Phase I & II Environmental Assessment

Land off Station Road
Surfleet
Spalding
Lincolnshire
PE11 4DG

Prepared for:

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LAND OFF STATION ROAD, SURFLEET

NON-TECHNICAL CLIENT SUMMARY

This report presents the findings of a Phase I & II Environmental Assessment which was carried out to identify potential contamination from previous or current uses of the site and surrounding area and to determine if there are any environmental risks associated with the site and its development for residential use. Pertinent findings and conclusions may be summarised as follows:

- The site is currently mixed use, with residential properties, sheds/garages and a large workshop that are proposed to be demolished and replaced with new residential housing, with associated domestic garden areas. Notably, at least one of the buildings has roofing panels which were anticipated to be made up from asbestos containing materials.

- Potential risks were identified associated with the developed nature of the site, which may have also been previously used as a saw pit, and both could lead to the presence of Made Ground (fill). Localised impacts from daily activities such as vehicle maintenance were recognised as requiring further assessment.

- Intrusive investigation comprised the drilling of five boreholes to a maximum depth of 5.0m and the ground conditions were found to comprise mainly granular fill materials with construction debris (brick and concrete fragments), overlying natural sandy silts representative of Tidal Flat Deposits.

- Laboratory analysis of shallow soils obtained from across the site identified concentrations of contaminants that are not suitable for use within modern garden areas. Therefore, in areas of future gardens or soft landscaping associated with Plots 1,4 and 5, a minimum thickness of **425mm** of topsoil cover will be required to protect future residents. In Plots 2 and 3, this layer should be increased to **600mm** due the presence of asbestos in soils beneath the footprint of the workshop. When garden areas are formalised, verification works will be required to demonstrate this has been carried out to the required standard.

- Additional recommendations have been made including the removal of any asbestos containing materials from the existing buildings (including roofing panels of the workshop), prior to commencement of any other redevelopment activities (including groundworks). Ground gas monitoring should also be undertaken using the installed monitoring pipes so this risk can be fully assessed. A number of other standard health and safety measures are included within Section 6.3 of this report, to protect construction workers during the redevelopment works.

The above points represent a simplified summary of the findings of this assessment and should not form the basis for key decisions for the proposed development. A thorough review of the details is contained within the following report, or alternatively get in touch and we'll talk you through it.

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The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' in house quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

As stated within DEFRA's Contaminated Land Statutory Guidance, with any complex risk assessment it is possible that different suitably qualified people may reach slightly different conclusions when interpreting the same information. EPS recognises this and considers the conclusions presented within this report to be robust and appropriate but input from the Local Authority and their judgement in line with this guidance would still be welcomed.

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1 INTRODUCTION

In March 2020, Environmental Protection Strategies Ltd (EPS) was commissioned by Bates Environmental to complete a Phase I & II Environmental Assessment report at Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG ('the site'); see Figure 1.

The work was commissioned in order to support planning requirements for the '*demolition of shed and associated outbuildings and replacement with 5No. two and three bedroom houses*' under South Holland District Council Planning Reference: H17-1040-17.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study and subsequent Phase II Intrusive Investigation undertaken as instructed.

1.1 Objectives

The objectives of this investigation were as follows:

a) Examining the site history - late 1800s to present day, through collection of historical maps of the area, site records, records held by relevant local authorities, the Environment Agency and review of other information databases.
b) Characterising the site's environmental and geological sensitivity through examination of existing geological, hydrogeological, topographical, and historical maps and aerial photographs of the area.
c) Identifying Potential Areas of Concern (PAOCs) through a combination of historical map and data review.
d) Consideration of any future plans for the site and the effects any proposed changes may have on contaminant linkages over time.
e) Development of a Conceptual Site Model and Preliminary Risk Assessment to evaluate the potential risks posed by the site and make recommendations for any further work that may be required to ensure suitability for use and safe development. In accordance with the Environment Agency's *Land Contamination: Risk Management* (2019) and the *National Planning Policy Framework*.

1.2 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRAs '*Contaminated Land Statutory Guidance*' (2012), BS10175 –'*Investigation of Potentially Contaminated Sites*', and BS5930:2015 *'Code of practice for ground investigations'*, the following tasks were undertaken:

Desk Study:

- Collection of site records.
- Study of existing geological, hydrogeological and historic maps of the area.
- Consultation of environmental databases, including records held by the local authority (where available).
- Review of proposed development plans.
- Development of a Conceptual Site Model (CSM) and Preliminary Risk Assessment.

Intrusive Investigation:

- Site walkover, inspection of any visual evidence of contamination at the site, obtaining photographic records.
- Health and safety briefing/ site supervision.
- Drilling of five window sample boreholes to a maximum depth of 5.0m below ground level (bgl), using a track-mounted percussive rig.
- Continual logging of ground conditions including inspection of samples for visual and olfactory contamination, and laboratory analysis of selected representative samples.
- Installation of gas and groundwater monitoring standpipes at selected locations (on a precautionary basis).
- Data collection
- Interpretation of data including completion of Generic Quantitative Risk Assessment.
- Reporting

The findings and conclusions of these investigations are presented in the following sections.

1.3 Project Limitations and Constraints

The purpose of this report is to present the findings of a soil sampling investigation conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site. Where outlined in our report, we have examined the ground beneath a site by constructing a number of boreholes and / or trial pits to recover soil and / or groundwater samples. The locations of these excavations and sampling points are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the conditions encountered may differ to those found during the investigation.

No visible evidence of Japanese Knotweed was identified during the site walkover. However, this plant can be difficult to identify in the early stages of growth and therefore it is not always possible to identify its' presence at certain times of the year. For this reason, EPS cannot confirm that Japanese Knotweed rhizomes do not exist and it is recommended that if it is suspected that this species, or other similarly invasive plants are present at the site, a specialist contractor should be commissioned to make a detailed assessment.

The investigation was carried out to assess the significance of contamination resulting from the use of the site as identified in this report. Unless EPS has otherwise indicated, no assessment of potential impact of any other previous uses has been made.

2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

2.1 Site Location and Description

Detail	Description
Location	The site is located in the east of the village of Surfleet approximately 6.2km north of Spalding, Lincolnshire.
Grid Reference	526530, 328790
Topographic Elevation	Levels appear mostly flat at approximately 6m Above Ordnance Datum (AOD).
Description of Site	A walkover was completed by EPS on the 17th March 2020, with the site noted to be rectangular in shape, covering an area of approximately 0.17 hectares. Access was from a private road just south of Station Road, with the area found to consist of a large workshop building, a couple of small residential dwellings and numerous sheds and portable structures. A large rectangular workshop is located in the north western corner of the site, with a smaller extension that juts out to the south, both of which are brick built with large metal roller doors. Asphalt hardstanding leads up to the roller door, whilst inside a concrete floor is present, with a brick lined inspection trench running north-south through the majority of the building. Furthermore, the roofing of this workshop appeared to be made from panels of asbestos containing materials (ACM). The rear of this building is partitioned off, possibly for office/ welfare use whilst the rest of the space is currently used for vehicle storage, with a small tanker present as well as a couple of other trailers. Throughout the warehouse, engine parts and corresponding tools/ equipment (including for vehicle repair are also stored. The inspection trench appeared to be holding some water. Between the wooden fencing that demarcates the western perimeter of the site and the workshop, a narrow alleyway permits access to the rear of the building, with a storage tank of unknown purpose elevated above the ground on a metal frame. A manhole cover was also present at the base of this tank. On the eastern half of property, a two-storey dwelling with a narrow gravel driveway marks the eastern extent, with a smaller single-storey property and associated garage attached to the north. An area of concrete hardstanding was present along the edge of the warehouse to the west with manhole covers suggesting the presence of underground drainage systems running under the workshop.

Detail	Description
Description of Site (continued)	The north east area appears mostly overgrown with nettles and brambles, as well as several piles of debris, including metal signs, engine parts and household goods scattered across the surface. Additionally, a small portable building and a shed are located in this section of the study area. A narrow public footpath connecting the private access road and Station Road was found to form the eastern boundary, with a small hedgerow the other side of the path separating it from the adjacent land. Mature deciduous trees were observed bordering the site to the north along Station Road, with mature coniferous trees located in the neighbouring residential properties; along the western edge of the workshop
Surrounding Land Use	To the east, south and west the land appears to be used mainly for residential housing, and the property to the south east is occupied by a hotel and public house. Arable farmland and a small strip of woodland are present to the north, with some farm buildings located to the north east and Spalding Golf Club is positioned to the south east.

A plan showing the site location is provided as Figure 1, the current site layout is detailed on Figure 2 and an aerial photograph is included as Figure 3. Selected site photographs are included as Appendix A, a proposed development plan is included as Appendix B and relevant extracts of a Landmark Envirocheck report are included as Appendix C.

2.2 Environmental Setting

Detail	Description
Geology	Geological mapping indicates the site to be underlain by superficial clay and silt of the Tidal Flat Deposits with the bedrock geology mapped as mudstone of the Oxford Clay Formation. Mapping also reveals that two large areas of made ground are located to the south east, underlying Spalding Golf Club and the adjacent agricultural field to the south of this feature. Information on the site's geological context is included as Appendix D.
British Geological Survey (BGS)	A historical borehole log hosted by the BGS for a position drilled approximately 50m to the south west reports layers of silty sand increasing with density to a depth of 19.35m. Below this, stiff to very stiff clays are recorded to the base of the borehole at 25m bgl. The elevation that this borehole was drilled from is not provided on the log but groundwater appears to have been recorded as resting as shallow as 0.6m depth. The historical borehole is also included in Appendix D.

Detail	Description	
Geological Hazards	**Hazard**	**On Site Risk**
	Mining Activities	No Hazard
	Collapsible Ground	No Hazard
	Compressible Ground	Moderate
	Ground Dissolution	No Hazard
	Running Sand	Moderate
	Landslide	Very Low
	Shrinking / Swelling Clay	Low
Radon	The Envirocheck report shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. It also reports that the site does not lie within an area where basic radon protection methods will need to be employed.	
Hydrogeology	Groundwater vulnerability maps for the area show that both the underlying bedrock and superficial geology are classified by the Environment Agency (EA) as Unproductive Strata, and the site does not lie within a Source Protection Zone (SPZ) for local groundwater abstraction. The Envirocheck report does not list any groundwater abstractions within a 1km radius. Groundwater vulnerability maps are included as Appendix E.	
Hydrology	The nearest surface water feature is the River Glen, located roughly 20m to the south. There are five discharge consents listed within 500m, the closest of which is 270m north west, relating to storm sewage overflow discharging into Fen Drain. The Envirocheck report lists two surface water abstractions within 500m, both of which used for spray irrigation at Spalding Golf Club (located 133m and 169m south east respectively). Review of the EA Flood Zone Map for the area indicates that the site lies within Flood Zone 1, which is defined as the area with a low potential risk of flooding from fluvial or tidal sources. It should be noted that the flood maps consulted do not take into account flooding from other potential sources of floodwater, such as from poor drainage, or groundwater. A copy of the flood map for the site and surrounding area is also included within Appendix E	
Known Site Drainage & Utilities	Manhole covers observed during the walkover suggest the presence of underground drainage systems that run across the site. Overhead power cables enter the site from the private access road to the east, and connect to the smaller buildings located within the limits of the study area. A telegraph pole is present in the centre of site, just off the southern edge of the workshop.	
Landfill & Waste	No active or historical landfills have been highlighted within 1km, nor have any cases of potentially infilled land been identified.	

