implications of developing the site for residential and leisure/open space uses. The study was split into two distinct phases: Phase 1, Desk Study and Site Walkover, and Phase 2, Preliminary Intrusive Ground Investigation.

The Phase 1 study was produced in June 2002 and made recommendations for an ecological assessment of the site followed by intrusive site works, laboratory testing and subsequent geotechnical and environmental assessments.

This document summarises the findiugs of Phase 1 of the project (Report Number; 44518/AMM June 2002), and presents the works undertaken, resnlts and findings of Phase 2, which included the following intrusive works:

- 30 machine excavated trial pits;
- installation of 10 piezometers in a selection of the trial pits;
- the drilling of 3 cable percussion boreholes; and
- 10 static cone penetration tests undertaken by Lankelma Cone Penetration Testing Ltd.

We understand that it has been proposed to redevelop the area under investigation to incorporate residential accommodation together with private gardens and public open space. At the time of the investigation, it was anticipated that the development would take place at the eastern end of the site. Subsequently, consideration has been given to the development area being decided pending the results of this investigation.

2. SITE LOCATION AND DESCRIPTION

The site is located off Princes Parade, Hythe and is centred on approximate Ordnance Survey grid reference TR 180 347 as shown on Figure 1 (Site Location Plan). The site is a narrow strip of land running parallel to the sea. It is some 1000 m in length and narrows from 120 m at its western end to 50 m at the eastern end (Figures 2a and 2b). The site is bounded by Princes Parade, which runs along the sea front, to the south; by the Royal Military Canal to the north and The Imperial Hotel links golf course to the west. The eastern most point of the site abuts a children's play area.

Beyond the Royal Military Canal to the north are residential properties with gardens beyond which is the A259 (Seabrook Road) and more residential properties, including guesthouses and hotels. The English Channel lies to the south of Princes Parade.

The total length of the site is approximately 1000 m. The site is divided at its mid point by a footpath leading from Princes Parade to a bridge crossing the Military Canal. The site is generally level although the western end is slightly higher (between 0.5 m to 1 m) than the eastern end.

The site is generally elevated compared to the surrounding area and covers an area of approximately 8 ha. The Royal Military Canal and the golf course are situated approximately four to five metres below the level of the site. The promenade is generally at the same level as the site. The beach to the south of the site has been engineered as part of a sea defence system and has been built up in recent years.

The site is, for the most part, covered with grass and occasional scrub vegetation. However, the site is overgrown in the north eastern corner with vegetation including small trees and large shrubs. It was also noted that there was a large amount of chipped and shredded cuttings from trees stockpiled near to one of the entrances to the site.

During the site works it was noted that council lorries were depositing soil and similar horticultural materials in the north western corner of the site.

3. ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey 1:50000 Series, Sheet 305 and 306 Folkestone and Dover A, indicated that the site is located in an area of generally level ground between the Hythe Beds escarpment to the north and the sea to the south and is made up predominantly of Storm Beach Gravels.

The Storm Beach Gravels consist of gravels with some sand which have been thrown up into ridges by wave action. Where there has been a ready supply of shingle the beach accretes seaward by the addition of sub parallel ridges.

Thin bands of marine alluvium are shown in the area and which generally comprise brown and blue clays. These were probably formed in slight depressions and hollows between shingle ridges. A thin band of clay coinciding within the easternmost section of the Royal Military Canal is believed to be alluvium associated with the Seabrook Stream which formerly flowed into a harbour at Hythe.

The interface between the Storm Beach Gravels and underlying Weald Clay is often marked by a band of disturbed ground generally comprising clays intermixed with gravel to cobble and occasional boulder sized fragments of sandstone/limestone. This represents an accumulation of ancient landslip debris from the degradation of the Hythe Beds escarpment which is now some distance to the north of the site.

The depth to the Weald Clay can be variable in this area although the geological memoir indicates that a borehole to the west of the site encountered Weald Clay at approximately 10m, the interface including rock 'ragstone' debris.

Underlying the Storm Beach Gravels and Marine Alluvium is the Weald Clay which typically comprises cyclic sequences of dark grey silts with subordinate siltstones, sandstones, shelly limestones and clay ironstones. The Weald Clay is often weathered to light grey and yellow mottled high plasticity clays near surface.

3.2 GROUNDWATER

Reference to the Environment Agency's 1:100 000 scale Groundwater Vulnerability map of the area, Sheet 47, East Kent, indicated that the strata underlying the site are classified as a Minor Aquifer.

Minor Aquifers (variably permeable) can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although these aquifers will seldom produce large quantities of water for abstraction, they are important both for local supplies and in supplying base flow to rivers. Major Aquifers may occur beneath Minor Aquifers.

The soils are indicated to be of high leaching potential (HU), with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or shallow groundwater. However, this is a worse case classification due to the sparse data available for urban areas.

The site is not situated within a groundwater Source Protection Zone (SPZ).

The close proximity of the site to the sea would result in groundwater beneath it being influenced by tidal variation and possibly saline intrusion. Tidal variations are likely to affect both groundwater levels and quality.

3.3 SURFACE WATER

The nearest surface water course to the site is the Royal Military Canal, which is located immediately to the north of the site. The canal has a sluice at the eastern end of the site.

The Environment Agency's General Quality Assessment Scheme provided a measure of both chemical and biological water quality for rivers and canals in England and Wales. One of the six grades, A to F is allocated.

On the basis of the 2000 data, water quality for the Seabrook Sluices, is as follows:

Parameter	Grade
Chemistry	Fairly good
Biology	Very good
Nitrate	Moderately Low
Phosphate	Low
Aesthetics	Fair

3.4 RADON ASSESSMENT

Reference to the National Radiological Protection Board's "Radon Atlas of England and Wales" indicated that less than 1% of houses within the 5 km square which included the site have radon concentrations above the action level of 200 Bq/m³. The site is therefore not located within a "Radon Affected Area" which would otherwise require buildings to incorporate appropriate radon control measures.

3.5 ADDITIONAL INFORMATION

Reference was made to the environmental database Sitescope, extracts from which are provided in Appendix 1. Relevant information relating to the site's environmental sensitivity is summarised as follows:

The British Geological Survey classify the area as being susceptible to landslip or land instability, however, this classification is related to areas north of the Royal Military Canal where steep slopes and rock faces of the Hythe Bed escarpment are present.

Two water abstraction licences were recorded between 250 m and 500 m of the site with six being recorded within a 1000 m radius of the site.

A single discharge consent was recorded between 500 m and 1000 m radius of the site.

There were four former landfill sites recorded within a 1000 m radius of the site.

No pollution incidents were recorded within a 250 m radius of the site. Two Category 3 (Minor) pollution incidents were recorded within a 500 m radius of the site, with 30 pollution accidents recorded within a 2000 m radius of the site. All these 30 incidents were either Category 3 (Minor) or Category 4 (Unsubstantiated).

There were no Sites of Special Scientific Interest recorded within a 1000 m radius of the site, although two were recorded between 1000 m and 2000 m.

A single industrial land use was recorded within a 250 m radius of the site with Chapel laboratories noted to the northwest of the site.

No mines and quarries, IPC Part B authorisations, chemical releases, operational landfills, waste treatment sites, National Nature Reserves, Environmentally Sensitive Areas, Nitrate Sensitive Areas or Nitrate Vulnerable Zones were recorded near the site.

4. SITE HISTORY

4.1 HISTORIC MAPS SUMMARY

The following summary is based on historic maps dating back to 1872 and provided in full in the Phase 1 report.

The town of Hythe and the village of Seabrook are located to the west and east of the site respectively. The Royal Military Canal to the north is shown in existence. By 1899 the Hythe and Sandgate Branch of the South Eastern Railway had been constructed to the north of the site. Development continued throughout the early part of last century and as such, the two areas essentially merged together, with only playing fields separating them.

The eastern and western areas of the site appear to have been excavated for gravels since at least 1899. However, by 1931, part of the western half of the site (adjacent to the footpath) had been converted into a recreation ground. The eastern half of the site still appeared to be used as a gravel pit in 1931.

By 1958, the recreation ground was no longer shown. However, the gravel pit was still indicated although by 1976 it was no longer shown. No significant changes are indicated after 1976.

4.2 ADDITIONAL INFORMATION

A children's play area has been constructed immediately beyond the extreme eastern point of the site. Prior to the development of this play area an intrusive investigation was carried out by Weeks Consulting, which was made available by SDC prior to this current study.

The Weeks investigation comprised the drilling of two shallow boreholes using shell and auger techniques, logging of the ground conditions encountered and the collection of samples for laboratory analysis. The boreholes were fitted with standpipes for groundwater and landfill gas monitoring purposes. Detectable concentrations of carbon dioxide were recorded by Weeks however, it is not known what the concentrations were. Methane concentrations were below the instrumental detection limit in both of the boreholes. Groundwater was recorded in BH1 (depth unknown) and absent in BH2.

The ground conditions reported were Made Ground to depths of between 4.3 m and 4.6 m below ground level (bgl) overlying Storm Beach Gravel. The Made Ground was described as consisting of clay, sand and gravel (flint, brick, concrete, ash and clinker) with deposits of rubber tubing, rope, wood leather etc. The Storm Beach Gravel consisted of loose flint gravel with some sand and clay. Both of the boreholes were terminated at a depth of 5.0 m.

Elevated concentrations of potentially toxic (to humans) and phytotoxic metals were recorded in a sample recovered from a depth of 2 m bgl in one of the boreholes. No methane was detected at the site although carbon dioxide was. Flow rates of carbon dioxide were reported as variable and this was assigned to pressure changes due to tidal action. The Weeks report concluded that the site did not pose a risk to future users given the proposed end use.

No significant testing was carried out in relation to geotechnical aspects of the development and it was concluded that, given the low loadings likely, they would be within the bearing capacity of the Made Ground.

A letter giving the results of a search of Kent landfill sites was also provided by SDC. This identified a landfill site at Princes Parade that was closed in 1975 (consistent with the evidence provided in the historical maps) that received Category B and C wastes. Category B wastes included Slowly Degradable Waste (B1) and Scrap Metal (B2), whilst Category C Wastes are those that are Putreseible or Difficult. The depth of the landfill was reported to be 5 m.

It is also understood that dredgings from the canal are likely to have been disposed of onto the site. No data exists in relation to the quantity or the quality of these dredgings, although recent analytical data (1998), which was supplied by SDC, from tests carried out on samples of the canal sediment indicate that the concentrations of potential contaminants were generally low.

It is likely that much of the carbon dioxide was from natural biological processes including soil microbial activity and root respiration. However, the additional monitoring and analytical works (assessment of gas generating potential) will provide further data to fully assess any risks that may be posed by landfill gases.

5. ECOLOGICAL ASSESSMENT

The Phase 1 Desk Study and Site Walkover identified areas of the site, notably the north eastern corner, that have the potential to provide suitable habitats for protected animal species. Any significant intrusive investigation, in this and other areas of the site, could be deemed a contravention of the Wildlife and Countryside Act 1981 (as amended) if important habitats were actually present. It was therefore recommended that an Ecological Assessment of the site be undertaken, focusing on the north eastern area in order to confirm, or otherwise, the presenee of protected species or sensitive habitats prior to any site works.

This section reports the findings of the Ecological Assessment, which included the following core components:

- Desk study research;
- limited consultations;
- site walkover assessment (Phase 1 Habitat Survey).

5.1 METHODOLOGY

Baseline conditions with respect to flora and fauna interests at the proposed development site were determined by desk study research, consultation with the appropriate bodies and a Phase 1 Habitat Survey of the site. The survey methodology and descriptive classification is applicable to both national and local scale surveys and provides a baseline from which the ecological value of habitats can be assessed. Phase 1 Surveys also provide information for targeting any future investigations into the ecology of the area of study.

The study area was defined as the proposed development area plus a minimum 50 m zone around the perimeter of the site. This study area was defined to allow the assessment of both the direct and indirect impacts arising from the development.

5.1.1 DESK STUDY RESEARCH

Reference was made to the environmental database Sitescope, extracts from which are provided in Appendix 1. Relevant information relating to the site's ecology and nature conservation status is summarised as follows:

	Distance from site (m)			
Designated status	0 - 250	251 - 500	501 - 1000	1001 - 2000
Area of Outstanding Natural Beauty	0	0	1	1
National Parks	0	0	0	0
National Nature Reserves	0	0	0	0
RAMSAR sites	0	0	0	0
Sites of Special Scientific Interest	0	0	0	2
Special Areas of Conservation	0	0	0	0
Special Protection Areas	0	0	0	0

5.1.2 CONSULTATION

In parallel to carrying out the habitat survey The Kent Wildlife Trust were consulted in order to determine whether or not any nature conservation sites are located within, or near to, the development area. We were informed that the site itself is not designated by Kent Wildlife Trust although the stretch of canal to the north is a Site of Nature Conservation Interest.