Detail	Description		
Industrial Land Use	The Envirocheck report lists 3 industrial land uses within 500m, which are summarised below.		
	Land Use	**Distance (Direction)**	**Status**
	Spalding Domestic (Washing Machines Servicing & Repairs)	149m (W)	Inactive
	K J Williams (Boilers Servicing, Replacements & Repairs)	433m (E)	Active
	Graphix Design & Print (Printers)	447m (NW)	Active
Pollution Incidents	Two pollution incidents to controlled waters are recorded within a 500m radius. The nearest incident occurred in March 1994 where the River Glen 215m to the west, was contaminated with oils which had a serious impact on the receiving waters.		
Previous Investigation or Remediation	EPS are not aware of any previous site investigations or remedial works undertaken at the site.		
Sensitive Land Use	The site lies within a Nitrate Vulnerable Zone where surface water is identified as being at risk from nitrates leaching from agricultural land. No further environmentally sensitive areas/ designations are present within 1km.		

2.3 Site History

A summary of historical map data from 1887 to 2020 is provided below and copies of relevant historic maps and any others examined during the investigation are included in this report as Appendix F. A map detailing historic features in the area surrounding the site is displayed below.



- Earliest mapping reveals that a saw pit used to partially lie on the western half of site and is possibly associated with a nearby 'smithy' to the south west; with numerous small rectangular buildings situated along the centre of property in an approximate north-south alignment. Railway tracks and buildings associated with Surfleet Station were located about 50m to the east, whilst to the north a large triangular shaped field of reeds, suggesting an area of marsh, lies adjacent to the railway. By 1904 a goods shed is recorded as part of the station infrastructure. A road, following the present day line of Station Road lies directly to the south with the River Glen beyond this.
- The layout of the site and surrounding area remained apparently unchanged until the early 1970's, when, the railway is listed as disused, with the railway yard having been replaced by Glen House Farm. To the west lies, a haulage depot consisting of a large rectangular building with two tanks attached to the western most edge.
- The building layout on site has also changed by the early 1970's, consisting of 4 small rectangular buildings along the centre of site, as well as two small sheds to the rear. By 1987, an additional large square building has been constructed in the north western corner in the present day position of the largest structure on site.
- By 1996 the former railway line has been replaced by the A16, with the haulage depot and associated tanks being replaced with a housing estate by 1999. The site layout remains unchanged to the present day.

3 CONCEPTUAL MODEL & PRELIMINARY RISK ASSESSMENT

The following section provides a review of the contaminant linkages that may be active at the site through the process of a Preliminary Risk Assessment, whereby EPS have examined the potential sources that may be present as a result of historic and / or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

3.1 Background

A Desk Study comprises the first stage of any geo-environmental assessment, the purpose of which is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose an environmental or geological risk to site users, the surrounding environment or proposed development, either at present or in the future.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

Source	The location from which an environmentally hazardous / contaminative substance is, (or was,) derived.
Pathway	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.
Receptor	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health.

3.2 Source Characterisation

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

Potential Source	Source Description	Principal Contaminants of Concern
Current Site Use	Infill material of unknown origin (made ground) used to level areas beneath existing/ historic buildings and hardstanding.	PAH, Metals, ACM
	Ongoing use as a workshop.	TPH (incl. BTEX), PAH
	Suspected ACM roofing on the existing workshop building.	ACM
Historic Site Use	Historical use as part of the site as a saw pit.	Ground Gas (CH_4, CO_2)

Potential Source	Source Description	Principal Contaminants of Concern
Current and Historical Surrounding Land Use	Current/ historic commercial and industrial land use of the surrounding area including farms, 'smithy' and a haulage depot.	PAH, Metals, ACM, TPH, VOC's & SVOC's
	Dismantled railway line located to the east of the site.	
	Large area of made ground under Spalding Golf Course to the south east (as indicated by BGS mapping).	Ground Gas (CH_4, CO_2)

Notes: PAH Polycyclic Aromatic Hydrocarbons; ACM Asbestos Containing Materials; TPH Total Petroleum Hydrocarbons; BTEX Benzene, Toluene, Ethylbenzene and Xylenes; CH_4 Methane; CO2 Carbon Dioxide; VOC Volatile Organic Compounds; SVOC Semi-Volatile Organic Compounds

3.3 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report: '*Using Science to Create A Better Place: Updated Technical Background to the CLEA Model* – Science Report SC050021/SR3'. This guidance document defines a series of standard land-uses which have been further developed into six generic land uses in the Category 4 Screening Levels project for Land Affected by Contamination (DEFRA/Contaminated Land: Applications in Real Environments (CL:AIRE) Project Report SP1010, 2014) which form a basis for the development of the Conceptual Site Model.

The proposed development plan includes the demolition of the existing sheds and outbuildings, with the erection of five residential dwellings with associated private gardens. Therefore, the land use has been considered as:

- Residential (with home-grown produce)

In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for any contaminant impact are discussed below:

Receptor	Site Specific Description
Human	Future site users, site workers involved in the site redevelopment, and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
Groundwater	The site is reported to be underlain by superficial Tidal Flat Deposits and Oxford Clay Formation, both of which are defined by the EA as Unproductive Aquifers, and the site does not lie within a SPZ for nearby groundwater abstraction. Therefore, underlying groundwater has not been considered as a potential receptor to site derived contaminants.

Receptor	Site Specific Description
Surface Water	A number of surface watercourses are present within the surrounding area including the River Glen, 20m to the south. It is possible that site derived contaminants of concern may enter these watercourses by overland flow, migration through unsaturated soils or entering shallow surface drainage / historical land drainage which discharges to these drains; therefore, surface waters must also be considered as a sensitive receptor within the conceptual site model.
Flora and Fauna	The proposed development includes the provision of domestic garden areas and as such, flora and fauna should initially be considered as sensitive receptors.
Buildings & Infrastructure	Subsurface structures are likely to be present at the site which may be adversely affected by the potential presence of the identified contaminants of concern. These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	Adjacent properties including private residential dwellings could also be at risk from potential contaminants found at the site.

3.4 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with contaminated soil
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outdoors
- Inhalation of vapours indoors

Clearly, not all of these potential pathways apply for every standard land-use. For example, ingestion of contaminated vegetables will not apply to land uses other than residential with plant uptake and allotments.

However, in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the following:

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater.
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

3.5 Summary of Contaminant Linkages

Considering the site use and environmental setting, and the proposed land use; the plausible contaminant linkages that require further investigation are summarised in the following table:

Source	Pathway	Receptor
Contaminated soil	Direct contact and inadvertent ingestion by eating or smoking with dirty hands	Construction workers during redevelopment & site users
	Inhalation of fugitive dusts	
	Direct uptake and/ or adherence of contaminated soil to vegetation and subsequent ingestion	Site users
	Ingress/ diffusion through permeable potable water supply pipes	
	Migration of ground gas to indoor and outdoor air	
	Direct uptake via root systems	Plants
	Direct contact	Buried infrastructure

The following comments are made with respect to contaminant linkages, which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- PAHs and metals have been identified as contaminants of concern associated with the historic on-site infill, however these contaminants are considered to be relatively immobile in the environment by virtue of their very low solubility and volatility. On this basis, plausible pathways by which these potential contaminants could pose a significant risk to controlled waters are not considered to be active.

- Additionally, petroleum hydrocarbons have been identified as a potential on-site source associated with ongoing use of one of the buildings as a workshop, albeit this is considered to be of limited potential, with any small-scale impacts anticipated to be localised spills and leaks associated with daily activities. As such, a plausible contaminant linkage has not been identified associated with the migration of organic vapour to indoor or outdoor air, although isolated impacts to soil and consequently human health and buried infrastructure have been maintained. Groundwater or surface waters are not considered to be at risk from any mobile contamination due to the scale of any potential impacts, and the low permeability geology.
- Given some observations made during the walkover survey, the suspected presence of ACM has been raised (the roofing of the main workshop present in the north western corner). These materials need to be removed in accordance with current best practice including the *Control of Asbestos Regulations 2012* and as such, have not been considered as a plausible contaminant linkage this stage, although recommendations for their safe handling and removal are included in Section 6.3.
- Whilst areas of made ground are indicated under Spalding Golf Course located approximately 100m from the site, given the distance of this feature from the boundary, the limited permeability of the underlying geology and as the River Glen (a major surface water feature) lies between the source and the study area, a plausible contaminant linkage is not recognised from the on-site migration of landfill gas. However, risks from infilled materials which may be present due to potential former presence of a saw pit have been maintained.
- A number of historical farms were present in the area, including Glen House Farm, located approximately 160m east of the site. Although several contaminants of concern have been identified associated with these historical land uses, due to their age and limited scale, it is not anticipated that significant quantities of fuel or agri-chemicals were ever stored on these sites and therefore no significant source of potential off-site contamination is recognised from these specific land uses.
- A number of relatively low risk commercial and industrial sites are located in the surrounding area such as a haulage depot; however, these are all located in excess of 50m of the boundary and given the nature of these premises and the low permeability of the underlying geology, no plausible risk associated with on-site migration of contaminants within in soil and/or groundwater from these features has been recognised.
- Contaminants of concern may be associated with the nearby, (now dismantled) railway line, located to the east of the site. However, given the distance of this feature from the site, and as no goods / storage yards or sidings have been present close to the site, a plausible contaminant linkage has not been identified associated with this source.

3.6 Key Potential Areas of Concern and Uncertainties

Based on the findings of the Phase I Desk Study, the key area of focus for intrusive investigation are the nature and quality of infilled materials present across the property, which may not be suitable for use in future garden areas. The assessment should also explore any potential for small fuel/ oil spills or leaks, which may impact future site users, building foundations and potable water supply pipework.

Suspected ACM has also been identified in the form of roofing materials on the main workshop building.

The presence of a saw pit has also been indicated and should deeper areas of infill be encountered during the intrusive works, consideration of the presence of ground gas should be given through

installation of standpipes to facilitate future gas monitoring, should this be considered necessary in the future.

4 SUMMARY OF INTRUSIVE INVESTIGATIONS

Intrusive ground investigations were undertaken on 17th March 2020 in accordance with EPS standard operating procedures, copies of which will be made available on request. A summary of all site activities is presented in the following sections:

4.1 Exploratory Hole Locations

Exploratory hole locations were selected through consideration of the potential contaminant linkages identified through the Phase I Desk Study, the proposed development layout, the location of below ground utilities as well as operational and health & safety considerations.

Five window sample boreholes (WS01 – WS05) were formed at the site to a maximum depth of 5.0m, using a track-mounted percussive drilling rig. The overall objective in terms of exploratory hole locations was to provide an appropriate lateral and vertical coverage of the soils underlying the site in order to offer information relating to their quality and nature.

Monitoring standpipes were installed within positions WS01, WS04 and WS05 (on a precautionary basis), using 50mm diameter uPVC well casing and fitted with a gas tap. Slotted casing (1mm slot) was installed at each of the above locations from the base of the open borehole to approximately 1.0m below the surface. The installations were completed to ground surface using plain casing. A filter pack of 2-3 mm of washed gravel extended from the base of the boreholes to approximately 0.1m above the slotted section with a bentonite seal to surface. All installations were finished with flush-mounted, bolt-down headworks.

A borehole location plan is presented as Figure 4.

4.2 In-Situ Testing & Soil Sampling

Each borehole was logged for ground conditions encountered and inspected for any physical evidence of contamination, such as soil staining, odour and the presence of separate phase liquids on a precautionary basis. Borehole logs are presented in Appendix G.