At this stage no further consultations have been made to specialist interest groups, although we would note that should the development plans be progressed then we would recommend consultations with such groups at an early stage of the planning process. Such specialist group could included:

- Reptile and Amphibian Group;
- ornithological Society;
- butterfly Conservation (Kent Group);
- bat Group;

- mammal Group;
- badger Group.

5.1.3 SURVEY METHODOLOGY

Detailed methodologies for the completion of Phase 1 Habitat Surveys are given in the "Handbook for Phase 1 Habitat Survey" (NCC 1994), and these were followed where possible in the execution of this survey.

A range of site plans, maps and aerial photographs were inspected prior to the survey to identify any areas of particular wildlife or conservation interest, and to allow an initial assessment of the site to be made. This review was followed by a detailed field habitat survey which was carried out by a Chartered Biologist on 24th July 2002. During this survey the site, and surrounding areas, were walked and habitats identified and classified in line with the vegetation based classification given in the NCC handbook. In addition, the areas were also surveyed with respect to potential habitats for badgers, bats, amphibians, reptiles and birds.

Habitat descriptions are based on the Handbook for Phase 1 Habitat Survey (Nature Conservancy Council, 1990). Plant Latin names mostly follow Flora Europaea (1964 - 1980), the Atlas of Ferns of the British Isles (1978) and Ferns of Britain and Ireland (1982) as given in The Wild Flowers of Britain and Northern Europe (Fitter and Fitter, 1980) and Guide to Grasses, Sedges, Rushes and Ferns of Britain and Europe (Fitter and Fitter, 1987).

5.2 SURVEY FINDINGS

5.2.1 GENERAL

The site was relatively flat, although undulations especially in the western half of the site suggested that differential settlement had occurred. Such settlement may be due to the presence of variably compacted waste materials, causing the uneven ground surface.

The southern boundary of the site is formed by the Princes Parade road, which separates the site from the beach and sea. The coastal beach is predominantly shingle. The northern boundary is formed by the Military Canal, which lies some 4 m below the site level. A wide (approximately 3.5 m) towpath runs between the site and the canal and is just above canal level.

The site is generally overgrown with variable grass sward, although the northern side of the site, abutting the canal, is densely overgrown with large scrub vegetation and medium (up to 2 m in height) bushes. This scrub vegetation is especially noted in the north west corner of the site where small immature trees have developed to form a small wooded area.

5.2.2 HABITATS

The habitats identified within the area surveyed are shown on Figure 3 and listed below:

- Unimproved neutral grassland;
- tall ruderal;
- bare ground;
- scrub, dense continuous;
- open water – standing water;
- ammenity grassland;
- coastland – shingle.

These habitats are described below and their key features noted. Where a species list is given it is intended to be representative of vegetation present and should not be considered as exhaustive.

Unimproved neutral grassland (NCC Classification B2.1)

This classification is allocated due to the rank and neglected nature of most of the site, which has resulted in a high species diversity. Much of the site is classified as this type and the species present included the following.

Grasses:

- *Lolium temulentum* (Darnel)
- *Holcus lanatus* (Yorkshire Fog)
- *Agrostis stolonifera* (Creeping Bent)
- *Agrostis capillaris* (Common Bent)
- *Poa* spp. (possibly Early Meadow Grass - *Poa infirma*)

Forbs:

- *Picris echioides* (Bristly Ox-Tongue)
- *Malva sylvestris* (Common Mallow)
- *Sisymbrium officinale* (Hedge Mustard)
- *Calystegia silvatica* (Great Bindweed)
- *Convolvulus arvensis* (Field Bindweed)
- *Epilobium hirsutum* (Great Willowherb)
- *Trifolium repens* (White Clover)
- *Achillea ptarmica* (Yarrow)
- *Plantago lanceolota* (Ribwort Plantain)
- *Lotus corniculatus* (Birds Foot Trefoil)
- *Heracleum sphondylium* (Hogweed)
- *Cirsium dissectum* (Meadow Thistle)

Bare ground (NCC Classification J4)

An area of bare ground was recorded to the south western corner of the site where the tarmaced access road was located. In addition an area of compacted hardcore was noted which allowed for the turning of vehicles to carry out tipping operations. This area also had a significant amount of tipped bark and wood chipping in mounds up to 2 m in height.

Tall Ruderal (NCC Classification C3.1)

The vegetation noted in this the area given this classification was, in general, similar to that noted in the Unimproved neutral grassland area, although forbs made up a greater proportion of the ground cover. In addition, large examples of *Foeniculum vulgare* (Fennel), *Tanacetum parthenium* (Tansy) and *Chenopodium album* (Fat Hen) were recorded growing in stands of between heights of 1.5 – 2.5 m.

Amenity Grassland (NCC Classification J1.2)

Land to the west of the site is occupied by The Hythe Imperial Golf Course.

Open water – Canal (NCC Classification G1)

The Royal Military Canal is located immediately north of the site and forms its northern boundary. The canal towpath separates the canal form the site. The canal is a locally designated site of Site of Nature Conservation Interest, and provides habitat for a number of aquatic and riparian plants and animals. A detailed survey of the canal was not carried out as part of this general assessment since activities at the site, some 3 m higher than the canal are considered unlikely to significantly impact on the canal.

Coastland – shingle/gravel (NCC Classification H3)

To the south of the site, beyond Princes Parade a shingle beach is present. No plants were noted on this beach which is heavily used for recreational purposes.

5.2.3 FAUNA

5.2.3.1 Vertebrates

Mammals

No evidence of any large mammals was noted at the site and it is considered that the site's use by people for exercising dogs may act as a deterrent to regular larger mammals.

There were numerous potential habitats for small mammals (e.g. mice and voles). Evidence of small mammal population was noted with both runs through ground vegetation and burrow entrances recorded. In addition, gnawed snail shells were noted near to the canal towpath, which may be an indication of rat or shrew feeding.

Birds

During the site visit a number of bird species were noted. The following list comprises those species that were seen during the visit and those that are known, from ornithological records, to nest/feed at, or near to, the site during the summer. It should however be noted that the list is not definitive and is provided for information purposes only.

Black Cap (*Sylvia atricapilla*)
Chaff Finch (*Fringilla coelebs*)
Green Finch (*Carduelis chloris*)
Chiffchaff (*Phylloscopus collybita*)
Pied Wagtail (*Motacilla alba*)
Yellow Wagtail (*Motacilla flava*)
Blackbird (*Terdus merula*)
Reed Bunting (*Emberiza schoeniclus*)
Robin (*Erithacus rebecula*)
Skylark (*Alauda arvensis*)
Moorhen (*Gallinula chloropus*)
Grey Heron (*Ardea cinerea*0
Black headed gull (*Larus ridibundus*)
Yellow Legged Gull (*Lnrus michahellis*)
Wood Pigeon (*Columba palumbus*)
Collared Dove (*Streptopelia decaocta*)
Kestrel (*Falco tinnunculus*)
Gold Finch (*Carduelis carduelis*)
Reed Warbler (*Acrocephalus scirpaceus*)
Sedge Warbler (*Acrocephalus schoenobaenus*)
Meadow Pipit (*Anthus pratensis*)
Northern Wheatear (Oenanthe oenanthe)
Stone Chat (*Saxicola torquata*)
Whitethroat (*Sylvia communis*)
Blue Tit (*Parus caeruleus*
Great Tit (*Parus major*)
Mute Swan (*Cyngus olor*)
Mallard (*Anus platyrhynchos*)
Cormorant (*Phalacrocorax carbo*)
Herring Gull (*Larus argentatus*)
Greater Black Backed Gull (*Larus marinus*)
Mediterrancan Gull (*Larus melanocephalus*)
Lesser Black Backed Gull (*Larus fuscus*)
Little Grebe (*Tachybaptus ruficollis*)

5.2.3.2 Invertebrates

The most notable features of invertebrate fauna at the site were the number of Lepidoptera (Butterflies) at the site. In particular large numbers of *Pieris brassicae* (Large White) were noted across almost the whole of the site as were *Maniola jurtina* (Meadow Brown) although to a slightly lesser extent. In addition, *Vanessa cardui* (Painted Lady), *Artogeia rapae* (Small White), *Pyronia tithonus* (Gatekeeper) and *Vanesse atalana* (Red Admiral) were also noted albeit as solitary individuals rather than in significant populations.

Numerous Black Ant (*Lasius* niger) colonies were noted across the site and these were particularly abundant in the western half of the site.

5.3 CONCLUSIONS

Based on the findings of the ecologieal assessment carried out at land at Princes Parade, the following conclusions are drawn:

- The site is not designated with any national, regional or local conservation status;
- thc site comprises mainly an area of rough grassland, with ruderal and scrnb vegetation dominating the northern boundary.

Since no evidence of protected species was noted, or significant areas of potential habitat identified there was considered to be no ecological reason for delaying site intrusive works. However, to minimise damage to the flora of the site, and therefore damage to animals habitat, and also reduce the potential for disturbance to any animals not identified during the survey the following controls were implemented:

- All vehicles involved in site works should be wheeled and no tracked vehicles should be used.
- All intrusive works should be carried out in such a manner to minimise, as far as is responsibly possible, damage to vegetation.
- Intrusive works be carried out between the hours of 8 am and 8 pm when general site usage of the site is at a maximum (e.g. dogs being exercised) and therefore abnormal disturbance to the site minimised.

6. SITE INVESTIGATION WORKS

6.1 SITE INTRUSIVE WORKS

The fieldwork was undertaken between 29th July and 7th August 2002 and comprised the following elements:

- 4 no. Cable Percussion Boreholes (BH's 1, 2, 3 and 3A);
- installation of combined groundwater/gas monitoring standpipes in BH's 1, 2 and 3A together with subsequent monitoring;
- 10 no. Static Cone Penetration Tests undertaken by Lankelma Cone Penetration Testing Ltd;
- 30 no. Machine Excavated Trial Pits;
- installation of 10 no. gas monitoring standpipes in a selection of the trial pits together with subsequent monitoring.

The approximate exploratory hole locations are shown on the Site Layout Plan (Figures 2a and 2b).

Boreholes

Three boreholes were excavated to depths of 7.50 m using cable percussion boring techniques. One borehole was abandoned at 3 m due to an obstruction and relocated. Boreholes were commenced at 200 mm diameter in order to allow a subsequent reduction in casing size which allows a greater depth of excavation within the anticipated ground conditions. As boring progressed, 200 mm diameter, reducing to 150 mm diameter temporary steel casing was installed to support the sides of the bore. Disturbed and 'undisturbed' U100 samples were taken for description and subsequent laboratory inspection and testing purposes. Despite the use of two casing diameters, the drilling was not able to progress the boreholes beyond 7.50 m having proved natural ground beneath the landfill.

Groundwater and gas monitoring standpipes were installed in three boreholes to 7.50 m bgl. A monitoring visit was carried out approximately one week after the installation of the boreholes in order to obtain representative groundwater samples and gas readings. A further visit was made on 8th October.

Borehole logs describing the materials/soils encountered are presented in Appendix 2.

Trial Pits

Thirty trial pits were excavated to depths of between 3.3 and 5.0 m. The soils and materials encountered in the excavations were logged and representative samples recovered for laboratory analysis. Ten standpipes were installed to a depth of 3.0 m in a selection of the trial pits. Notes have been added to trial pit logs and include occurrences of roots, services, evidence of contamination and general pit stability and standpipes installation details. Trial pit logs describing the materials/soils encountered are presented in Appendix 3.

Static Cone Penetration Tests

Lankelma CPT Ltd. were instructed to carry out in-situ soils testing that comprised the following:

- 9 electric Static Cone Penetration Tests (CPT's) to measure the cone resistance and local side friction; and
- 1 electric Piezocone Penetration Test (CPTU) to measure the cone resistance and local side friction together with pore water pressure.

The report and details of the testwork carried out by Lankelma CPT Ltd are provided in Appendix 4.

The CPT's and trial pits were used to provide total coverage for contamination investigation purposes and for initial appraisal of ground conditions. Prior to investigations, it was anticipated that development would take place at the eastern end of the site and hence the boreholes were concentrated in this area.

6.2 SERVICES ENCOUNTERED

No live/active services were encountered during the recent site works.

6.3 ORGANOLEPTIC EVIDENCE OF CONTAMINATION

Olfactory evidence of contamination was recorded in the following trial pits.

Trial Pit	Depth (m)	Description
TP5	3.00	Slight hydrocarbon odour
TP11	1.50	Landfill odour consistent with organic esters
TP12	2.70	Landfill odour consistent with organic esters
TP15	2.70	Landfill odour consistent with organic esters
TP19	4.0	Landfill odour consistent with organic esters

In addition to the olfactory evidence recorded in the trial pits above, visual evidence of contamination was noted in all of the trial pits. This consisted of general household refuse including plastic sacks, glass, metal, crockery and textiles. In addition to the household waste, sterile unused stomach tubes were noted in TP4.