Where potentially volatile organic compounds are suspected, EPS carries a Photoionisation Detector (PID), which can be used to measure the relative concentrations of vapour associated with soil samples collected from different depths and locations at the site. In these circumstances, soil samples will be placed into plastic bags, sealed, shaken and then allowed to rest for a few minutes to allow time for volatile vapour to accumulate in the air trapped within the bag. The PID probe will then be used to pierce the bag and sample the air above the soil to measure the concentration of volatile compounds that have accumulated. PID readings are only used to provide EPS with a basic means to quantify areas of volatile organic compound in the field to help guide the investigation. As potentially volatile organic compounds, specifically including petroleum hydrocarbons, were identified in the conceptual site model, PID readings were collected during this intrusive investigation. These readings are included within borehole logs presented as Appendix G and the results are discussed further in later sections.

4.3 Laboratory Testing

Samples obtained for analysis of identified contaminants of concern were submitted to Element Materials Technology of Flintshire, who hold appropriate UKAS / MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered by an approved courier.

A laboratory testing schedule is included as Table 1.

5 FINDINGS OF THE INVESTIGATION

This section of the report provides a summary of the findings of the various aspects of the ground investigation.

5.1 Ground Conditions

A total of five window sample boreholes were formed at the site and the ground conditions encountered, from surface level, were found to comprise:

- Made Ground
- Tidal Flat Deposits

Site specific borehole logs are included as Appendix G and give descriptions and depths of strata encountered. A summary of the general strata encountered across the site is provided in the table below, with more detailed description given in the following sub-sections.

Geological Strata	Maximum Depth to Base of Strata (m bgl)	Strata Thickness (m)
Made Ground	2.0	1.0 – 2.0
Tidal Flat Deposits	>4.0	>2.0 - >4.0 (not proven)

5.1.1 Made Ground

Made ground was encountered in all borehole locations, consisting of an initial layer of brown/ black sandy gravel or gravelly sand in WS05. This was anticipated to be placed as engineering aggregate but also contained evidence of construction debris throughout such as fine to coarse brick fragments and bituminous material with occasional charcoal. Small metal fragments (fixings such as nuts and bolts) were observed in WS04, located in front of the workshop, with concrete surfacing found at WS05, formed within the limits of the same building.

Beneath these materials was a further distinctive layer of infilled soils comprising brown/ black gravelly clays and silt with evidence of similar construction debris as the layer above noted throughout. This progressed to around 1.0m bgl across the majority of the site, but was approximately twice as deep and contained much larger brick and concrete cobbles in WS05; perhaps deposited as a sub-base for the building.

5.1.2 Tidal Flat Deposits

Directly underlying the made ground, material interpreted to be representative of superficial Tidal Flat Deposits were recovered. These deposits were observed as brown occasionally clayey sandy silt, and was present to beyond the formation depth of each borehole.

5.2 Groundwater

Groundwater was struck in all boreholes during drilling, with rest levels also recorded post drilling in selected positions (those which were installed with a monitoring standpipe).

Borehole Location	Approximate Groundwater Strike (m bgl)	Approximate Resting Groundwater Level (m bgl)
WS01	1.8	3.60
WS02	1.9	-
WS03	2.0	-
WS04	2.1	3.09
WS05	2.6	2.57

It is anticipated that rest levels could become shallower given more time to reach equilibrium.

5.3 Physical Evidence of Contamination

Despite the presence of a notable thickness of made ground, there was no palpable evidence of contamination, waste or putrefiable material encountered in any of the sampling locations during the investigation including any visual or olfactory evidence of hydrocarbon staining.

This was supported by headspace testing undertaken at regular intervals during the field works which did not identify any noteworthy concentrations of organic vapours.

5.4 Laboratory Analysis – Soil

A laboratory analysis testing schedule is presented as Table 1 and all environmental sample results obtained from the laboratory are included as Appendix H. The key results of laboratory testing on environmental soil samples are summarised below.

Contaminant	No. of Samples	No of Detections	Range of Detections (mg/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	6	6	2.3	23.1	WS05 (0.3-1.0)
Cadmium	6	2	0.2		WS01 (0.3-1.0) & WS05 (0.3-1.0)
Chromium	6	6	24.3	47.7	WS04 (4.6-4.8)
Copper	6	6	5	52	WS05 (0.3-1.0)
Lead	6	6	5	593	WS01 (0.3-1.0)
Mercury	6	0	-		
Nickel	6	6	9.3	52	WS05 (0.3-1.0)
Selenium	6	0	-		
Zinc	6	6	25	408	WS01 (0.3-1.0)
Naphthalene	6	3	0.11	0.19	WS01 (0.3-1.0)
Benzo[a]pyrene	6	3	0.15	5.58	WS01 (0.3-1.0)
Dibenz(ah)anthracene	6	2	0.06	0.86	WS01 (0.3-1.0)
BTEX	2	1	0.007		WS05 (0.3-1.0)
TPH CWG	2	2	227	425	WS01 (0.3-1.0)
TPH CWG Aliphatics (C5-C35)	2	2	89	115	WS05 (0.3-1.0)
TPH CWG Aromatics (C5-C35)	2	2	227	425	WS01 (0.3-1.0)
ACM (% of sample mass)	6	1	0.023		WS05 (0.3-1.0)

Notes: - Contaminant not found above laboratory detection limits
PAH Polycyclic Aromatic Hydrocarbons
BTEX Benzene, Toluene, Ethylbenzene, Xylenes
TPH CWG Total Petroleum Hydrocarbons (Criteria Working Group)

- Detectable concentrations of ACM, in the form of chrysotile and amosite fibre bundles and insulation debris were identified in shallow soils recovered from WS05. On quantification analysis, the percentage of ACM by sample mass was identified at 0.023%.

6 ENVIRONMENTAL APPRAISAL

The following section outlines the approach applied to assessing the risks posed to human health through a Generic Quantitative Risk Assessment, then identifies any sample results found by this investigation which warrant further consideration.

6.1 Human Health

6.1.1 Land Use Setting

It is understood that development proposals for the site include the demolition of the existing shed and outbuildings and construction of five residential properties. In order to screen laboratory data for concentrations of contaminants in soil with potential to cause harm to human health in a residential (with home-grown produce) land use setting, relevant generic screening values for contaminants in soils have been utilised.

The technical framework used to derive the assessment criteria and the documents in which they are published are summarised as follows:

- *EA Science Reports* (SC050021/SR2, SC050021/SR3, and SC050021/SR7)
- *EA Soil Guideline Value Science Reports*
- *Suitable For Use Levels (S4ULs) for Human Health Risk Assessment* – LQM and CIEH (2015)
- *Soil Generic Assessment Criteria for Human Health Risk Assessment* - EIC/AGS/CL: AIRE (2010)
- *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – SP1010 – DEFRA (2013)*

Where assessment of the risk to human health from asbestos in soil is concerned, there is no nationally recognised suitable for use/ generic screening value commonly referred to through the planning system. Due to this, it is necessary to take a more qualitative approach to the risks posed to future site users from asbestos on a site specific basis.

A summary of the screening criteria and the methodology used to derive them is included in Appendix I.

6.1.2 Assessment of Results- Human Health

The results of the screening process for on-site human receptors showed that generic screening criteria, representative of suitability limits for human health have been exceeded for the heavy metal Lead and a limited number of PAH compounds. It has been considered reasonable to utilise recorded concentrations of Benzo[a]pyrene (BaP) as a risk driver representative of genotoxic PAHs to further assess the data. The exceedances are summarised in the table below.

Contaminant	Screening Criteria (mg/kg)	No. of Exceedances	Highest Exceedance (mg/kg) & Sampling Location (m bgl)
Lead	200	2	593 at WS01 (0.3-1.0)
Benzo(a)pyrene	5	1	5.58 at WS01 (0.3-1.0)

While the above exceedances are recognised as potential risks, they do not unequivocally mean that unacceptable risks to future residents of the proposed development exist. By their very nature, the generic screening criteria are conservative and in the first instance an exceedance should lead to qualitative consideration of the risks that may be posed given the context of a specific site. This process is outlined in Section 6.1.3 (below).

In addition to the Lead and BaP impacts described above, a potential human health risk was also considered to be present from asbestos detected in the made ground in one location (WS05) at 0.023% by sample mass. It should be noted that this position was formed within the building footprint; and therefore beneath the floor-slab of the main workshop building, where the profile of the made ground was noted to be slightly different to external positions, on account of depth as well a higher proportion of construction debris recorded throughout.

The key issue for ACM comes down to exposure, and it is apparent from the proposed development plan, that this area coincides with part of a proposed access route, driveways and footprints of the buildings associated with Plots 2 and 3. The exposure pathway; the disturbance of underlying soils releasing free fibres to future site users (residents) is considered to be unlikely here, as these particular sections will be capped with concrete and will not be disturbed post completion of the redevelopment works.

However, if (as anticipated) this material is to be consistent beneath the entire floor-slab of this building, areas of proposed gardens (to the front and rear of these same properties) will lie within the extent of this source material. The main risk in these areas would not only be from the exposure of ground workers during the construction phase, but to future residents interacting with these soils post completion of the redevelopment. Therefore, further consideration should be given to mitigating risks associated with this infilled material, including the identification and handling (and avoidance where possible), as will be further discussed in Section 6.3.

6.1.3 Statistical Analysis

In order to further assess if the presence of Lead and genotoxic PAHs (namely BaP) in shallow soils may pose a potentially unacceptable risk to future site users, statistical analysis was carried out on the datasets for these contaminants of concern. All samples were taken were from made ground materials with all data relating to natural soils being removed from this statistical analysis, as these are not considered representative of the source material.

Initially an outlier test was carried out and although a potential numerical outlier was identified for both contaminants of concern (Lead and BaP), the field evidence did not justify removing either from the respective dataset (i.e. the soils appeared comparable to other boreholes and were obtained using the same method and sampling procedure), so all sample results have been retained in the main dataset and treated as a single population.

On this basis, an upper 95th percentile confidence limit on the true mean (U95) was also calculated for the samples of made ground so that a better comparison for lifetime exposure to future site users could be made. This was carried out in line with recent guidance from CIEH and CL:AIRE entitled: '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*'. The calculated U95 values are detailed below along with the relevant screening value.

Contaminant	U95 Value (mg/kg)	Screening Criteria (mg/kg)
Lead	572.09	200
BaP	7.41	5

For the analysed datasets, the U95 value for both Lead and BaP does exceed relevant generic screening criteria by a notable margin and therefore mitigation measures will be required to ensure the site is safe and suitable for use. These measures are fully defined in Section 6.3 of this report.

A summary of the calculations for statistical testing referred to in this section are provided as Appendix J, with detailed information regarding the calculations undertaken being available on request.

6.2 Summary of Findings

The Phase I Desk Study has identified that the site comprises several residential properties, with associated small sheds/ garages and a large workshop to the rear. The workshop was found to contain an inspection pit as well as materials/ evidence of vehicle maintenance and the roofing was noted to comprise suspected ACM panels.

Notable historic use includes the presence of a saw pit, which could feasibly have led to the existence of infilled soils, which can have the potential to generate ground gasses. Therefore, standpipes were installed as part of the ground investigation works, to facilitate future ground gas monitoring (as required).

Due to the previous/ current and future land use, an assessment of the nature and quality of soils present across the property was recommended to identify any potentially harmful contamination and assess the suitability of soils for use in future garden areas.

Given the nature of the anticipated ground conditions and limited sensitivity of the geo-environmental setting, controlled waters were not considered to be at risk from contaminants possibly present within soils beneath the property.

The ground investigation comprised the completion of five boreholes which found a notable thickness of infilled soils overlying natural silt/ clay. It should be noted that the depth of made ground was noticeably deeper (2m) beneath the footprint of the workshop and was found to contain asbestos fibres and debris, albeit at low concentrations. Therefore, this material has been assessed as a separate source for the purposes of some elements of the risk assessment.

The screening process identified that as well as asbestos present in the infilled soils beneath the footprint of the workshop, impacts from Lead and selected PAH compounds has deemed the made ground present throughout the remainder of the site as unsuitable for use within domestic gardens. On this basis, EPS considers it necessary to apply appropriate remedial action/ control measures to all areas of the made ground within the site boundary in order to make the site safe and suitable for its proposed use.

On this basis, further environmental assessment is considered to be warranted in addition to the implementation of a number of control measures being carried out to ensure safe development, as outlined in Section 6.3 (below).

6.3 Recommendations

In the context of potentially unacceptable or acceptable risks as outlined within the Environment Agency's Land Contamination: Risk Management guidance (LC:RM, 2019), the risks identified by this work will require further assessment, as outlined below.

a) The following cover requirements are made with reference to the guidance presented in the *BRE publication: Cover Systems for Land Regeneration: Thickness Design of Cover Systems for Contaminated Land (BRE, Mar 2004)*. Across all gardens and soft landscaping areas associated with Plots 1, 4 and 5, it is recommended that a minimum of **425mm** of certified clean cover material is installed (it is recognised that some material may have to be removed to achieve this thickness). Furthermore, the minimum thickness of cover should be increased to **600mm** within the same areas associated with Plots 2 and 3, due to the presence of asbestos within soils beneath the footprint of the existing workshop.

   For further details regarding the cover system calculations, reference should be made to Appendix K.

   It should be noted that this recommendation is made only for areas of gardens and landscaping, and there is no such requirement for areas beneath any proposed hardstanding or building footprints. A checklist of requirements generated by EPS for imported topsoil within cover systems is included as Appendix L and a verification report should be provided to the local authority once the work has been completed, demonstrating it has been carried out in line with the recommendations above.

b) In addition to the above, given the presence of asbestos within the made ground material in the north west corner of the site (beneath the footprint of the workshop), it is recommended that a Working Method Statement (WMS) is created for this area in particular; primarily covering the risks to ground workers during the redevelopment phase This WMS should be in accordance with guidance from CIRIA as well as the CL:AIRE /Joint Industry Working Group industry guidance on Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials (2016).

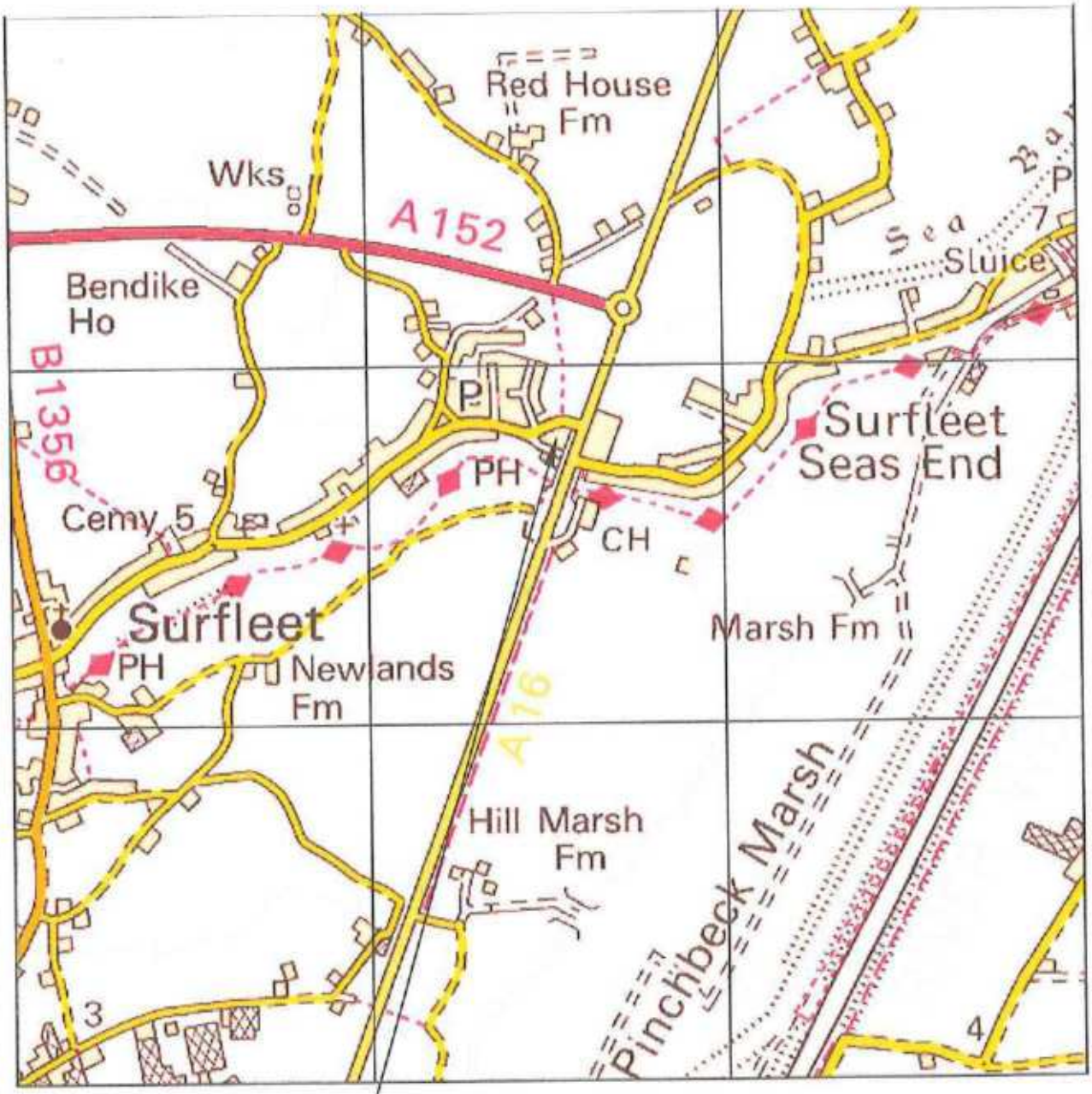
c) All asbestos containing materials including the existing roofing materials on the main workshop and any visually identifiable fragments at the surface should be disposed of with the appropriate duty of care in accordance with the *Control of Asbestos Regulations (2012)*. This work should be carried out prior to the commencement of any other formal redevelopment works including groundworks and should be completed by a suitably qualified professional.

d) Should any palpable evidence of unexpected contamination (including any visually identifiable fragments of ACM) be encountered during the redevelopment work, it should be reported to EPS so that an inspection can be made and appropriate sampling and assessment work carried out, a method statement for this is provided as Appendix M.

e) Given the presence of a significant thickness of made ground encountered beneath the site and the potential saw pit identified within historical records, it is recommended that a period of gas monitoring is undertaken so that the risks to future site users can be fully assessed. This should include a minimum of three return visits (using the recently installed monitoring points), under varying atmospheric conditions. Additional visits may be required depending on the findings of the initial programme, to fully assess the gas regime and whether protection measures will be required for the proposed buildings.

It is recommended that a copy of this report be provided to the Environmental Health Department of South Holland District Council so that the information may be incorporated into their land quality records and used to support the current planning application.

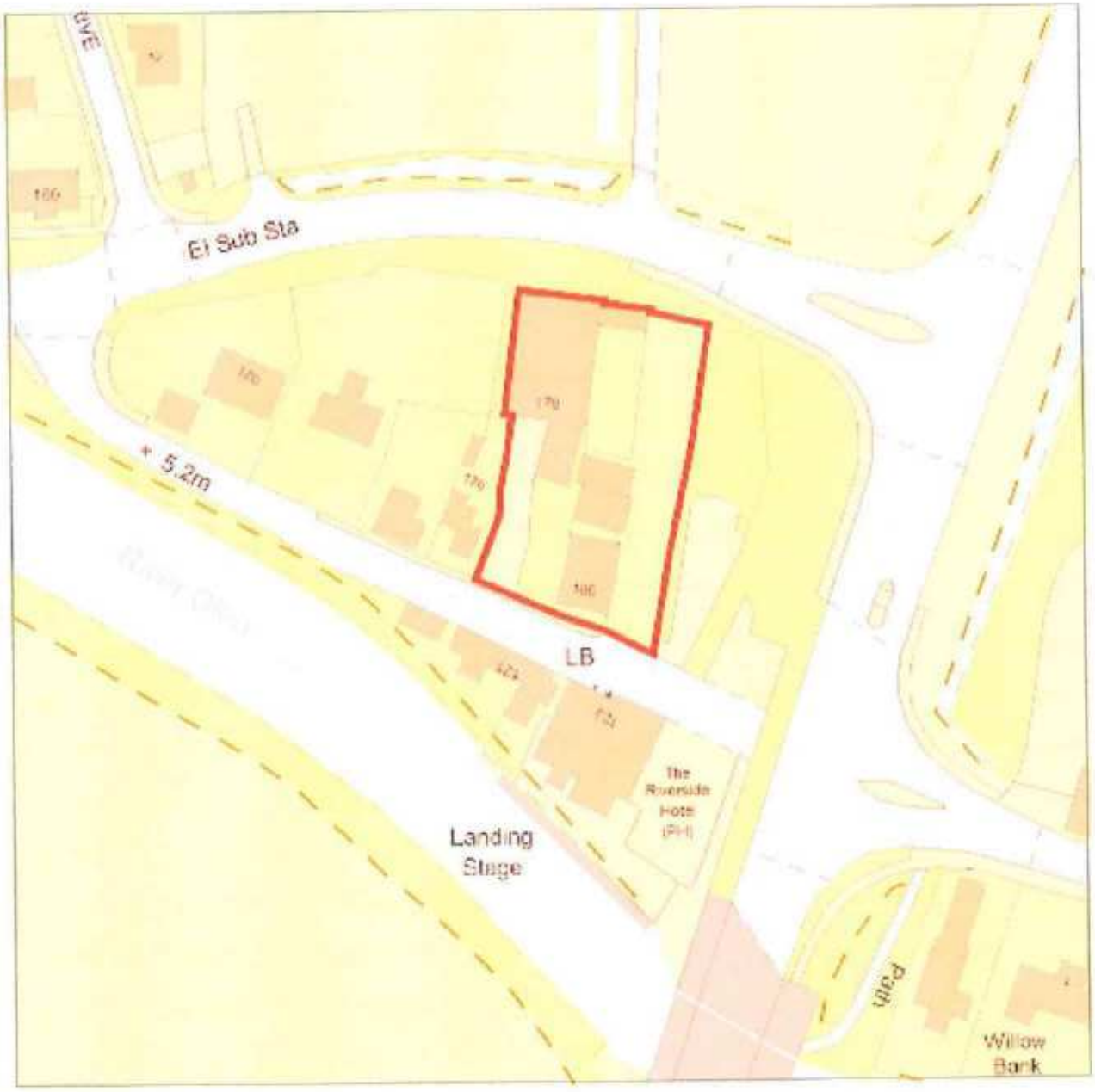
FIGURES



Approximate Site Location

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Licence Number: 100054115

eps	**Title:**	**Site Location Plan**	
	Project:	Land off Station Road, Station Rd, Surfleet, Spalding, Lincolnshire, PE11 4DG	Scale: NTS Drawn By: MT Approved By: BV Job No: UK20.4948 Dwg No: Surfleet/0320/01 Date: March 2020
	Fig No:	1	



Approximate Site Boundary —

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Licence Number: 100054115

Title:	**Current Site Layout**		
Project:	Land off Station Road, Station Rd, Surfleet, Spalding, Lincolnshire, PE11 4DG	Scale:	NTS
		Drawn By: MT	Approved By: BV
		Job No:	UK20.4948
Fig No:	2	Dwg No:	Surfleet/0320/02
		Date:	March 2020