6.4 GROUNDWATER MONITORING

Groundwater was not encountered in the boreholes or trial pits during excavation. However water was added to the boreholes to assist drilling and this may have masked any slow groundwater ingress.

Groundwater samples were retrieved from the borehole installations on the 15th August and 8th October 2002. The depths of groundwater encountered in each borehole are summarised in the table below.

	Groundwater Level (m bgl)	
Monitoring Location	15/08/02 1400	8/10/02 0815
BH1	6.47	6.30
BH2	5.91	5.74
BH3A	5.23	5.14

The readings taken on 8th October were made 3 hours before a high spring tide.

It should be noted that groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other factors such as tidal/saline intrusion.

7. LABORATORY TESTING

7.1 ANALYTICAL TESTING – SOILS AND GROUNDWATER

One hundred and seventy three soil samples were recovered during the intrusive investigations. Following screening, seventy of these samples were scheduled for laboratory analysis which was undertaken by Eclipse Scientific, Ashford, Kent. All samples were analysed for potential contaminants which could reasonably be expected to be present on the site based on its history. The soil analytical suite comprised the following determinands:

Toxic Metals	Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic Cadmium Chromium Lead Mercury Selenium	Water soluble boron Copper Nickel Zinc	pH Water Soluble Sulphate	Total polyaromatic hydrocarbons (PAH) Total petroleum hydrocarbons (TPH) Gasoline Range Organics Diesel Range Organics Oil Range Organics

A section of piping recovered from TP24 possibly containing asbestos was also scheduled for confirmatory analysis.

A selection of the soil samples were scheduled for leachate analysis which consisted of the same determinands as above. Groundwater samples recovered on the 15th August 2002 were also tested for the same analytical suite as above.

A selection of the samples were also scheduled for Loss on Ignition (LOI) and Acid Digestible Fibre (ADF) analysis to determine the gas generation potential of the material. This testing provides data in order to assess the likelihood of gas generation and whether or not there is a need for the inclusion of gas protection systems in buildings.

The results of the analytical testing of soil, leachate and groundwater samples are presented in Appendix 5, 6 and 7 respectively.

7.2 GEOTECHNICAL SOILS TESTING

The following range of laboratory soils testing was scheduled and the results presented in Appendix 8.

- Determination of moisture content (4 no. tests);
- Determination of liquid and plastic limits (2 no. tests);
- Determination of particle size distribution by wet sieving (8 no. tests);

- Determination of undrained shear strength, single stage tests on U100 samples (1 no. test); and
- Determination of consolidation properties in an oedometer cell (1 no. test).

8. EVALUATION OF GROUND CONDITIONS AND ENGINEERING PROPERTIES

8.1 GROUND MODEL

The desk study research for the Princes Parade site has indicated a number of geotechnical hazards. These have been given careful consideration in the design of the preliminary intrusive ground investigation phase of works in order to prove the depth to natural ground beneath landfill and provide an indication of foundation options for the proposed future development on the site. Where ground conditions were found to be variable across the area the investigation also aimed to identify preferred areas for development in terms of ease of foundation construction. The principal geotechnical hazards include:

- Variable soil type and locally low strength and highly compressible nature of the near surface natural deposits in this area and the unknown but potentially variable depth to competent natural ground due to land filling. This would influence depth and type of foundations that can be used.
- An anticipated high and tidally influenced groundwater level and groundwater likely to have been affected by saline intrusion. The groundwater level variation should be taken into consideration in the design of any foundations as it could have an influence on soil strength and compressibility. The saline nature of groundwater should be considered with respect to aggressive chemical attack on buried concrete.
- Stability issues and foundation performance associated with any construction that may be planned at shallow depth close to the site boundary adjacent the Royal Military Canal.

The ground conditions which were encountered in the boreholes and trial pits are summarised in the following table:

Stratum	Depth to Base of Stratum (m)	Thickness (m)
Made Ground Variable deposits comprising clays, sands and gravels with brick, concrete, ash, clinker, glass, rubber and general domestic refuse. Some bonlder size concrete fragments and large pieces of timber.	2.8 – 4.2 Where proved	2.8 – 4.2 Where proved
Possible Made Ground/Marine Alluvium Medium dense fine to coarse rounded to angular sand and gravel with occasional cobbles. Bands of soft, soft to firm and firm gravelly clay with occasional black organic mottling and decomposed plant matter either within or at the base of this horizon.	7.0 – 7.50	3.4 – 3.8
Beach Gravels Medium Dense at the surface rapidly becoming dense or very dense fine to course rounded to subrounded and occasionally subangular sandy gravel.	Base not proven at 7.0 – 7.5 m	0.5 m Proved in BH1 and BH2

The preliminary investigation combined a limited number of boreholes with Cone Penetration Testing (CPT) to investigate the soil profile across the entire site. Near surface conditions were investigated by trial pitting. The CPT provides a rapid and cost effective means of investigating the soil profile provided it can be correlated with borehole data. The records of cone resistance and shaft friction are interpreted to provide an indication of in situ soil strength and an estimate of the soil type. The CPT is generally reliable at interpretating soil type in natural deposits but cannot readily distinguish between made ground and natural ground and the estimated soil profiles within the near surface landfill deposits should therefore be treated with caution.

The ground investigation generally proved the anticipated soil sequence with significant depths of made ground being encountered across the entire site. At the base of the made ground were variable deposits of medium dense sands and gravels or soft locally firm and locally organic clays. The clays appeared to be widespread but were found to be laterally discontinuous. They may represent the remains of marine alluvial deposits within parts of the Beach Gravels sequence or possibly dredgings from the Royal Military Canal, which the desk study noted had been placed in the former landfill. This sequence showed no positive indications of these materials being made ground and they have tentatively been described as possible made ground/marine alluvium.

Beneath the made ground and possible made ground/marine alluvium sequence the site was underlain across the entire site at consistent depth by dense and very dense Beach Gravels.

The made ground comprised variable deposits of claycy gravels and gravelly clays with brick, coucrete, glass, plastic, metal, timbcr and household waste, consistent with the site having been a landfill. The made ground locally contained fragments up to cobble and occasionally bolder size and large timber pieces. Where proved in the boreholes and trial pits the depths of made ground were fairly consistent across the site at about 4 m bgl with a variation between 2.8 m, TP20 near of the site and 4.2 m (TP10). These soils exhibited very variable strength and compressibility characteristics, locally being very weak and highly compressible and unstable in excavation.

The underlying possible made ground/marine alluvium was found in the boreholes to be approximately 3.5 m thick and comprised a sequence of gravels with localised bands of clay either within or at the base of this horizon. The clay bands varied in thickness from 1.3 to 1.6 m in the boreholes and up to 2 m interpreted in the CPT profiles. Within one of the CPT profiles the results were interpreted as encountering a band of organic clay (CPT 9 at 4.6 to 6.5 m).

Beneath the possible made ground/marine alluvium Beach Gravels were encountered. The surface of the Beach Gravels were marked by a rapid increase in strength/density. The boreholes were unable to progress within the Beach Gravel due to the density of the deposits and the high permeability, which preventing shelling and recovery of the gravels from the boreholes. The CPT's also terminated within the surface of the Beach Gravels, at slightly greater depth, due to the high in situ density. The depth to this horizon was found to be fairly consistent between 7.0 and 7.5 m. The maximum thickness of Beach Gravels proved before refusal in the boreholes or CPT's was abont 1 m.

The geology of the area suggests that the Beach Gravels rest upon a layer of disturbed ground with rock debris, possibly representing ancient landslip debris, at the interface with the underlying Weald Clay. The depth to Weald Clay was not proved during investigation but may be between 10 and 15 m depth based on nearby geological references.

Groundwater was not encountered during the fieldwork period. However subsequent monitoring of standpipes indicated groundwater levels ranging between 5.14 mbgl in BH3A and 6.47 m in BH1. The results are likely to be tidally influenced.

8.2 ENGINEERING PROPERTIES OF PRINCIPAL SOIL TYPES

The made ground comprised mixed deposits of gravelly clays and claycy gravels with demolition rubble and domestic refuse. Fragments of concrete timber and brick up to cobble and occasionally bolder size were encountered. Obstructions were locally encountered at shallow depth that prevented borehole and CPT progress and required relocation of some of the investigation positions.

The trial pits were generally unstable indicating low strength/loose ground. The CPT's indicated variability in the in situ strength/density profile both laterally and with depth. The anticipated variability in strength and settlement characteristics of the made ground and local presence of biodegradable material would make it unsuitable as a bearing horizon due to the potential for significant total and differential settlement. The irregular surface of the site suggests that the fill is undergoing self weight settlement.

The underlying possible made ground/marine alluvium varied from medium dense predominantly granular deposits to cohesive soils which were variably soft or firm and locally organic. Laboratory testing of the clays indicated high moisture contents, in the range 49 to 61%, and plasticity indices of 43 to 51%. The clays were classified as intermediate to high plasticity. Within BH 1 the undrained shear strength of the clay was 17 kN/m^2, soft, and oedometer results indicated that the clay was highly compressible. The variable strength and consolidation characteristics of this deposit combined with lateral variations in the thickness of the clay layer would make it unsuitable as a founding horizon.

The Beach Gravels generally showed a rapid increase in the in situ density with depth comprising dense and very dense sand and gravels which were proved to the full depths of investigation. SPT 'N' values within this horizon varied from 11 to 21 locally at or near the surface of the deposits but generally ranged between 45 and 50 before refusal.

8.3 FOUNDATION OPTIONS

The site was underlain by a significant thickness of made ground, and variable strength deposits, which would be unsuitable as bearing strata due to potentially high total and differential settlements, even under low and moderate loading conditions.

The Beach Gravels provide the first suitable bearing horizon for foundations to structures sensitive to differential settlement. The gravels were found at fairly consistent depths of between 7 and 7.5 m bgl. Given the depth to the Beach Gravels and the nature of the overlying deposits it is recommended that piled foundations are adopted to support the proposed structural loads and that the minimum depth of piling would be between about 7 and 8 m. Suspended ground floor slabs would be required.

The depth and consistency of the Beach Gravels did not vary significantly across the site and the overlying deposits showed little consistency in any areas of the site. It is therefore considered that on the basis of the investigation data no parts of the site appear any more suited than others from the point of view of relative ease of foundation construction.

For access roads and infrastructure the near surface variability of the soils encountered will require some ground treatment to provide a more even response to loading and to reduce differential settlements.

8.4 PILES

The dense to very dense Beach Gravels may provide a suitable bearing horizon for piles provided the thickness, lateral extent and in situ density of this horizon remains consistent across the development area. This could not be proved at the investigation positions due to termination of the BH's and CPT's within the surface of the Beach Gravels.

Piles terminating within the Beach Gravels will support the majority of the working load in end bearing. The pile to soil contact at the base of the pile therefore needs to be clean and undisturbed and soil stiffness should be uniform within a depth of at least 10 times the pile diameter beneath the pile toe to prevent pile head settlements. Prior to final design when details of the proposed development layout are known, limited additional investigation would be required to prove the thickness of Beach Gravels and the nature of the underlying deposits. In the event that the Beach Gravels are limited in thickness deeper piles terminating within the underlying Weald Clay may be required.

Given the nature of the soil sequence above the Beach Gravels 'downdrag' or negative skin friction should be considered in the design of piles.

There are a number of piling types and methods of construction available and suitable for use on this site. Specialist contractors will offer advice on the products they supply, methods of installation to suit the ground conditions and provide detailed pile design. The principal pile types considered suitable for this are driven pre-formed piles or continuous flight auger piles. The relative merits of these methods are discussed below:

8.4.1 Driven Piles

Piles should be driven to a depth to ensure termination within the bearing horizon and then to a set. Driven piles are likely to provide the most suitable approach to piling on the site provided the piling method is designed to keep noise and vibration within acceptable limits. However there is a risk of piles terminating on obstructions within the made ground, generally at shallow depth, and to a lesser extent within the possible made ground. Provision should be made for probing and excavation of obstructions at shallow depth at pile locations and for a degree of redundancy where piles meet obstructions at greater depth above the bearing horizon.

A further consideration with the choice of driven pile is to ensure that where individual pile lengths are joined the method of coupling can accommodate local lack of lateral support through the made ground and soft clays within the possible made ground deposits.

8.4.2 CFA Piles

With CFA piles it is essential that the pile toe to soil contact is clean and undisturbed by the process of installing the pile. This is of concern with some CFA type piles although modern methods of CFA pile installation can overcome this and ensure a clean base contact. The presence of obstructions within the landfill may result in some piles having to be abandoned before reaching founding depth. Pre probing at pile locations could be employed to investigate for the presence of obstructions which could be excavated and removed prior to installation of piles.

The method of construction should ensure that a uniform cross sectional area of pile can be maintained through variable deposits of made ground and possible made ground.