Approximate Site Boundary —

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Licence Number: 100054115

eps	**Title:** Aerial Photograph		
	Project: Land off Station Road, Station Rd, Surfleet, Spalding, Lincolnshire, PE11 4DG	Scale: NTS	
		Drawn By: MT	Approved By: BV
	Fig No: 3	Job No: UK20.4948	
		Dwg No: Surfleet/0320/03	
		Date: March 2020	



Approximate Site Boundary

Borehole by Percussive Window Sampler

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Licence Number: 100054115

Title:	**Borehole Location Plan**		
Project:	Land off Station Road, Station Rd, Surfleet, Spalding, Lincolnshire, PE11 4DG	Scale:	NTS
		Drawn By: MT	Approved By: BV
Fig No:	4	Job No:	UK20.4948
		Dwg No:	Surfleet/0320/04
		Date:	March 2020

TABLES

Table 1 – Laboratory Testing Schedule (Environmental)

Sample ID	Sample Depth (m bgl)	EPS Mini Suite	EPS TPH Suite	VOC
WS01 ES2	0.3-1.0	1	1	-
WS02 ES4	0.7-1.0	1	-	-
WS03 ES7	2.0-2.3	1	-	-
WS04 ES9	0.9-1.1	1	-	-
WS04 ES10	4.6-4.8	1	-	-
WS05 ES11	0.3-1.0	1	1	1

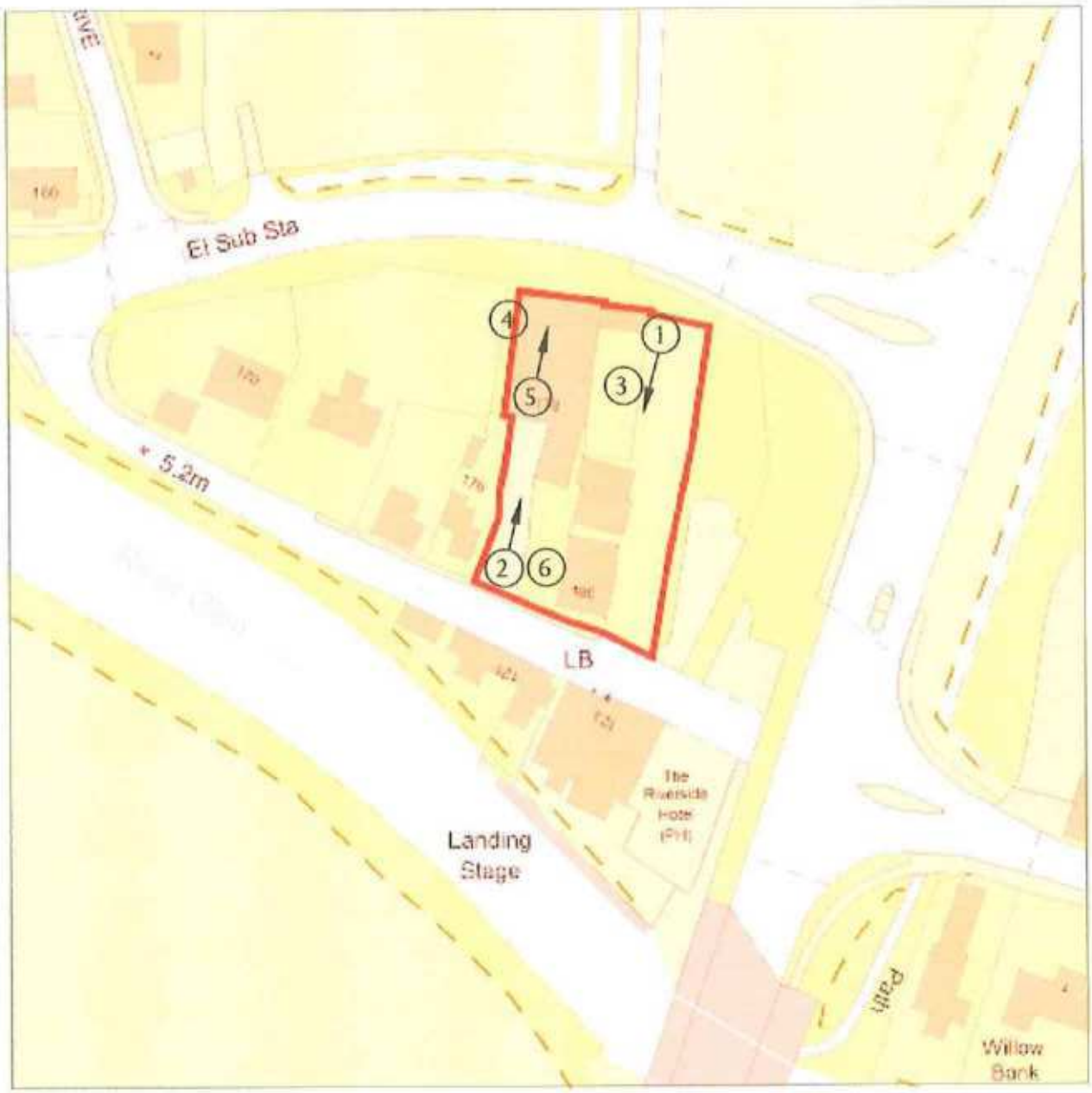
Notes:

mbgl	meters below ground level
1	Sample Taken
-	Sample Not Analysed
EPS Mini Suite	Organic Matter, Cyanide, Metals, PAH's, Phenols and Asbestos Screen
EPS TPH Suite	Total Petroleum Hydrocarbons, BTEX and MTBE
VOC	Volatile Organic Compounds

APPENDICES

APPENDIX A

Selected Site Photographs



Approximate Site Boundary

(1) Approximate Photo Location

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Licence Number: 100054115

eps	**Title:**	**Photo Location Plan**	
	Project:	Land off Station Road, Station Rd, Surfleet, Spalding, Lincolnshire, PE11 4DG	Scale: NTS
			Drawn By: MT Approved By: BV
	Fig No:	A	Job No: UK20.4948
			Dwg No: Surfleet/0320/A
			Date: March 2020

Photo 1: Looking south from Station Road, showing the eastern half of the site, including concrete hardstanding adjacent to warehouse, overgrown areas with assorted debris and residential properties.



Photo 2: Looking north at the workshop.



Photo 3: Patch of made ground observed adjacent to the concrete hardstanding next to the eastern edge of the workshop.



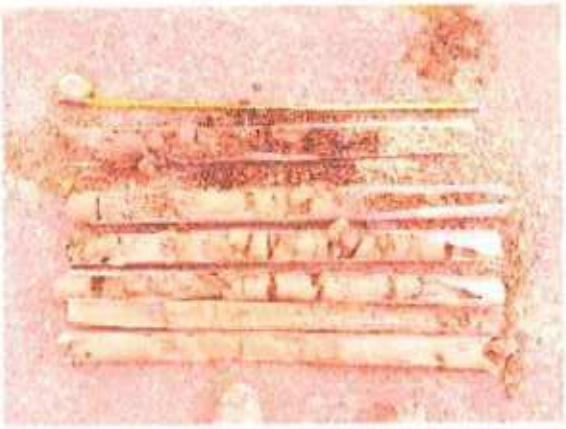
Photo 4: Elevated metal tank observed affixed to the western side of the workshop building.



Photo 5: Inside of the workshop, showing inspection trench, stored vehicles and partitioned section to the back.



Photo 6: Core recovered from WS04, showing made ground with bituminous gravel in the top metre, with underlying natural silt.



APPENDIX B

Proposed Development Plan

STUDIO 11 architecture



Site Layout 1:200

Housetype Schedule

2 Bedroom House			
2 Bed House	±3.68 m² (685.44 ft²)	Plots 1,4, 5	3
3 Bedroom House			
3 Bed House	81.92m² (881.78 ft²)	Plots 2, 3	2
			5
			Total 5

Site Area: 0.16 Hectares (0.39 Acres)

KEY

- Existing trees
- Proposed trees
- 1.8m panel fence between plots
- 1.8m garden wall
- 1.2m post & rail fence
- Proposed shrub planting



Location Plan 1:1250

PLANNING APPLICATION

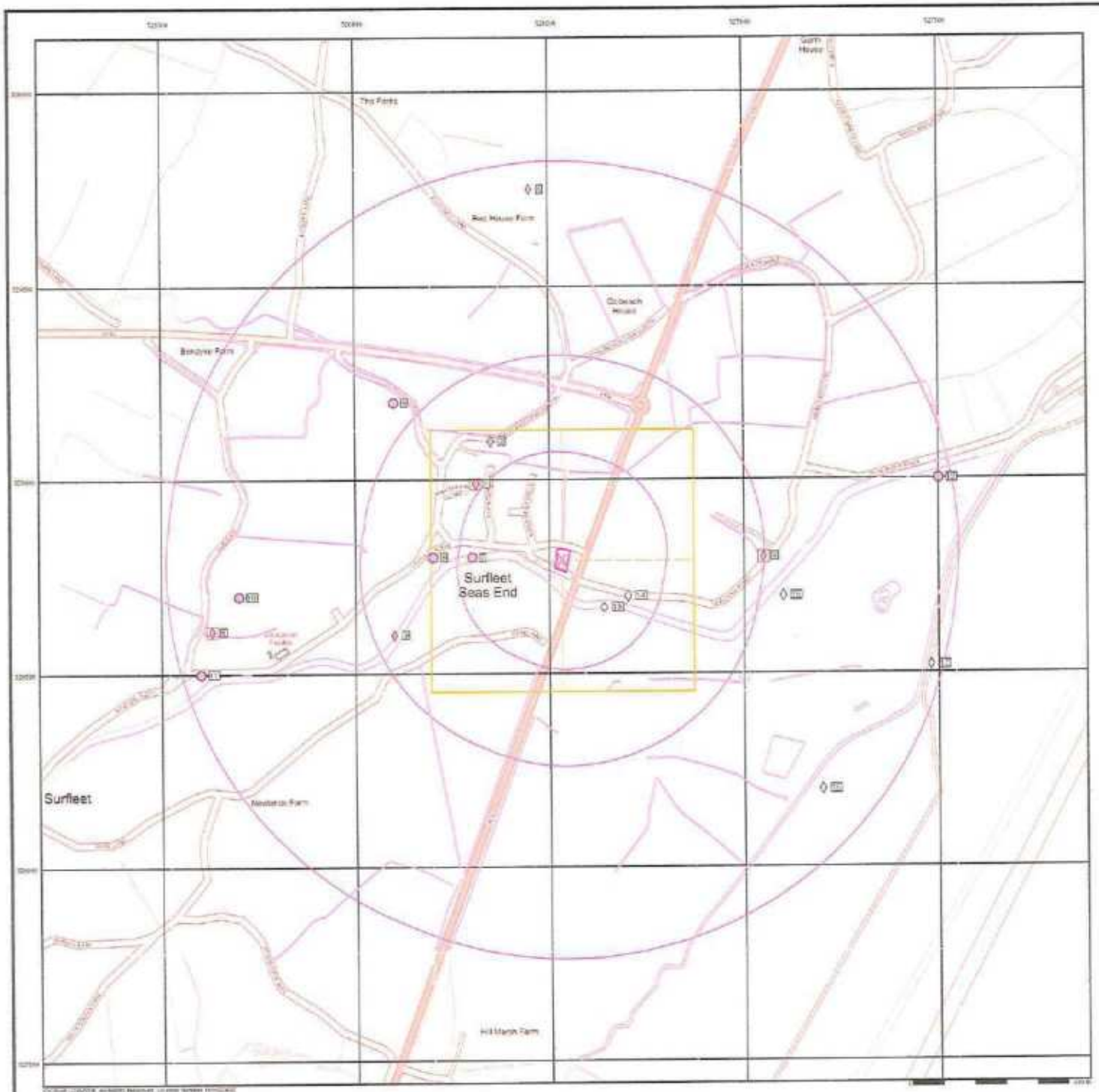
CLIENT
PROJECT
DRAWING
SCALE
DRAWN
DATE

390.SL.01

Chartered Institute of Architectural Technologists

APPENDIX C

Surrounding Land Use



eps

General
Specified Site
Specified Buffer(s)
Bearing Reference Point
Map ID
Search of Type at Location

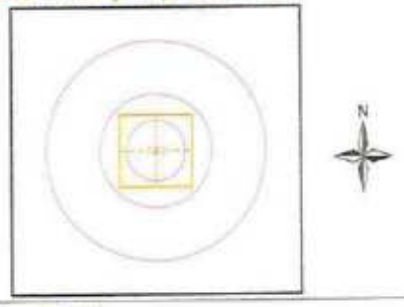
Agency and Hydrological
Contaminated Land Register Entry or Notice (unseen)
Contaminated Land Register Entry or Notice
Discharge Consent
Enforcement or Prohibition Notice
Integrated Pollution Control
Integrated Pollution Prevention Control
Local Authority Integrated Pollution Prevention and Control
Local Authority Pollution Prevention and Control
Local Authority Pollution Prevention and Control Enforcement
Pollution Incident to Controlled Waters
Prosecution Relating to Authorised Processes
Prosecution Relating to Controlled Waters
Registered Radioactive Substance
River Network or Water Feature
River Quality Sampling Point
Substantiated Pollution Incident Register
Water Abstraction
Water Industry Act Referral

Hazardous Substances
COMAH Site
Explosive Site
NIHHS Site
Planning Hazardous Substance Consent
Planning Hazardous Substance Enforcement

Geological
BGS Recorded Mineral Site

Waste
BGS Recorded Landfill Site (Location)
BGS Recorded Landfill Site
EA Historic Landfill (Surface Area)
EA Historic Landfill (Percent)
Integrated Pollution Control Registered Waste Site
Licensed Waste Management Facility (Landfill Boundary)
Licensed Waste Management Facility (Location)
Local Authority Recorded Landfill Site (Location)
Local Authority Recorded Landfill Site
Potential, Infilled Land (Non-water)
Potential, Infilled Land (Non-water)
Potential, Infilled Land (Non-water)
Potential, Infilled Land (Water)
Potential, Infilled Land (Water)
Potential, Infilled Land (Water)
Registered Landfill Site
Registered Landfill Site (Location)
Registered Landfill Site (Point Buffered to 100m)
Registered Landfill Site (Point Buffered to 250m)
Registered Waste Transfer Site (Location)
Registered Waste Transfer Site
Registered Waste Treatment or Disposal Site (Location)
Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice A



Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark INFORMATION GROUP



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eps

General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID
Several of Type at Location | Polygon | Overhead Transmission Line

Agency and Hydrological

Contaminated Land Register Entry or Notice (Location)
Contaminated Land Register Entry or Notice
Discharge Consent
Enforcement or Prohibition Notice
Integrated Pollution Control
Integrated Pollution Prevention Control
Local Authority Integrated Pollution Prevention and Control
Local Authority Pollution Prevention and Control
Local Authority Pollution Prevention and Control Enforcement
Pollution Incident to Controlled Waters
Prosecution Relating to Authorised Processes
Prosecution Relating to Controlled Waters
Registered Radioactive Substance
River Network or Water Feature
River Quality Sampling Point
Substantiated Pollution Incident Register
Water Abstraction
Water Industry Act Referral

Hazardous Substances

COMAH Site | Explosive Site
NIHHS Site
Planning Hazardous Substance Consent
Planning Hazardous Substance Enforcement

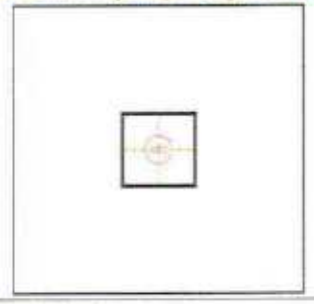
Geological

BGS Recorded Mineral Site

Waste

BGS Recorded Landfill Site (Location)
BGS Recorded Landfill Site
EA Historic Landfill (Part/Point Area)
EA Historic Landfill (Polygon)
Integrated Pollution Control Registered Waste Site
Licensed Waste Management Facility (Landfill Boundary)
Licensed Waste Management Facility (Location)
Local Authority Recorded Landfill Site (Location)
Local Authority Recorded Landfill Site
Potential, Infilled Land (Non-Water)
Potential, Infilled Land (Non-Water)
Potential, Infilled Land (Non-Water)
Potential, Infilled Land (Water)
Potential, Infilled Land (Water)
Potential, Infilled Land (Water)
Registered Landfill Site
Registered Landfill Site (Location)
Registered Landfill Site (Point Buffered to 500m)
Registered Landfill Site (Point Buffered to 250m)
Registered Waste Transfer Site (Location)
Registered Waste Transfer Site
Registered Waste Treatment or Disposal Site (Location)
Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A13



Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Plot Buffer (m):	100

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark INFORMATION GROUP

Tel: [redacted]
Fax: [redacted]
www.[redacted].co.uk

APPENDIX D

Geological Context

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Not Supplied - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	TFD	Tidal Flat Deposits	Clay and Silt	Not Supplied - Holocene

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	OXC	Oxford Clay Formation	Mudstone	Not Supplied - Callovian

eps

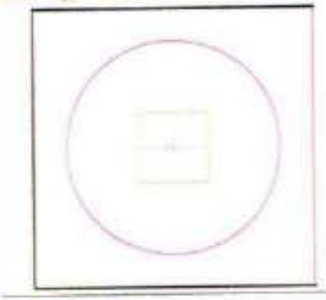
Geology 1:50,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	144
Map Name:	Spalding
Map Date:	1992
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Available
Faults:	Not Supplied
Landslip:	Not Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



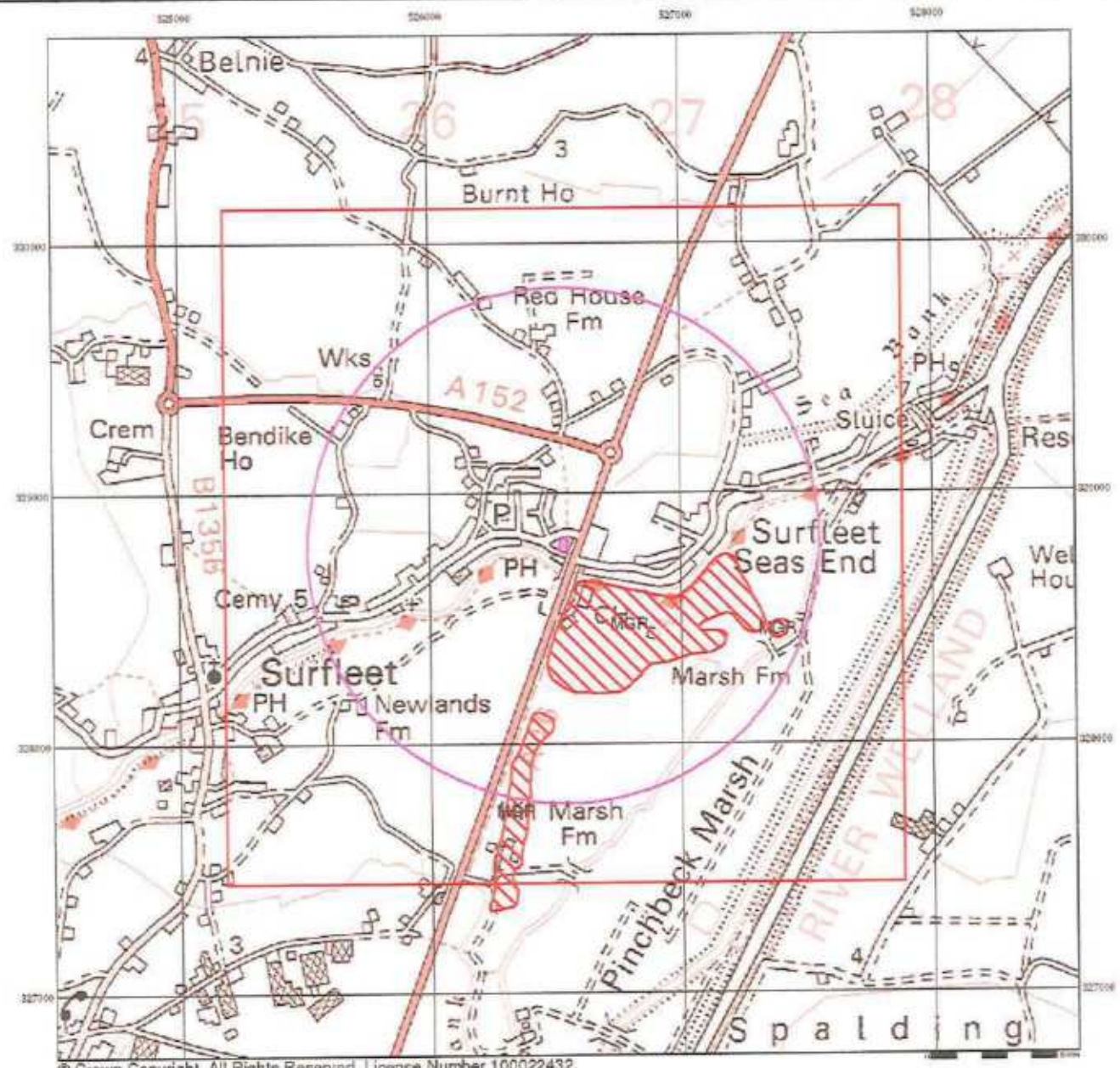
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Customer Reference:	UK20.4948
National Grid Reference:	526530, 326790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details:

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark



eps

Artificial Ground and Landslip

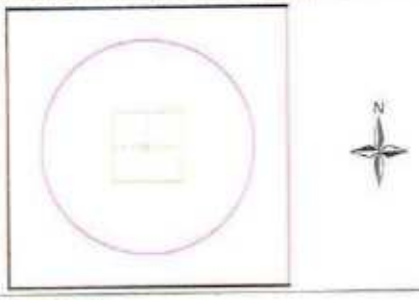
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