8.5 ACCESS ROADS/HARDSTANDING

The made ground is variable in composition and is generally a low strength and highly compressible material. Lightweight constructions on or in the surface of the landfill would be likely to experience significant total and differential settlements. Access roads, areas of hard standings and services corridors could be effected. In order to provide a more uniform response to loading and to reduce the magnitude of total and, in particular, differential settlements ground treatment would be required. The effects of any differential movement would be most pronounced adjacent to piled structures and at service entry points into buildings which would require flexible joints.

Along the access road and service corridors it may therefore be necessary to use a ground treatment method suitable to the ground conditions encountered. Specialist contractors would provide advice on the most suitable method that can be used which might include installation of vibro stone columns, excavation and replacement of soils with compacted granular backfill or soil mixing.

8.6 TEMPORARY WORKS

Prior to personnel entering any excavation a risk assessment should be carried out to determine trench support requirements. However excavations for pile caps and service corridors etc will be within the made ground which was recorded as being unstable within the trial pits. Trench/excavation support will therefore be required wherever personnel are required to enter excavations.

9. GROUND CONTAMINATION ASSESSMENT

9.1 GENERAL

The Phase 1 study indicated that the site was used historically for the disposal of waste and more recently canal dredgings. The categories of wastes accepted during the landfill operation of the site were such that a potential contamination risk was considered to be present. It was concluded that future site occupants could be exposed via ingestion, inhalation or direct contact to contaminated soils should they be present.

The risk of exposure depends upon a number of factors including the source and bioavailability of the contamination, existence of potential pollutant pathways and the layout of buildings and hardstanding areas in relation to any contamination found.

SDC informed GSG that there was no official proposed site development plan for Princes Parade although residential development is being considered. It was therefore agreed to assume residential housing across the whole of the site. The site was therefore divided into three horizontal sections as follows:

- Ground Level-1.0 m

It is considered that future occupants of the properties would most likely come into contact with the underlying soils in this layer. Likely pathways are via ingestion (direct and via consumption of vegetables), inhalation and absorption.

- 1.1-2.0 m

It is considered unlikely that future occupants would come into regular contact with this layer. However, occupants involved in structural improvements to their homes or gardens in the future might be exposed to underlying soils.

- 2.1-5.0 m

It is considered that site workers involved in the construction of the properties would come into contact with this layer during laying of foundations rather than future site occupants.

9.2 GUIDELINES ON CONTAMINANT LEVELS

The UK has contaminated land guidelines in the form of guidance note ICRCL (Inter-departmental Committee on the Redevelopment of Contaminated Land) 59/83 and the recently introduced "Contaminated Land Exposure Assessment" (CLEA) guidance values. Both sets of advice provide guidance concentrations for a range of metals for a range of end uses. The soil guideline values provided by the CLEA model represent intervention values and soil concentrations of a contaminant above these values might represent a unacceptable risk to the health of the site uses. The ICRCL guidance provides threshold concentrations, although action levels are not specified and professional judgement is relied upon to determine the upper limit of these contaminants for different end uses. ICRCL also provides threshold and action trigger concentrations for a range of contaminants typically associated with old town gasworks. The ICRCL guidance only assesses soil quality and does not address impacts to the aquatic environment.

An alternative approach is adopted in the Dutch contaminated land assessment criteria where two trigger levels exist, the intervention values and target values. Target values are intended to indicate a level implying negligible toxicological and ecotoxicological risk. Intervention values provide a framework for the determination of serious contamination, based upon (eco) toxicological data and all potential human exposure routes. They indicate concentrations of contaminants in 'standard' soils (based on 10% organic matter and 25% clay content), sediments and groundwater above which the functional quality of these media for plants, animals and ultimately humans will be severely diminished. In the Netherlands, remediation is required if the intervention values are exceeded and a further site specific risk assessment is conducted to determine whether remediation is required immediately or in the future.

The Dutch approach differs from that set out in ICRCL and CLEA, in that it aims to achieve "multifunctionality" (i.e. clean up for any future use), whereas ICRCL and CLEA, and the basis of the contaminated land legislation in the UK, is clean-up for the immediate proposed end use.

Both ICRCL and CLEA do not provide guidance concentrations for mineral oils – indicative of contamination derived from lubricating oils and other heavier hydrocarbons, or for total petroleum hydrocarbons (TPH) – indicative of contamination derived from fuels such as diesel, petrol and kerosene. The Dutch soil intervention value for mineral oils is 5,000 mg/kg. This can also be used when dealing with less volatile petroleum hydrocarbon mixtures at sites where groundwater is not a significant issue. However, for sites, which may potentially impact groundwater resources, a more stringent value of 500 to 1,000 mg/kg may be used by the Environment Agency, to determine whether or not remedial action is required.

A formalised "Methodology for the derivation of remedial targets for soil and groundwater to protect water resources" was published by the Environment Agency in 1999. The methodology allows the assessor to derive site specific remedial targets for soil and groundwater, in order to protect the water environment. In the case of the site, the water environment would be the Minor Aquifer underlying the site and the Royal Military Canal to the north.

ICRCL provides guidance on the threshold and action trigger concentrations for total PAH's but does not specify which individual compounds should be considered. In the USA the Environmental Protection Agency has identified 16 "priority pollutants" from the PAH family of chemical based upon the toxic/carcinogenic properties. Alternatively the Dutch guidelines provide intervention and target values for 10 PAH's. It is normal practice to use these lists of PAH's to compare with the total PAH concentration guidance provided in ICRCL.

SDC informed GSG that there was no official proposed site development plan for Princes Parade although a residential development is being considered. Therefore the more stringent CLEA Soil Guideline Values for a "Residential with Plant Uptake" end use across the whole of the site were adopted. Where guidance is not provided by the CLEA model then ICRCL values or the Dutch Limits are used.

9.3 SOIL QUALITY

Figures showing where elevated concentrations of potentially toxic and phytotoxic metals were recorded from GL-1.0 m and 1.1-2.0 m are provided in Figures 4a to 4f.

- Depth Range GL-1.0 m

Metals

The concentrations of the potentially toxic metals cadmium, chromium, mercury and selenium were less than their respective CLEA Soil Guideline Values for a "Residential with Plant Uptake" end use in all of the samples tested.

The concentration of arsenic and nickel slightly exceeded their respective CLEA Soil Guideline Values of 20 and 50 mg/kg for a "Residential with Plant Uptake" end use in TP6 at 0.50 m (41 and 62 mg/kg), TP17 at 1.0 m (31 and 70 mg/kg), TP18 at 1.0 m (24 and 52 mg/kg) and TP29 at 0.30 m (26 and 52 mg/kg).

The concentration of lead exceeded the CLEA Soil Guideline Value of 450 mg/kg for a "Residential with Plant Uptake" end use in TP17 at 1.0 m (610 mg/kg).

The single elevated concentration of lead was subjected to a maximum value test in accordance with CLR 7. The result indicated that the maximum value statistic calculated (T=1.48) is less than the 10% critical value of 2.13. It is therefore considered reasonable to treat the maximum value as belonging to the same underlying distribution as the other values recorded at this depth range and not as a statistical outlier that may indicate a localised area of contamination.

Mean value tests were applied to arsenic, lead and nickel data in accordance with the Environment Agency's RD7 Publication "CLR7: Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research" (CLR7).

The results indicated that, with a 95% confidence interval, the population mean concentration of arsenic across the site, based on a sample number of 12, was 23.6 mg/kg. This is slightly greater than the SGV of 20 mg/kg.

The population mean concentration of lead was 344 mg/kg significantly lower than the SGV of 450 mg/kg and the population mean concentration of nickel was 46.3 mg/kg, lower than the SGV of 50 mg/kg.

The concentrations of copper, zinc and boron exceeded their respective ICRCL Threshold Trigger Concentrations for "any uses where plants are to be grown" in the following samples:

Location	Depth (m)	Determinand
TP6	0.50	Boron 3.2mg/kg
TP17	1.0	Copper 440mg/kg Zinc 1200mg/kg Boron 3.2mg/kg
TP18	1.0	Zinc 350mg/kg
TP29	0.30	Copper 190mg/kg Zinc 480mg/kg

Organic Compounds

Generally, the concentrations of TPH's were below the analytical detection limit of 20 mg/kg in all of the samples tested. However, the concentration of TPH's recorded in TP1 (GL-0.2 m), TP21 (0.50 m) and TP17 (1.0 m) are 243, 23 and 38 mg/kg respectively. In all three samples, the high total concentrations were due to Oil Range Organics (C20-C44). These concentrations were all less than the general guidance value of 1,000 mg/kg.

Generally, the concentration of PAH's were less than the analytical detection limit of 20 mg/kg in all of the samples tested. However concentrations of 29 and 33 mg/kg were recorded in TP14 at 0.20 m and TP15 at 0.40 m respectively. Both these concentrations were less than the ICRCL Threshold Trigger Concentration of 50 mg/kg for "Domestic gardens, allotments and play areas".

Inorganic Compounds

The pH of the samples at this depth ranged from 7.4 to 8.5 indicating that the soil samples are in the neutral to slightly alkaline range.

The water soluble sulphate concentration ranged from less than the analytical detection limit of 0.5 g/l in the majority of samples tested to 0.89 g/l in TP18 at 1.0 m.

- Depth Range 1.10-2.0 m

Metals

The concentrations of the potentially toxic metals cadmium, chromium, mercury and selenium were less than their respective CLEA Soil Guideline Values for a "Residential with Plant Uptake" end use in all of the samples tested.

The concentration of arsenic slightly exceeded the CLEA Soil Guideline Value of 20 mg/kg for a "Residential with Plant Uptake" end use in TP5 at 1.50 m (68 mg/kg), TP24 at 1.70 m (71 mg/kg), TP26 at 1.50 m (63 mg/kg) and TP30 at 1.40 m (22 mg/kg).

The concentration of lead exceeded the CLEA Soil Guideline Value of 450 mg/kg for a "Residential with Plant Uptake" end use in TP5 at 1.50 m (1200 mg/kg), TP16 at 1.50 m (490 mg/kg), TP24 at 1.70 m (770 mg/kg) and TP26 at 1.50 m (870 mg/kg).

The concentration of nickel exceeded its CLEA Soil Guideline Value for a "Residential with Plant Uptake" end use in TP5 at 1.50 m (110 mg/kg), TP24 at 1.70 m (130 mg/kg) and TP26 at 1.50 m (110 mg/kg).

The concentrations of copper, zinc and boron exceeded their respective ICRCL Threshold Trigger Concentrations for "any uses where plants are to be grown" in the following trial pits:

Location	Depth (m)	Determinand
TP5	1.5	Copper 350mg/kg Zinc 590mg/kg Boron 7.5mg/kg
TP6	1.3	Zinc 650mg/kg
TP14	1.5	Zinc 440mg/kg
TP24	1.7	Copper 580mg/kg Zinc 960mg/kg Boron 4.6mg/kg
TP26	1.5	Copper 420mg/kg Zinc 1500mg/kg Boron 3.6mg/kg

Organic Compounds

Generally, the concentration of TPH's were less than the analytical detection limit of 20 mg/kg. However, the concentration of TPH's recorded in TP5 at 1.50 m, TP19 at 1.20 m and TP20 at 1.70 m was 28, 51 and 26 mg/kg respectively. In all three samples, the high concentration was due to Oil Range Organics (C_{20}-C_{44}). However, the concentrations were all less than 1,000 mg/kg.

The concentration of PAH's were generally less than the analytical detection limit of 20 mg/kg in the majority of the samples tested. However, two concentrations recorded in TP1 at 1.40 m (71 mg/kg) and TP26 at 1.50 m (134 mg/kg) exceeded the ICRCL Threshold Trigger Concentration of 50 mg/kg for "Domestic Gardens, Allotments and Play Areas".

Inorganic Compounds

The pH of the samples at this depth ranged from 7.6 to 8.9 indicating that the soils lie in the neutral to alkaline range.

The water soluble sulphate concentration ranged from less than the analytical detection limit of 0.5 g/l, in the majority of samples tested, to a maximum of 1.68 g/l recorded in a sample from TP24 at 1.70 m.

The results from the analysis of the asbestos piping encountered in TP24 at 2.10 m indicated that there was a significant (i.e. ≤30%) amount of chrysotile present.

- Depth Range 2.10-5.0 m

Metals

A summary of the concentrations of metals considered potentially toxic to humans recorded in samples from 2.10 m to 5.0 m across the site is provided in the table below.

Determinand	Concentration (mg/kg)			Number of Times SGV Exceeded
	Minimum	Maximum	Mean	
Arsenic	9.2	150	36.1	23
Cadmium	<1	12.4	1.70	0
Lead	<30	4600	694.4	18
Mercury	<0.5	43.7	2.14	1
Nickel	<20	470	69.6	18
Selenium	<0.5	2.2	0.73	0

A summary of the concentrations of metals considered to be potentially phytotoxic recorded in samples from 2.10 m to 5.0 m is provided in the table below.