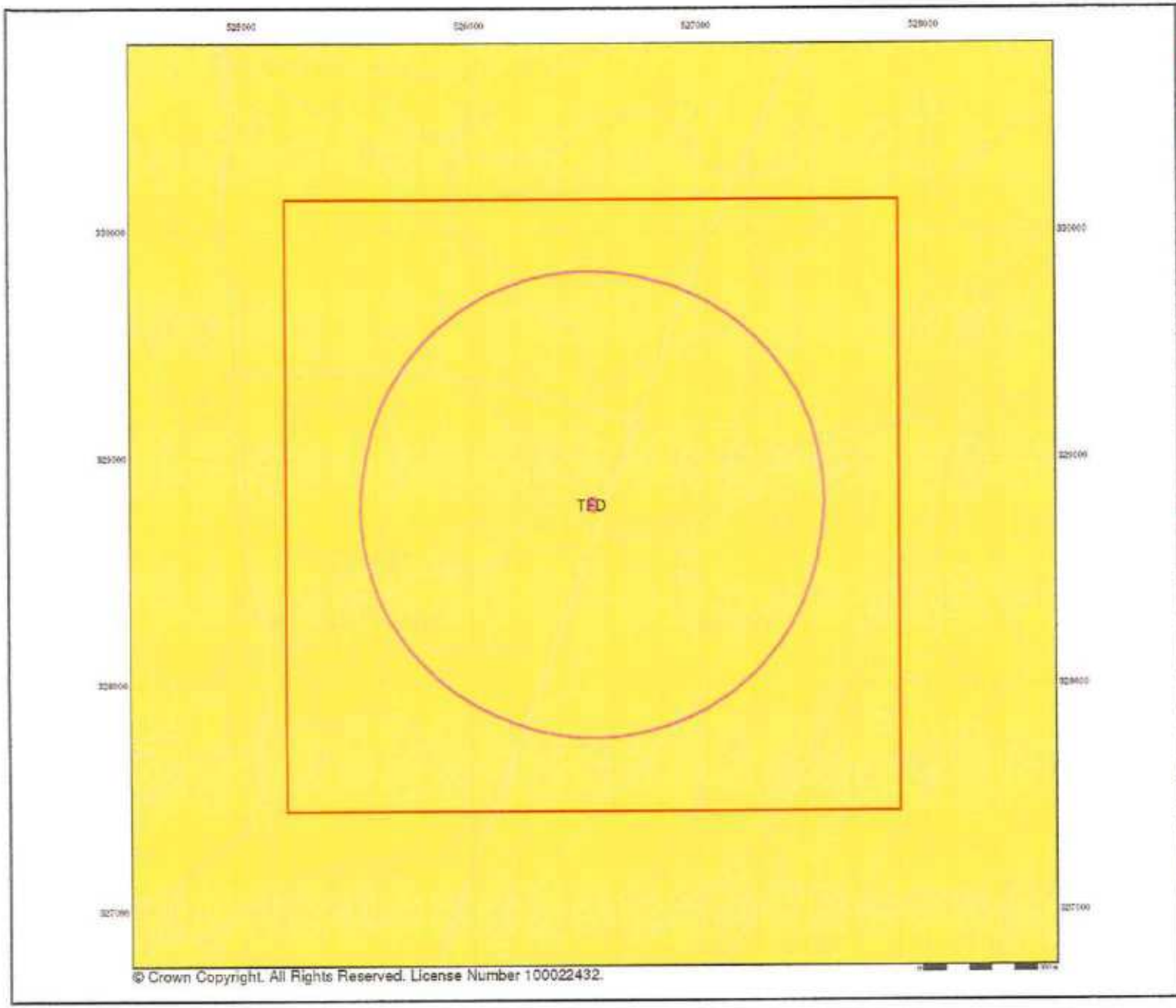
Order Details:

Order Number:	237803778_1_1
Customer Reference:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details:

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Landmark



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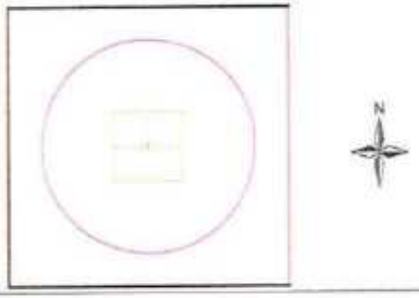
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A

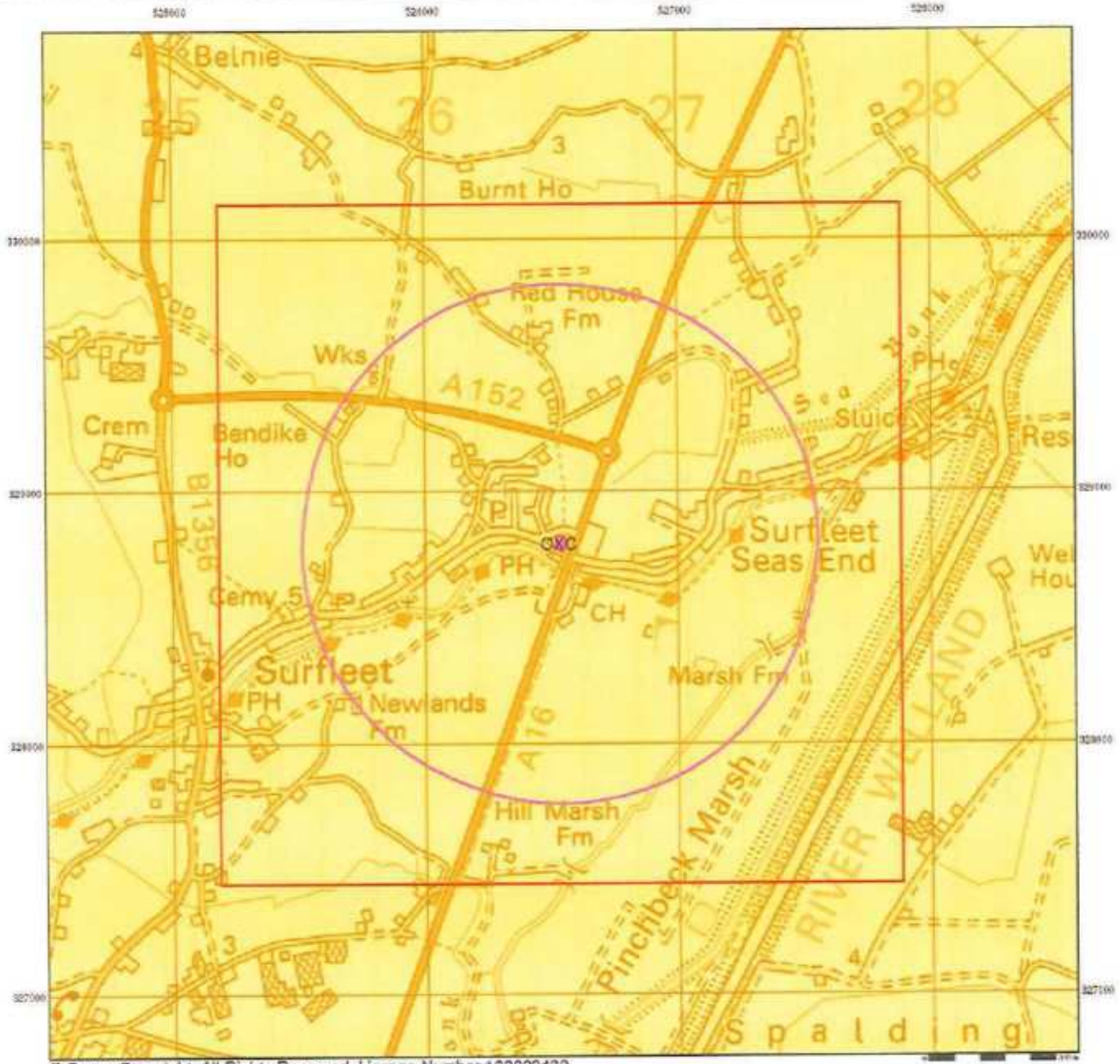


Order Details:

Order Number:	237803778_1_1
Customer Reference:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details:

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Bedrock and Faults

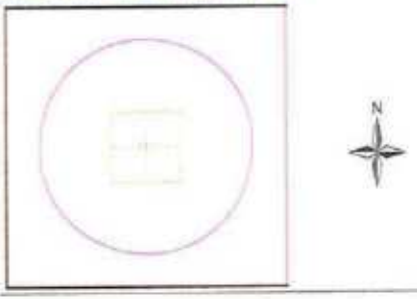
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



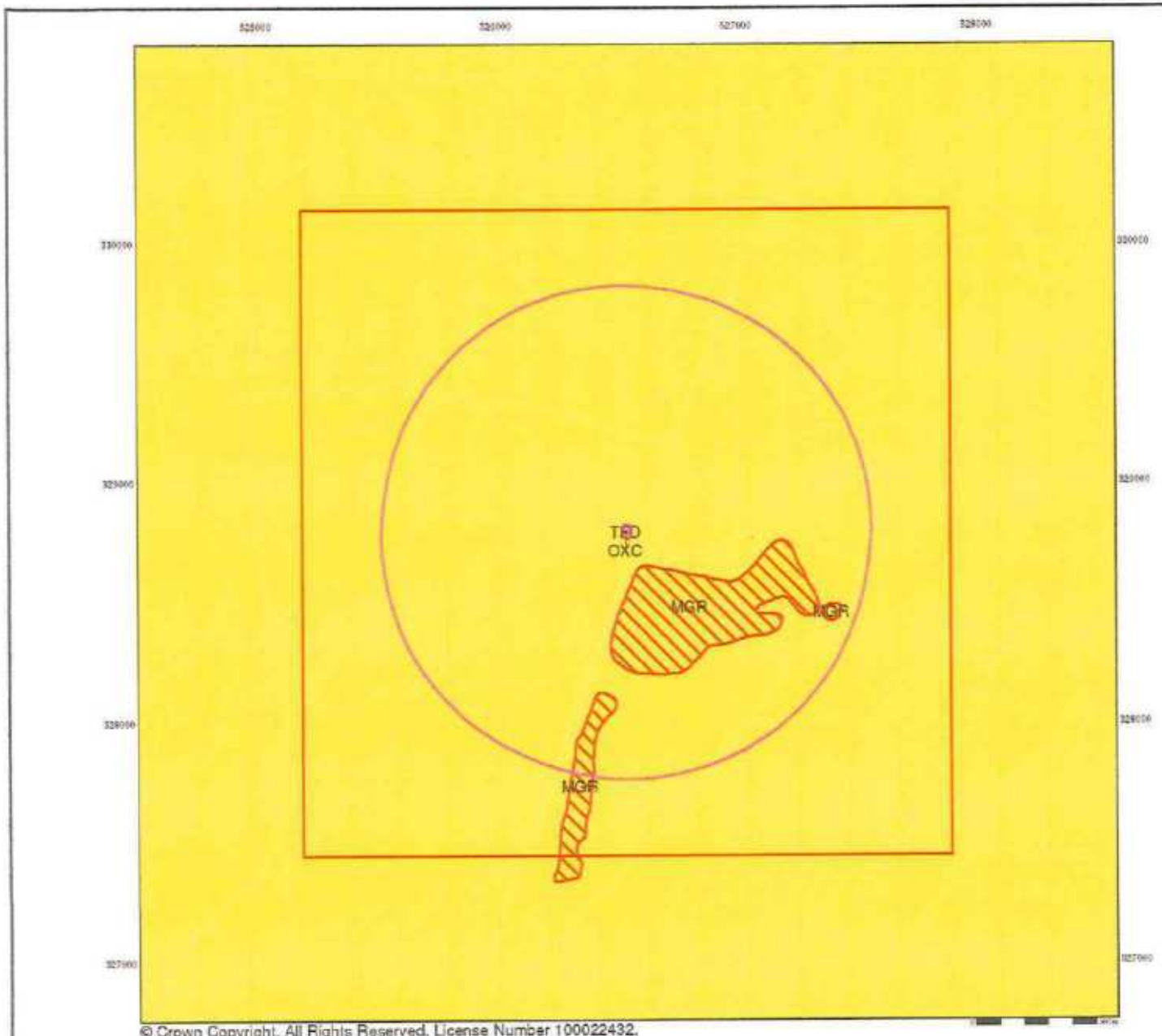
Order Details:

Order Number:	237803778_1_1
Customer Reference:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details:

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DE

Landmark



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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

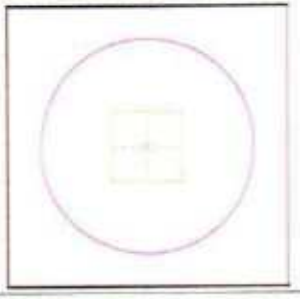
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details:

Order Number:	237803778_1_1
Customer Reference:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details:

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

26543 28740 - 38 TF 22 NE 35

Contract Name A16 TRUNK ROAD, SPALDING TO SUTTERTON

Borehole No. 17

Sheet 1 of 4

Method of boring Light cable percussion
Diameter 200mm diameter to 11.90m cased to 20m
150mm diameter to 25m cased to

Ground level 26563 28710 sl c 5.8
Start 1.4.85.
Finish 4.4.85.