Determinand	Concentration (mg/kg)			Number of Times Guidelines Exceeded
	Minimum	Maximum	Mean	
Copper	<10	840	176.6	15
Zinc	37	19000	1413	26
Boron	1.5	13.2	3.98	25

Organic Compounds

The concentrations of TPH's in this depth range were low across the site and did not exceed 1,000 mg/kg. The concentrations ranged from less than the analytical detection limit of 20 mg/kg to 173 mg/kg.

The concentration of PAH's recorded at this depth range exceeded the ICRCL Threshold Trigger Concentration of 50 mg/kg for "Domestic Gardens, Allotments and Play Areas" in the following samples:

Location	Depth (m)	Concentration (mg/kg)
TP2	3.5-4.0	98
TP4	4.0	264
TP7	2.5	244
TP8	4.3	54
TP9	2.8	239
TP9	4.5	64
TP10	3.0	117
TP13	2.6	54
TP23	3.7	70
TP25	4.0	59
TP26	2.6	212

Inorganic Compounds

The pH ranged from 7.4 to 9 at this depth span indicating that the soil samples lie in the neutral to slightly alkaline range.

The water soluble sulphate concentration ranged from less than the analytical detection limit of 0.5 g/l to 1.66 g/l.

9.4 LEACHATE ANALYSIS

Figures showing where elevated concentrations of metals were recorded from GL-2.0 m are provided in Figures 5a to 5g.

- Depth Range GL – 1.0 m

Metals

Generally, the concentration of the metals considered toxic to humans (arsenic, cadmium, chromium, lead, nickel and mercury) and the metals considered phytotoxic (boron, copper, and zinc) were less than their respective Leachate Quality Threshold Concentrations.

However, the concentration of copper in TP1 at Gl-0.10 m (26 µg/l) slightly exceeded the LQT value of 20 µg/l.

Organic Compounds

The concentration of TPH's were less than the analytical detection limit of 100 µg/l in all of the samples tested at this depth.

Generally, the concentration of the sum of PAH's were less than their respective analytical detection limits of 0.1 µg/l. However, the concentration of PAH's recorded in leachates from TP12 at 0.50 m (1.38 µg/l) and TP13 at 1.0 m (0.52 µg/l) exceeded the LQT concentration of 0.2 µg/l.

Inorganic Compounds

The pH ranged from 7.8 to 8.2 indicating that the leachate samples are in the neutral to slightly alkaline range. The sulphate concentration ranged from less than the analytical detection limit of 4 µg/l to 49 mg/l.

- Depth Range 1.1 – 2.0 m

Metals

The concentration of the metals considered to be potentially toxic to humans (selenium, mercury and nickel) were all less than their respective Leachate Quality Threshold Concentrations. The concentrations of cadmium, chromium and arsenic exceeded their respective LQT's in TP22 at 1.10 m (2, 90 and 21 µg/l respectively).

The concentration of lead exceeded the Leachate Quality Threshold Concentration of 50 µg/l in TP2 at 1.50 m (148 µg/l), TP16 at 1.50 m (56 µg/l) and TP22 at 1.10 m (84 µg/l).

The concentration of the metal boron considered potentially phytotoxic was less than its respective Leachate Quality Threshold Concentrations in all samples tested at this depth range.

The concentration of copper and zinc exceeded their respective LQT's of 20 µg/l and 500 µg/l in TP22 at 1.10 m (125 µg/l and 1689 µg/l respectively). The concentration of copper exceeded its LQT in TP2 at 1.50 m (22 µg/l).

Organic Compounds

The concentrations of TPH's recorded in the leachate samples ranged from less than the analytical detection limit of 100 µg/l to a maximum concentration of 622 µg/l.

Generally, the concentration of the sum of PAH's was less than the analytical detection limit of 0.1 µg/l. However, the concentration of the sum of PAH's recorded in TP6 at 1.30 m (0.60 µg/l) exceeded the Leachate Quality Threshold Concentration of 0.2 µg/l.

Inorganic Compounds

The pH ranged from 7.8 to 8.5 indicating that the leachate samples are in the neutral to slightly alkaline range. The sulphate concentration exceeded the Leachate Quality Threshold Concentration of 150 mg/l in TP22 at 1.10m (351 mg/l) and TP26 at 1.50 m (1073 mg/l). All other concentrations were less than the LQT.

- Depth Range 2.10 – 4.50 m

Metals

A summary of the concentrations of metals considered potentially toxic to humans recorded in the leachates samples from 2.10 – 4.50 m across the site is provided in the table below.

Determinand	Concentration (µg/l)			Number of Times LQT Exceeded
	Minimum	Maximum	Mean	
Arsenic	<1	22	4.1	1
Cadmium	<0.2	0.4	<0.2	0
Lead	<1	280	27.2	3
Mercury	<0.05	0.18	<0.05	0
Nickel	<2	10	5	0
Selenium	<1	2	<1	0

A summary of the concentrations of metals considered to be potentially phytotoxic recorded from 2.10 m to 4.50 m is provided in the table below.

Determinand	Concentration (mg/kg)			Number of Times Guidelines Exceeded
	Minimum	Maximum	Mean	
Copper	<20	45	5.18	2
Zinc	<20	423	57.35	0
Boron	58	4704	668.9	2

Organic Compounds

The concentrations of TPH's ranged from less than the analytical detection limit of 100 µg/l to 786 µg/l.

Generally, the concentration of PAH's were less than the Leachate Quality Threshold Concentration of 0.2 µg/l in the samples tested. However, the concentration of total PAH's exceeded the LQT concentration in TP7 at 2.50 m (2.37 µg/l), TP9 at 4.10 m (4.81 µg/l) and TP10 at 3.0 m (0.36 µg/l).

Inorganic Compounds

The pH ranged from 7.2 to 8.1 indicating that the leachates are in the neutral to slightly alkaline range. The sulphate concentration exceeded the Leachate Quality Threshold Concentration of 150 mg/l in the following samples:

Trial Pit Number	Depth(m)	Concentration (mg/l)
TP17	3.8	266
TP23	3.7	339
TP25	4	376
TP30	2.5	162

9.5 GROUNDWATER QUALITY

Metals

The concentration of all metals considered to be toxic to humans (arsenic, cadmium, chromium, lead, mercury, nickel and selenium) and phytotoxic metals (boron, copper and zinc) were less than their respective Dutch Intervention Values and also Leachate Qnality Threshold Concentrations.

Organic Compounds

The concentration of TPH's recorded in all of the water samples tested were below the analytical detection limits.

Generally, the concentrations of PAH's were less than the analytical detection limits in the water samples tested. However, the concentration of pyrene in the sample recovered from BH2 was 0.15 µg/l. None of the samples tested exceeded the Dutch Intervention Values for water or the Environment Agency's Leachate Quality Threshold Concentrations for waste disposal classifications.

Inorganic Compounds

The pH of the water samples tested ranged from 7.7 to 7.8 indicating that the groundwater samples are slightly alkaline in nature. The concentration of sulphate recorded in the water samples ranged from 36 to 99 mg/l.

9.6 SOIL GAS

9.6.1 GAS MONITORING

The soil gas survey carried out on 7th June 2002 at 87 positions across the site comprised monitoring of soil gases within narrow diameter holes up to 1 m deep. The atmosphere within the resultant voids was monitored for concentrations of carbon dioxide, methane and oxygen using portable equipment. The results of the soil gas survey are presented in the Phase 1 report, reference 44518/AMM.

The concentrations of methane measured were consistently less than instrument detection limits (< 0.25% v/v). Carbon dioxide concentrations varied from less than the instruments detection limit of 0.25% v/v to a maximum concentration of 7% v/v. Carbon dioxide concentrations of between 1.5% v/v and 5% v/v were recorded at 37 monitoring locations. Carbon dioxide concentrations exceeded 5% v/v in 5 locations.

Additional gas monitoring was carried out in the thirteen installed piezometers and three boreholes on the 15th August 2002. Concentrations of methane, carbon dioxide and oxygen were analysed using portable equipment. The results are provided in Appendix 9 and are presented in Figure 6.

The results indicate that the concentrations of methane were generally low across the site especially towards the eastern end where values ranged from less than 0.25% v/v to 0.60% v/v. However, elevated concentrations of methane were recorded in P1 (7-8% v/v), P2 (60% v/v) and P5 (4.7% v/v) in the western area of the site. The concentrations of methane within the three boreholes were all less than 0.25% v/v.

The concentrations of carbon dioxide ranged from 1.3% v/v to 15% v/v across the site. Concentrations exceeded 5% v/v in 5 locations, P2 (7-8% v/v), P3 (8% v/v), P5 (15 % v/v), P6 (5% v/v) and P7 (5% v/v). The concentrations of carbon dioxide in the BH1, 2 and 3 were 4.0% v/v, <0.25% v/v and 0.4% v/v respectively.

The concentrations of volatile hydrocarbons were low across the site and ranged from less than 1 ppm to a maximum concentration of 15.6 ppm.

9.6.2 LANDFILL GAS POTENTIAL DETERMINATION

In addition to the chemical soil testing a selection of samples were scheduled for analysis to determine the potential for landfill gas generation. Samples were analysed for Loss on Ignition (LOI) and Acid Digestible Fibre (ADF) content as outlined in Waste Management Paper 26A (WMP 26A). The results obtained from this analysis are presented in Appendix 11 and are assessed as stated in Waste Management Paper 26A.

The results from the LOI analysis indicated that the percentage of volatile solids (VS) within the samples ranged from 3-27.6%. The results are summarised in the table below.

Statistical Test	Value
Mean	11.36
Standard Deviation	7.86
t distribution value	1.70
Sample Population	29
Upper 90% Confidence Interval	13.28

The results indicate that with 90% confidence based on a sample size of 29, the volatile solids content of the samples is greater than the recommended value of 10%.

The samples were also analysed for ADF content to determine whether soil samples with a volatile solids content of between 10% and 25% would generate significant amounts of methane. The results indicated that the concentration ranged from 0.1% to 7.5% in the 29 samples tested. The subsequent ADF/VS ratios (provided in the table overleaf) were generally less than the recommended value of 0.25 and should be regarded as not having the potential to produce methane. However, one sample (TP4 ~~at 3.0 m~~) had an ADF/VS ratio of 0.27, slightly above the recommended value of 0.25.

TP5 @ 1.5m ?

Landfill Gas Potential Results				
Trial Pit Number	Depth (m)	ADF (%)	VS (%)	ADF/VS
TP1	1.4	0.2	4.7	0.04
TP2	3.5-4.0	0.3	9.4	0.03
TP3	1.3	0.2	6.7	0.03
TP4	3.0	0.2	8.1	0.02
TP5	1.5	7.5	27.4	0.27
TP6	0.5	0.6	10.9	0.06
TP7	3.1	1.3	27.6	0.05
TP8	4.3	1.5	27.3	0.05
TP9	2.8	0.9	11.3	0.08
TP10	2.4	0.4	10.8	0.04
TP11	2.9	0.2	6.1	0.03
TP12	2.7	0.2	5.2	0.04
TP13	2.6	0.4	7.2	0.06
TP14	1.5	0.4	8.4	0.05
TP15	2.7	0.5	4.6	0.11
TP16	2.1	0.2	4.2	0.05
TP17	1.0	0.5	9.1	0.05
TP18	1.0	0.3	7.6	0.04
TP19	1.2	0.7	15.3	0.05
TP20	1.7	0.4	3.3	0.12
TP21	2.7	0.7	22.3	0.03
TP22	2.3	0.5	8	0.06
TP23	2.5	0.5	25.2	0.02
TP24	3.2	0.7	20.3	0.03
TP26	2.6	0.5	16.2	0.03
TP27	1.2	0.1	3	0.03
TP28	2.4	0.2	4.5	0.04
TP29	0.3	0.4	10	0.04
TP30	1.4	0.2	4.9	0.04

10. CONTAMINATION RISK ASSESSMENT

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

- significant harm is being caused or there is significant possibility of such harm being caused; or
- pollution of controlled water is being, or is likely to be caused.

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

Table 10.1: Statutory definitions relating to pollution linkage.

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

The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination.

Potential sources of contamination associated with the site include:

- sub-surface contamination of ground originating from historic deposition of waste materials;

Potential pathways between the sources of contamination and the targets associated with the site include:

- vertical and lateral migration of contaminants to groundwater;
- inhalation of dusts;
- ingestion of contaminated soil; and
- dermal absorption including direct eye contact.

Potential sensitive receptors (targets) on the site and in the vicinity of the site are:

- site workers involved in any future development of the site;
- the health of future occupants of the properties;
- underground services in and around the site;
- the Minor Aquifer beneath the site;
- the Royal Military Canal; and
- the English Channel immediately to the south of the site.

Using the above factors and the results from the contamination test results, the following source-pathway-target linkage relationships are assessed:

HUMAN AND PHYTOTOXICITY

It is understood that the proposed layout of the development will be planned around the results and findings of this investigation. This risk assessment is therefore based on the assumption that residential houses with private gardens could be constructed on any part of the site or, the whole site.

In general, concentrations of metals potentially toxic to humans were low in samples recovered at shallow depths (GL-1.0 m) across the site and are not considered to pose a significant risk to occupants of the future properties. However, based on the analytical results, elevated concentrations of arsenic, nickel and lead were recorded within the central area of the site, TP 6, 17, 18 and 29 (arsenic and nickel) and TP 17 (lead).

The mean value tests indicated that the concentration of arsenic slightly exceeded the SGV of 20 mg/kg, the concentration of nickel was lower than the SGV of 50 mg/kg and the concentration of lead was lower than the SGV of 450 mg/kg. However, it is considered that due to the nature of the development there is nonetheless a potential toxicological risk to future occupants, especially children via direct ingestion, from the metals.

Based on the CLEA Model, the ingestion of soil and indoor dust contributes approximately 71% of the exposure from soil for both arsenic and lead and 54% for nickel for a residential with plant uptake end use. Consumption of home grown vegetables contributes to approximately 22% of the exposure from soil for both arsenic and lead and 41% for nickel. At such shallow depths it is considered that there is a potential risk to occupants of the future properties especially children via the ingestion of contaminated soil and the ingestion of home grown vegetables with increased metal concentrations from the central area of the site.

However, should the proposed footprints of buildings, areas of hardstanding or car parks fall within areas of the site where elevated concentrations of metals were recorded at shallow depths, then this would be sufficient to sever the potential pollutant linkage that currently exists.

The concentrations of the potentially phytotoxic metals boron, copper and zinc were elevated at shallow depths (GL-1.0 m) generally within the central area of the site. However, an increased zinc concentration was recorded at a shallow depth in the western area (TP13).

The soil pH across the whole of the site ranges from 7.4 to 8.5 and under such conditions, the chemical solubility of metals and therefore their bioavailability and potential for plant uptake is reduced. It is therefore considered that the potential risks to plants are low. This is demonstrated by the presence of a substantial covering of healthy vegetation across the whole of the site.

Based on the amount of established vegetation at the site it is considered that there is a suitable growth medium available. However, for aesthetic reasons, 'clean' imported topsoil is going to be a likely requirement. It is considered that the placement of this 'clean' topsoil layer in proposed domestic garden areas would additionally be sufficient to ameliorate the marginal risk posed by the metals at shallow depths.

This would function as a capping layer that would sever the pathway by which residents (particularly small children) could reasonably be expected to be exposed. Domestic garden areas are to be incorporated on the site therefore, a clean soil thickness of at least 350 mm would be required to provide a suitable growth medium.

Elevated concentrations of metals especially lead, considered to be potentially toxic to humans were encountered at depth. CFA bored pile installations in particular, will involve a substantial volume of "contaminated material" being brought to the surface. It is therefore considered that site workers involved in any current or future redevelopment of the site could be exposed by a variety of pathways such as direct skin contact, ingestion and inhalation. Provision of appropriate PPE (i.e. gloves), hygiene facilities and implementation of normal dust suppression measures would be considered appropriate control measures to minimise the potential health risks.

SOIL GAS AND VAPOUR

Guidance with respect to landfill gas is given in Building Research Establishment Report 212 and Approved Document C of the Building Regulations (1991). These documents recommend threshold values of 1% methane (v/v) and 1.5% (v/v) carbon dioxide above which consideration of design features to prevent the ingress of gas into buildings, for example suspended floor slabs on the ground floor should be adopted.

The results from the soil gas survey carried out on the 7th June indicated that it was likely that much of the carbon dioxide was from natural biological processes including soil microbial activity and root respiration.

Based on the results from the recent gas survey carried out in locations P1 to P10 and BH1-3, concentrations of carbon dioxide exceeded the recommended concentration of 1.5% v/v in the majority of installations. Five of these locations had concentrations greater than or equal to 5% v/v. The concentrations of methane exceeded the recommended concentration of 1% v/v in three of the piezometers (See Figure 6).

It is considered that the elevated concentrations of carbon dioxide and methane in the piezometers (which extend 3 m into the fill) compared to the spike survey are due to the aerobic degradation processes of putrescible material within the deeper sections of the landfill. This is consistent with the olfactory evidence of organic esters, indicative of degradation processes recorded during the recent intrusive investigations.

Based on the results of both gas surveys, it is considered that the use of passive gas control measures should be considered due to the elevated concentrations of carbon dioxide recorded across the whole of the site and the elevated concentrations of methane recorded in the western sections of the site. This will aid in reducing the potential for the build up of asphyxiating and explosive gases in any of the proposed buildings.

Due to the nature of the site it is likely that piles will be used. It is therefore considered that there is the potential for some piles to allow migration of landfill gas up into the atmosphere and buildings. Provided that the pile is formed in intimate contact with the surrounding soil, it is considered that there should be no formation of preferential pathways. As a result it is considered that the use of CFA piles will help to minimise the upward migration of landfill gases.

RISKS TO CONTROLLED WATER RESOURCES

The stratum underlying the site is classified as a Minor Aquifer. However, the proximity of the site to the sea suggests that the groundwater in the immediate vicinity of the site may be subject to saline intrusion. If so, local groundwater resources would be considered a less sensitive receptor of contamination.

Results from the leachate analysis indicated that copper and PAH's exceeded their respective Leachate Quality Threshold Concentrations (LQT) in one sample and two samples respectively out of the five analysed from GL-1.0 m. However the LQT for copper and PAH's is based on the maximum admissible concentration from the Water Supply (Water Quality) Regulations 1989 and is considered to be stringent in the context of the sites environmental setting.

Results from 1.10 m to 1.50 m indicated that 6 metals and PAH's exceeded their respective LQT's. Results from 2.50 m to 4.50 m indicated 4 metals and PAH's exceeded their respective LQT's. Based on these results it could be considered that there is a potential risk to the underlying groundwater from the leaching of metals through the layers of the landfill.

Results from the leachate analysis carried out on two natural soils recovered from the works, TP11 (4.50 m) and TP20 (3.70 m) indicated that slightly elevated concentrations of boron and copper were recorded in TP11, concentrations from TP20 were all less than their respective LQT's. Results from the analysis of groundwater retrieved from the boreholes indicated that significant contamination had not occurred. It is therefore considered that the risks to the underlying Minor Aquifer and the sea to the south of the site are low.

No significant concentrations of potentially mobile contaminants such as TPH's were recorded in the chemical results. It is therefore considered that the risks posed to the Minor Aquifer underlying the site and the sea to the south are low.

Most canals have a low permeability lining and it is considered that these are unlikely to be in hydraulic continuity with the underlying groundwater. The Royal Military Canal runs immediately to the north of the site and it is therefore considered that the risks to the canal are low.

As part of the development, CFA pile foundations are likely to be installed at the site. In the context of the sites environmental setting, this method is desirable because of the reduced potential for contamination to be transported from the Made Ground horizon into the underlying Minor Aquifer.

The proposed piling/foundation works is therefore considered not to have significant potential to facilitate pollution migration pathways into the underlying Minor Aquifer. Furthermore, the pH recorded in the soil samples was in the range of 7.4 to9.0 indicating that the soil is neutral to alkaline. Such a pH would reduce the solubility of any metals in the soil adsorbed to soil particles.

RISKS TO BURIED SERVICES AND STRUCTURES

Based on the results of this survey it is considered that there is not a potential contamination risk to buried services incorporating plastic sheathing such as water supply pipes that could react with organic contaminants.

Sulphate concentrations ranged from less than the analytical detection limit of 0.5 g/l to 1.68 g/l across the site. The procedure was followed in accordance with BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground' to determine the design sulphate class for data sets with 10 or more samples.

In accordance with BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground' a design sulphate class for the surface soils of DS-2 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-2 is recommended.

For concrete at greater depth, below the water table, a higher design class for sulphate would be required due to elevated chlorides where saline intrusion occurs.

WASTE DISPOSAL

General construction activities or piling operations and further levelling of the site are likely to generate surplus materials which will require off-site disposal at an appropriately licensed waste management facility. The concentrations of the various determinands found are likely to result in the arisings being classified as Waste Category C or E, Difficult Waste. However, a formal classification should be sought from the Environment Agency. Sterile unused stomach tubes were encountered in TP4. However, it is considered unlikely that this will be classified as clinical waste.

11. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations that can be drawn from the preliminary geo-environmental ground investigation of the Princes Parade site, Hythe can be summarised as follows;

Geotechnical

- The investigation indicated that the site is underlain by made ground, possible made ground/marine alluvium and Beach Gravels at depth.

- The made ground was consistent with landfill deposits. The possible made ground/marine alluvium appeared to be closely related to the local geology but bands of variable strength clay may represent dredgings from the Royal Military Canal or natural deposits of marine alluvium. The Beach Gravels were found at depths of between 7 and 7.5 m in the boreholes. The Beach Gravels were generally dense to very dense and boreholes were terminated a short distance into this horizon. CPT's progressed a little further into the deposit before reaching refusal.

- Groundwater was not encountered within the boreholes or trial pits during the investigation but standpipe monitoring indicated a shallowest recorded groundwater level at 5.14 m bgl in BH3A.

- The soil profile was unsuitable for a shallow strip/trenchfill foundation solution.

- The recommended foundation option for the sites is piles. These should be constructed within the Beach Gravels, the surface of which was identified in the boreholes. However the thickness of the Beach Gravels should be determined prior to final design when the proposed development layout has been determined. If the thickness of Beach Gravel is limited or laterally variable, piles would have to be constructed at greater depth within the underlying Weald Clay.

- Ground improvement would be required beneath areas of the site proposed for access roads and infrastructure corridors to avoid unacceptable total and differential settlement. Flexible connections would be required where services enter building constructed on piles.

- When the area of the site to be developed has been identified, further investigation would be required to determine the depths and thickness of Beach Gravel and the nature of the underlying soils prior to final design.

Environmental

- The natural soils underlying the site consist of Storm Beach Gravels and Marine Alluvium underlain by Weald Clay. The Storm Beach Gravels have been classified as a Minor Aquifer with soils of a high leaching potential. The site is not located within a groundwater Source Protection Zone (SPZ).

- Historical records indicated that the site has been operated as a domestic landfill and was closed in 1975. Significant quantities of domestic waste consisting of glass, metal, plastic, textiles and crockery were encountered in the majority of trial pits. However, waste consisting of domestic refuse in plastic sacks indicative of more recent deposits was encountered at the western end of the site.

- The results from the Loss on Ignition (LOI) analysis indicated that the percentage of volatile solids (VS) within the samples was generally greater than the recommended value of 10% provided in Waste Management Paper 26A. Acid digestible fibre (ADF)/VS ratios indicated that the majority of the underlying waste should be regarded as not having the potential to produce significant quantities of methane.

- Gas monitoring carried out in the piezometers and the boreholes indicated that methane concentrations were generally low across the eastern end of the site, however, elevated concentrations of methane were recorded in the western area. The concentrations of carbon dioxide were elevated across the site. The use of passive gas control measures should be considered, this will aid in reducing the potential for the build up of asphyxiating and explosive gases in any of the proposed buildings.

- Concentrations of metals potentially toxic to humans were low in samples recovered at shallow depths (GL-1.0m) across the site and are not considered to pose a significant risk to occupants of the future properties. However, elevated concentrations of arsenic, nickel and lead were recorded within the central area of the site. It is considered that placement of 'clean' imported topsoil in proposed domestic garden areas would be sufficient to ameliorate the marginal risk posed by the metals at shallow depths.

- The concentrations of the potentially phytotoxic metals boron, copper and zinc were elevated at shallow depths (GL-1.0 m) generally within the central area of the site. The soil pH across the whole of the site ranged from 7.4 to 8.5 and under such conditions, the chemical solubility of metals and therefore their bioavailability and potential for plant uptake is reduced. It is therefore considered that the potential risks to plants are low.

- Site workers involved in any current or future redevelopment of the site could be exposed by a variety of pathways such as direct skin contact, ingestion and inhalation. Provision of appropriate PPE, hygiene facilities and implementation of normal dust suppression measures would be considered appropriate control measures to minimise the potential health risks.

- In accordance with BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground' a design sulphate class for the surface soils of DS-2 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-2 is recommended.

- Results from the leachate analysis indicated that copper and PAH's exceeded their respective Leachate Quality Threshold Concentrations (LQT's). However the LQT for copper and PAH's is based on the maximum admissible concentration from the Water Supply (Water Quality) Regulations 1989. The proposed piling/foundation works are considered not to have significant potential to facilitate pollution migration pathways into the underlying Minor Aquifer. Furthermore, the pH recorded in the soil samples was in the range of 7.4 to 9.0 indicating that the soil is neutral to alkaline. Such a pH would reduce the solubility of any metals adsorbed to soil particles.

- General construction activities are likely to generate surplus materials which may require off-site disposal at an appropriately licensed waste management facility. The arisings are likely to be classified as Waste Category C or E, Difficult Waste. However, a formal classification should be sought from the Environment Agency. Sterile unused stomach tubes encountered in TP4 are unlikely to be classified as clinical waste.

Based on the principles and the definitions outlined under Section 57 of the Environment Act 1995, the site would not be considered to be "contaminated land" based on its redevelopment to residential housing incorporating private gardens providing the following recommendations are met:

- The incorporation of a sufficient growth medium in domestic gardens should be considered. Domestic garden areas to be incorporated on the site would require a clean soil thickness of at least 350 mm to provide a suitable growth medium.

- The use of passive gas control measures should be considered to aid in reducing the potential for the build up of asphyxiating and explosive gases in any of the proposed buildings.

AN idom GROUP COMPANY

Idom Merebrook Ltd 1 Leonard Place, Westerham Road, Keston, Kent, BR2 6HQ
t +44 (0)1689 889 980 **f** +44 (0)1689 889 981 **e** consulting@merebrook.co.uk **merebrook.co.uk** **idom.com**
Registered in England No. 02740216 Registered office: Belper
offices London Kent Derby Cardiff Manchester Moray

Please quote our ref: L-17436ai-2.4.2-17-S235-NTD

10 March, 2017

Dave Shore
Shepway District Council
Civic Centre,
Castle Hill Avenue
Folkestone, Kent
CT20 2QY

By E-mail and by Post: dave.shore@shepway.gov.uk

Dear Mr Shore

INVESTIGATION OF THE NORTHERN BOUNDARY (ADJOINING THE ROYAL MILITARY CANAL) PRINCES PARADE

I write further to your request to provide an assessment of the shallow soils in the proposed buffer area adjoining the Military Canal. Merebrook attended site on 22 February 2017 to advance hand dug pits and recover samples (see attached drawing for sampling locations).

BACKGROUND

The site occupies an area of approximately 7.5 hectares located at National Grid Reference 618523, 134832.

The site is bounded by the Royal Military Canal to the north, a carpark and residential flats to the east, Princes Parade Road and the beach to the south and a golf course to the west.

At the time of the Merebrook visit, the majority of the site was disused. The site is an overgrown former landfill with much of the site comprising rough grass, weeds, scrubland and trees. A gated entrance onto the site is located in the southwestern corner with historical hardstanding noted in this area. The eastern portion of the site is developed with Seapoint Canoe Centre, playground and picnic area identified. A pathway was identified north of Princes Parade through the central portion of the site and across the canal. A pathway encircles the western, northern and eastern perimeter of the site. No invasive species were noted during the site walkover, however, sporadic littering was noted on the site.

ENVIRONMENTAL SETTING

The published geological map indicates the presence of superficial drift deposits of Storm Beach Deposits comprising gravel underlying the majority of the site. Tidal Flat Deposits comprising clay and silt are likely to underlie the northern portion of the site. The underlying bedrock geology comprises clay and mudstone of the Weald Clay Formation.

Previous investigations conducted by Merebrook and reported in our Geo-Environmental report dated November 2016 (GEA-17436ai-15-193 Rev C) recorded localised polyaromatic hydrocarbons (PAH), and heavy metals (lead, arsenic, copper and zinc). Asbestos was also encountered, however where quantified was recorded at non-hazardous concentrations (< 0.1%).

INVESTIGATION

It was proposed that additional samples would be recovered to augment the existing data and establish if a capping layer of clean soil would be required in the proposed buffer area.

The proposed buffer zone comprised a flat strip next to the canal (used as a footpath) approximately 4 m wide with a bund along the south. The area was surfaced with rough grass, while brambles were encountered along the bund.

Ten hand dug pits (HP1 to HP10) were advanced to a maximum depth of 0.4 m bgl. Topsoil/ made ground was encountered at all locations and generally comprised sandy gravelly clay to clayey sand. Gravel-sized materials consisted of minor quantities of flint, brick, concrete and bituminous pieces.

In addition, inclusions of glass, pottery, metal, plastic, glass bottles and shoes were also encountered. A suspected piece of asbestos containing material (ACM) in the form of cement sheet was encountered at the surface close to HP5.

Eight samples were submitted to a UKAS accredited laboratory for analysis of a standard suite of contaminants. The laboratory chemical analysis certificate is appended (17-40957-1).

RESULTS

An initial screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against Suitable for Use Levels (S4ULs) published in 2015 by LQM/CIEH. These precautionary screening levels are designed to be representative of minimal risk to human health. As the area under investigation would be used as public open space, POSresi (POS2) criteria have been adapted.

For lead the DEFRA Category 4 Screening Level has been used as this is based on updated toxicological data and a low risk to human health.

An additional set of phytotoxin screening levels have been adopted from 'The Code of Agricultural Practice for the Protection of Soil' Ministry of Agriculture, Fisheries and Food (MAFF), 1993, which are protective of healthy plant growth. Landscaped areas are proposed within all scenarios.

Table 1: Summary of Soils Chemical Analysis Results

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Asbestos in soil	-	Detected	-	8	Detected	2
pH	-	8.2	7.89	8	10	0
Arsenic	$mg.kg^{-1}$	28	13.26	8	79	0
Cadmium	$mg.kg^{-1}$	7.6	1.18	8	120	0
Chromium (total)	$mg.kg^{-1}$	48	25.9	8	1500	0
Hexavalent Chromium	$mg.kg^{-1}$	<4.0	<4.0	8	7.7	0
Lead	$mg.kg^{-1}$	550	147.9	8	630	**0**
Mercury	$mg.kg^{-1}$	5.6	1.26	8	120	0
Nickel	$mg.kg^{-1}$	51	21.6	8	230	0
Selenium	$mg.kg^{-1}$	<1.0	<1.0	8	1100	0
TPH Aliphatic >EC_5 - EC_6	$mg.kg^{-1}$	<1.0	<1.0	8	590000	0
TPH Aliphatic >EC_6 - EC_8	$mg.kg^{-1}$	<1.0	<1.0	8	610000	0
TPH Aliphatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<1.0	<1.0	8	13000	0
TPH Aliphatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	4.8	3.33	8	13000	0
TPH Aliphatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	12	9.33	8	13000	0
TPH Aliphatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	<8.0	<8.0	8	250000	0
TPH Aliphatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	33	15.5	8	250000	0
TPH Aromatic >EC_5 - EC_7	$mg.kg^{-1}$	<1.0	<1.0	8	56000	0
TPH Aromatic >EC_7 - EC_8	$mg.kg^{-1}$	<1.0	<1.0	8	56000	0
TPH Aromatic >EC_8 - EC_{10}	$mg.kg^{-1}$	<1.0	<1.0	8	5000	0
TPH Aromatic >EC_{10} - EC_{12}	$mg.kg^{-1}$	6.1	2.79	8	5000	0
TPH Aromatic >EC_{12} - EC_{16}	$mg.kg^{-1}$	16	8.46	8	5100	0
TPH Aromatic >EC_{16} - EC_{21}	$mg.kg^{-1}$	84	35.3	8	3800	0
TPH Aromatic >EC_{21} - EC_{35}	$mg.kg^{-1}$	100	40.3	8	3800	0
Benzene	$mg.kg^{-1}$	<0.001	<0.001	8	72	0
Toluene	$mg.kg^{-1}$	<0.001	<0.001	8	24000	0
Ethylbenzene	$mg.kg^{-1}$	<0.001	<0.001	8	56000	0
Xylene	$mg.kg^{-1}$	<0.002	<0.002	8	42000	0
Acenaphthene	$mg.kg^{-1}$	0.53	0.2	8	15000	0

Continued from page 2

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Acenaphthylene	mg.kg^{-1}	0.56	0.24	8	15000	0
Anthracene	mg.kg^{-1}	2.5	0.78	8	74000	0
Benz(a)anthracene	mg.kg^{-1}	11	5.07	8	29	0
Benzo(a)pyrene	mg.kg^{-1}	13	5.51	8	5.7	3
Benzo(b)fluoranthene	mg.kg^{-1}	14	6.36	8	7.2	3
Benzo(ghi)perylene	mg.kg^{-1}	7.2	2.87	8	640	0
Benzo(k)fluoranthene	mg.kg^{-1}	7.3	2.99	8	190	0
Chrysene	mg.kg^{-1}	7.5	3.56	8	57	0
Dibenz(ah)anthracene	mg.kg^{-1}	1.6	0.73	8	0.57	5
Fluoranthene	mg.kg^{-1}	18	8.66	8	3100	0
Fluorene	mg.kg^{-1}	0.65	0.23	8	9900	0
Indeno(123-cd)pyrene	mg.kg^{-1}	6.7	2.65	8	82	0
Naphthalene	mg.kg^{-1}	0.36	0.16	8	4900	0
Phenanthrene	mg.kg^{-1}	10	3.16	8	3100	0
Pyrene	mg.kg^{-1}	15	7.19	8	7400	0
Phenol	mg.kg^{-1}	<1.0	<1.0	8	690	0
PHYTOTOXICITY RISK ASSESSMENT						
	Units	**Max**	**Mean**	**No of Test**	**Screening Level (SL)**	**No > SL**
Copper	mg.kg^{-1}	210	48.5	8	200	1
Nickel	mg.kg^{-1}	51	21.63	8	110	0
Zinc	mg.kg^{-1}	7600	1101.9	8	300	2

Notes: * Number of samples exceeding screening level nd = not detected

The results indicate PAH species (benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene) exceeded relevant screening at several locations. It should be noted that bituminous inclusions were noted in a number of locations. In addition, phytotoxic metals (copper and zinc) were encountered sporadically at elevated concentrations. The highest concentrations of zinc and copper (7,600 mg/kg and 210 mg/kg respectively) were encountered at HP1 and were associated with metal fragments.

Asbestos was encountered in two samples in the form of chrysotile/amosite (insulation lagging/loose fibres), however concentrations were recorded at non-hazardous concentrations (<0.1%). A suspected ACM fragment was encountered at the surface at HP5.

CONCLUSIONS

Soil contamination in the form of asbestos, PAH species and heavy metals has been encountered during this investigation at shallow depth. This is consistent with the findings of the previous investigation conducted by Merebrook.

The levels of contamination encountered represent a potential risk to future uses of the site. The identified risks in this portion of the site can be mitigated by removal of either; the source, pathway or receptor.

Remedial measures will be required that are protective of human health. Clean cover will be required in areas of soft landscaping as detailed below (this is in line with the clean capping recommendations for public open space elsewhere on site):

- 150 mm of soil and a geotextile marker or 300 mm without.

It is considered that the above capping measures should result in the mitigation of potential human health and environmental source-pathway-receptor linkages to an acceptable degree.

Although hydrocarbon contamination was recorded in made ground at concentrations which could pose a risk to human health, the concentrations were not sufficiently mobile to pose a risk to controlled waters.

Continued from page 3

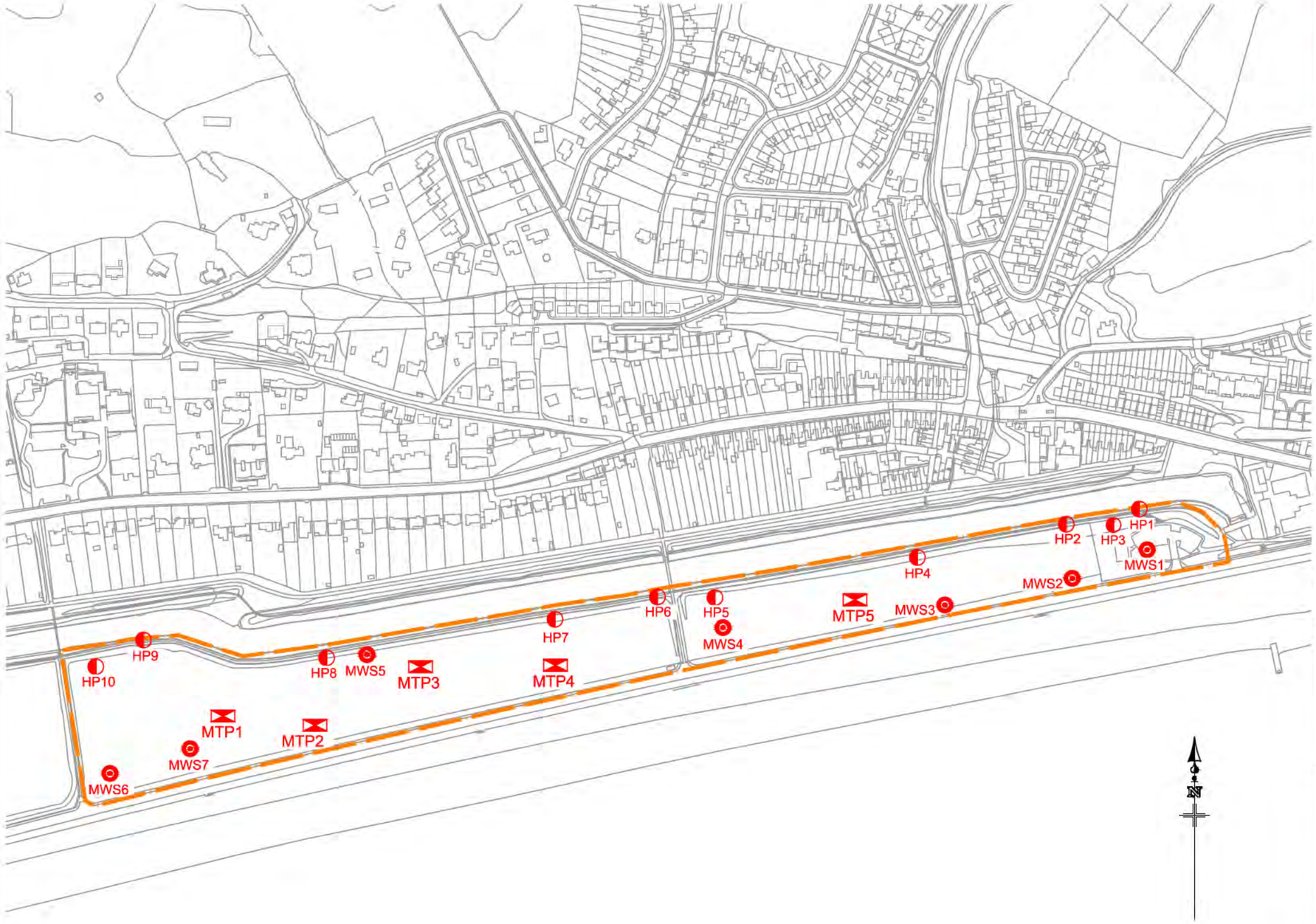
I trust that the information above is sufficient for your current needs, however should you require any further information please do not hesitate to contact me with any further queries.

Yours sincerely

Nathan Dellow
For Idom Merebrook Ltd

cc File

enc Drawing
Laboratory certificate 17-40957-1
Logs/sample descriptions



Legend

- Approximate Site Boundary
- MHAref — Approximate Merebrook hand auger location with reference (Feb 2017)
- MWSref — Approximate Merebrook window sample location with reference (July 2015)
- MTPref — Approximate Merebrook trial pit location with reference (July 2015)

Revision Details	Dwn	Chd	App'd
First Issue	D.M.S.	N.D.	R.G.
	07/03/17		-

Client/Project

Shepway District Council
Princes Parade
Seabrook, Hythe

Dwg Title

Site Investigation Locations

Job No.	Dwg No.	Revision
17436ai	17436ai-304-002	-
Scale	**Date**	**Frame Dimensions mm**
N.T.S.	March 2017	(A3) 400 x 280
Drawn	**Checked**	**Approved**
D.M.S.	N.D.	R.G.

London
Kent
Derby
Cardiff
Manchester

idom merebrook

1 Leonard Place, Westerham Road, Keston, Kent. BR2 6HQ
tel +44(0)1689 889980 fax +44(0)1689 889981 email consulting@merebrook.co.uk

Location	Depth (m)	Soil Description
HP1	0.00-0.33	Brown slightly silty sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded flint and bituminous surfacing. Two glass bottles, glass and metal fragments.
HP2	0.00-0.20	Brown slightly sandy gravelly CLAY with some rootlets. Gravel is subangular to subrounded flint.
	0.20-0.33	Pale brown gravelly CLAY. Gravel is fine to medium subangular to subrounded flint and concrete.
HP3	0.00-0.33	Brown sandy gravelly CLAY with some rootlets. Gravel is angular to surrounded flint, brick and bituminous surfacing.
HP4	0.00-0.30	Greenish brown to brown sandy slightly gravelly CLAY. Gravel is fine to medium subrounded flint and rare brick. Rare inclusions of glass and pottery fragments.
	0.30-0.40	Greenish brown to brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium coarse subrounded flint.
HP5	0.00-0.34	Greenish brown to brown sandy slightly gravelly CLAY with some rootlets. Gravel is subangular to subrounded flint, bituminous surfacing, concrete and brick.
HP6	0.00-0.20	Brown sandy CLAY with rootlets.
	0.20-0.30	Yellowish brown to light brown very sandy gravelly CLAY. Gravel is medium to coarse angular to subrounded flint, brick and concrete. Single brick cobble.
HP7	0.00-0.33	Brown sandy slightly gravelly CLAY with rootlets. Gravel is fine to medium subangular to subrounded flint and brick. Occasional inclusions of plastic, glass and metal fragments. A single boot.
HP8	0.00-0.33	Brown sandy slightly gravelly CLAY with rootlets and roots. Gravel is fine to medium angular to surrounded brick, flint and rare bituminous surfacing. and a shoe.
HP9	0.00-0.33	Brown sandy slightly gravelly CLAY. Gravel is fine to medium subrounded to rounded flint.
HP10	0.00-0.40	Yellowish brown clayey SAND with rootlets. Occasional inclusions of plastic.

Nathan Dellow
Merebrook
First Floor
1 Leonard Place
Westerham Road
Keston
BR2 6HQ

t: 01689 889980
f: 01689 889981
e: ndellow@merebrook.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 : 17-40957

Project / Site name:	Princes Parade	**Samples received on:**	23/02/2017
Your job number:	17436AI	**Samples instructed on:**	23/02/2017
Your order number:	17-S14-FDO-LABS	**Analysis completed by:**	02/03/2017
Report Issue Number:	1	**Report issued on:**	02/03/2017
Samples Analysed:	8 soil samples		

Signed [redacted]
Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Signed: [redacted]
Emma Winter
Assistant Reporting 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.

Analytical Report Number: 17-40957

Project / Site name: Princes Parade
Your Order No: 17-S14-FDO-LABS

Lab Sample Number				707967	707968	707969	707970	707971
Sample Reference				HP1	HP2	HP4	HP5	HP6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20-0.30	0.20-0.30	0.20-0.30	0.20-0.30	0.20-0.30
Date Sampled				22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
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	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	20	12	26	24	16
Total mass of sample received	kg	0.001	NONE	1.3	1.4	1.2	1.3	1.4
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	Chrysotile, Amosite	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	0.035	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	0.035	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.6	8.0	7.8	8.0	8.0
Total Cyanide	mg/kg	1	MCERTS	2	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.039	0.014	0.030	0.023	0.012
Sulphide	mg/kg	1	MCERTS	< 1.0	26	12	16	< 1.0
Organic Matter	%	0.1	MCERTS	5.7	3.3	6.0	5.3	1.7
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.20	< 0.05	0.36	0.26	0.13
Acenaphthylene	mg/kg	0.1	MCERTS	0.20	< 0.10	0.56	0.35	0.12
Acenaphthene	mg/kg	0.1	MCERTS	0.20	< 0.10	0.23	0.53	0.27
Fluorene	mg/kg	0.1	MCERTS	0.21	< 0.10	0.27	0.65	0.29
Phenanthrene	mg/kg	0.1	MCERTS	4.1	0.32	4.5	10	2.9
Anthracene	mg/kg	0.1	MCERTS	0.75	< 0.10	0.95	2.5	0.81
Fluoranthene	mg/kg	0.1	MCERTS	13	0.99	18	16	6.6
Pyrene	mg/kg	0.1	MCERTS	11	0.80	15	13	5.4
Benzo(a)anthracene	mg/kg	0.1	MCERTS	7.2	0.52	11	8.1	3.7
Chrysene	mg/kg	0.05	MCERTS	5.9	0.47	7.5	6.0	2.4
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	9.8	0.70	14	11	4.5
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	4.3	0.40	7.3	4.9	1.5
Benzo(a)pyrene	mg/kg	0.1	MCERTS	7.7	0.64	13	9.6	3.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	3.8	0.31	6.7	4.1	1.5
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	1.0	< 0.10	1.6	1.2	0.45
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.2	0.38	7.2	4.6	1.6
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	73.7	5.53	108	92.5	35.7
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	28	8.4	13	14	14
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	7.6	< 0.2	< 0.2	0.6	< 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	48	18	21	21	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	210	15	46	32	11
Lead (aqua regia extractable)	mg/kg	1	MCERTS	550	24	120	120	30
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	5.6	< 0.3	0.9	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	51	14	21	18	23
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	7600	49	170	150	53

Analytical Report Number: 17-40957

Project / Site name: Princes Parade
Your Order No: 17-S14-FDO-LABS

Lab Sample Number				707967	707968	707969	707970	707971
Sample Reference				HP1	HP2	HP4	HP5	HP6
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20-0.30	0.20-0.30	0.20-0.30	0.20-0.30	0.20-0.30
Date Sampled				22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	4.6	4.2	3.4	3.3	4.8
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	11	12	12	11	11
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	24	< 8.0	33	27	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	45	22	55	46	25
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	1.3	3.3	3.7	1.3	6.1
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	4.3	8.7	16	11	11
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	31	< 10	84	65	22
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	33	< 10	100	59	20
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	69	29	210	140	60

Analytical Report Number: 17-40957

Project / Site name: Princes Parade
Your Order No: 17-S14-FDO-LABS

Lab Sample Number				707972	707973	707974		
Sample Reference				HP7	HP8	HP9		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.20-0.30	0.20-0.30	0.20-0.30		
Date Sampled				22/02/2017	22/02/2017	22/02/2017		
Time Taken				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	< 0.1		
Moisture Content	%	N/A	NONE	17	17	15		
Total mass of sample received	kg	0.001	NONE	1.4	1.4	1.3		
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Amosite	-		
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Detected	Not-detected		
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	0.003	-		
Asbestos Quantification Total	%	0.001	ISO 17025	-	0.003	-		
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.2	7.8	7.7		
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1		
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.067	0.025	0.044		
Sulphide	mg/kg	1	MCERTS	9.3	9.1	< 1.0		
Organic Matter	%	0.1	MCERTS	3.1	4.0	4.3		
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.18	< 0.05	< 0.05		
Acenaphthylene	mg/kg	0.1	MCERTS	0.22	0.25	< 0.10		
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10		
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10		
Phenanthrene	mg/kg	0.1	MCERTS	1.2	1.9	0.35		
Anthracene	mg/kg	0.1	MCERTS	0.46	0.53	< 0.10		
Fluoranthene	mg/kg	0.1	MCERTS	5.2	8.4	1.1		
Pyrene	mg/kg	0.1	MCERTS	4.5	6.9	0.93		
Benzo(a)anthracene	mg/kg	0.1	MCERTS	4.1	5.4	0.56		
Chrysene	mg/kg	0.05	MCERTS	2.4	3.3	0.47		
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	4.5	5.7	0.71		
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.2	2.9	0.42		
Benzo(a)pyrene	mg/kg	0.1	MCERTS	3.9	5.1	0.67		
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.0	2.5	0.32		
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.64	0.78	0.10		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.0	2.6	0.39		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	33.5	46.1	6.02		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.7	12	11		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2		
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	35	13		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30	31	13		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	120	180	39		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.1	< 0.3	< 0.3		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	17	12		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	200	540	53		

Analytical Report Number: 17-40957

Project / Site name: Princes Parade
Your Order No: 17-S14-FDO-LABS

Lab Sample Number				707972	707973	707974		
Sample Reference				HP7	HP8	HP9		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.20-0.30	0.20-0.30	0.20-0.30		
Date Sampled				22/02/2017	22/02/2017	22/02/2017		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	3.0	< 1.0	2.3		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	7.7	2.9	7.0		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0		
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	19	< 10	20		
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	2.5	1.2	2.9		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	6.1	5.2	5.4		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	21	31	18		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	31	49	20		
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	61	87	47		

Analytical Report Number: 17-40957
Project / Site name: Princes Parade
Your Order No: 17-S14-FDO-LABS

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
707970	HP5	0.20-0.30	124	Insulation lagging, Loose fibres	**Chrysotile, Amosite**	0.035	**0.035**
707973	HP8	0.20-0.30	139	Insulation lagging	**Amosite**	0.003	**0.003**

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

Analytical Report Number : 17-40957

Project / Site name: Princes Parade

* 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 *
707967	HP1	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707968	HP2	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707969	HP4	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707970	HP5	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707971	HP6	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707972	HP7	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707973	HP8	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.
707974	HP9	None Supplied	0.20-0.30	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 17-40957

Project / Site name: Princes Parade

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

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 ouse method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
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 soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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 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
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
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
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
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 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
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

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.