Daily progress	Water levels	In-situ tests	Samples	Depth (m)	Reduced level (m O.D.)	Thickness (m)	Description of Strata	Legend
2/4	2/4			0.30		0.30	*	
1/4	1/4			0.75		0.45	Brown medium to fine subrounded gravelly medium to fine SAND	
	3/4	N=11						
2/4								
		N=10				5.00	Medium dense brown silty medium to fine SAND	
	4/4							
	3/4	N=11						
		N=18						
		N=12						
	1/4			5.75				
		N=23						
		N=15				5.50	Medium dense, becoming dense, brown silty medium to fine SAND	
		N=15						
1/4		N=32						

Notes

* Dark brown medium to fine gravelly medium to fine SAND

TF 26563 28710 TF 32 NE 35

Contract Name A16 TRUNK ROAD, SPALDING TO SUTTERTON	Borehole No. 17 Sheet 2 of 4

Method of boring
Diameter As sheet 1

Ground level 26563 28710
Start
Finish As sheet 1

Daily progress	Water levels	In-situ tests	Samples	Depth (m)	Reduced level (m O.D.)	Thickness (m)	Description of Strata	Legend
		N=34					AS ABOVE	
		N=34		12.25				
		N=56				2.00	Very dense brown silty medium to fine SAND with occasional shells	
		N=58		14.75				
2/4		N=28				3.25	Medium dense to very dense brown silty medium to fine SAND with occasional rounded fine gravel	
		N=37						
		N=62		18.00				
						1.35	Dense coarse brown SAND with rounded flint and chalk gravel, occasional shell fragments	
3/4		N=70		19.35	-13.85			
4/4							SEE BELOW	

Notes Unable to obtain penetration test due to adverse hydrostatic conditions at 18.50m

26563 28710 35 TF 22 NE 35

Contract Name A16 TRUNK ROAD, SPALDING TO SUTTERTON	Borehole No. 17
	Sheet 3 of 4

Method of boring
Diameter As sheet 1

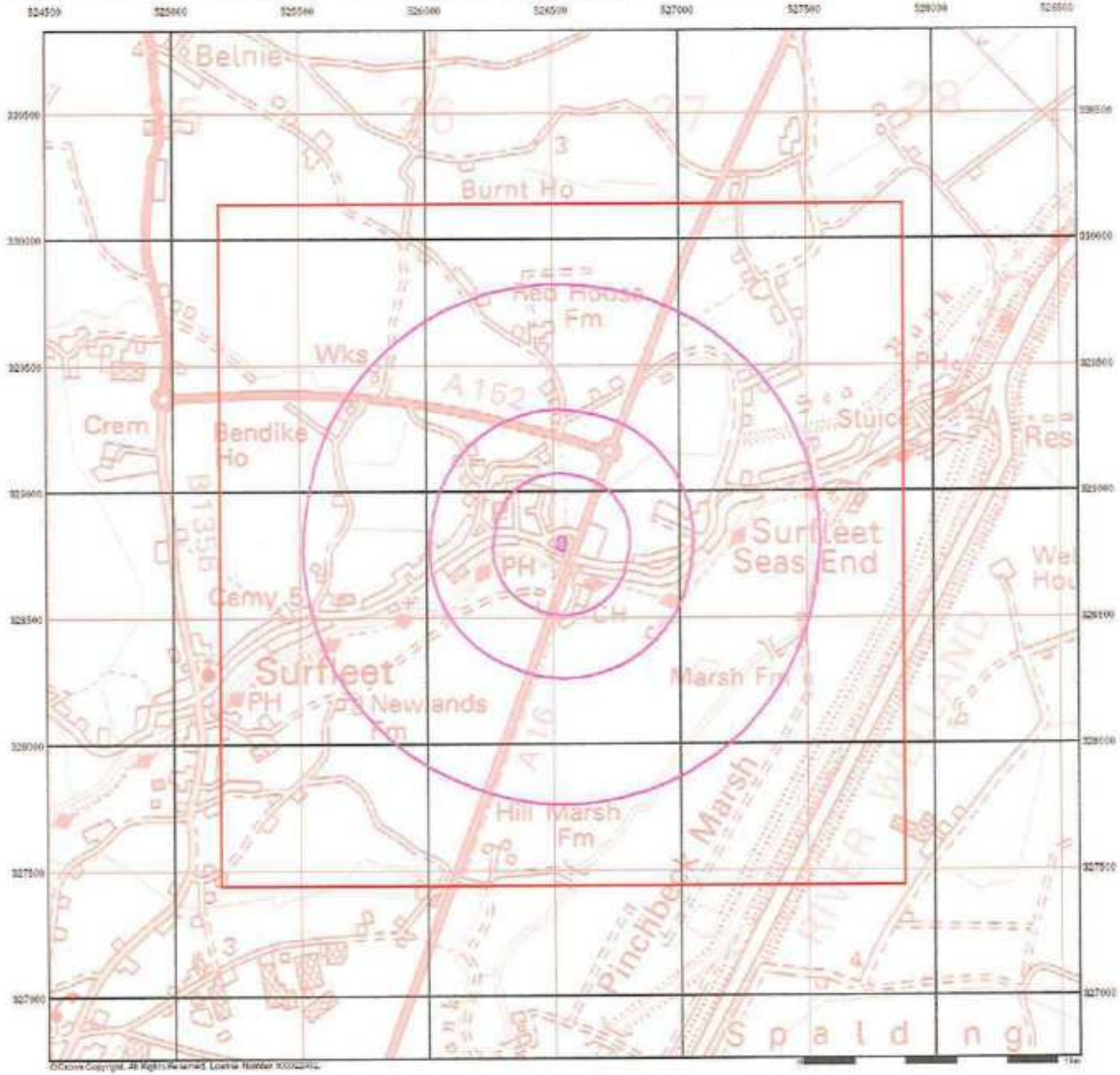
Ground level 26563 28710
Start
Finish As sheet 1

Daily progress	Water levels	In-situ tests	Samples	Depth (m)	Reduced level (m O.D.)	Thickness (m)	Description of Strata	Legend
						5.65	Stiff to very stiff grey silty CLAY with numerous medium to fine and occasionally coarse gravel sized erratics, mainly chalk with occasional flints and mudstone (Boulder Clay)	
4/4				25.00	>-19.2		BOTTOM OF BOREHOLE	

Notes

APPENDIX E

Groundwater Vulnerability and Flood Risk Maps



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eps

Groundwater Vulnerability

General

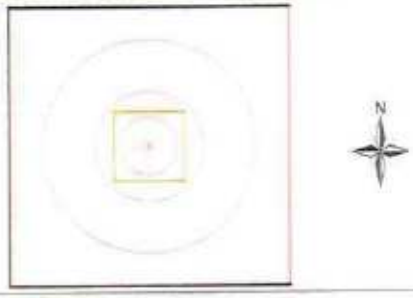
Specified Site | Specified Buffer(s) | Bearing Reference Point
Blow | Map ID

Agency and Hydrological

Bedrock Aquifers	Superficial Aquifers
High Vulnerability, Principal Aquifer	High Vulnerability, Principal Aquifer
High Vulnerability, Secondary Aquifer	High Vulnerability, Secondary Aquifer
Medium Vulnerability, Principal Aquifer	Medium Vulnerability, Principal Aquifer
Medium Vulnerability, Secondary Aquifer	Medium Vulnerability, Secondary Aquifer
Low Vulnerability, Principal Aquifer	Low Vulnerability, Principal Aquifer
Low Vulnerability, Secondary Aquifer	Low Vulnerability, Secondary Aquifer

Unproductive Aquifer
Soluble Rock

Site Sensitivity Context Map - Slice A



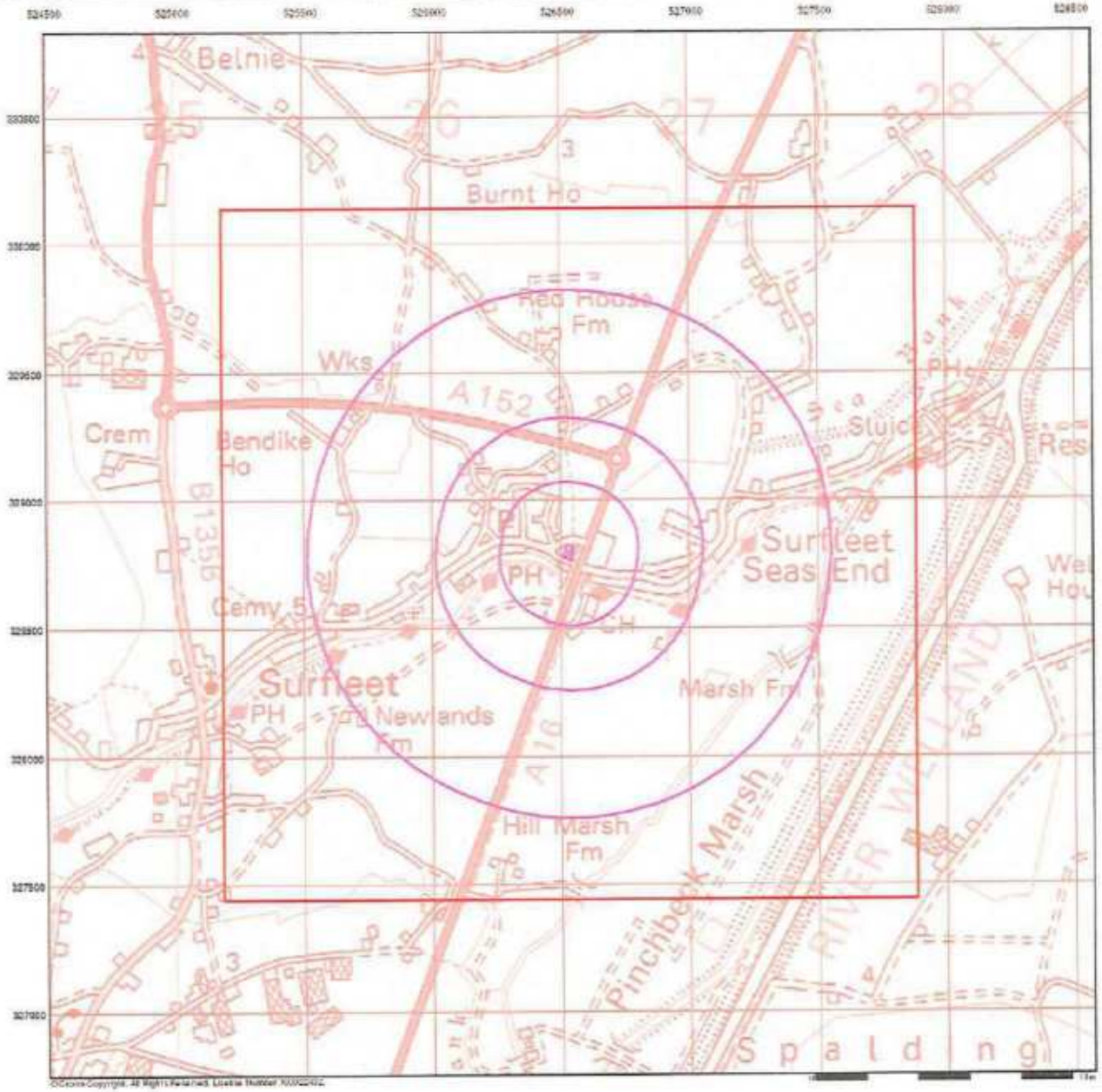
Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark



Bedrock Aquifer Designation

General

Specified Site | Specified Buffer(s) | Drawing Reference Point
Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

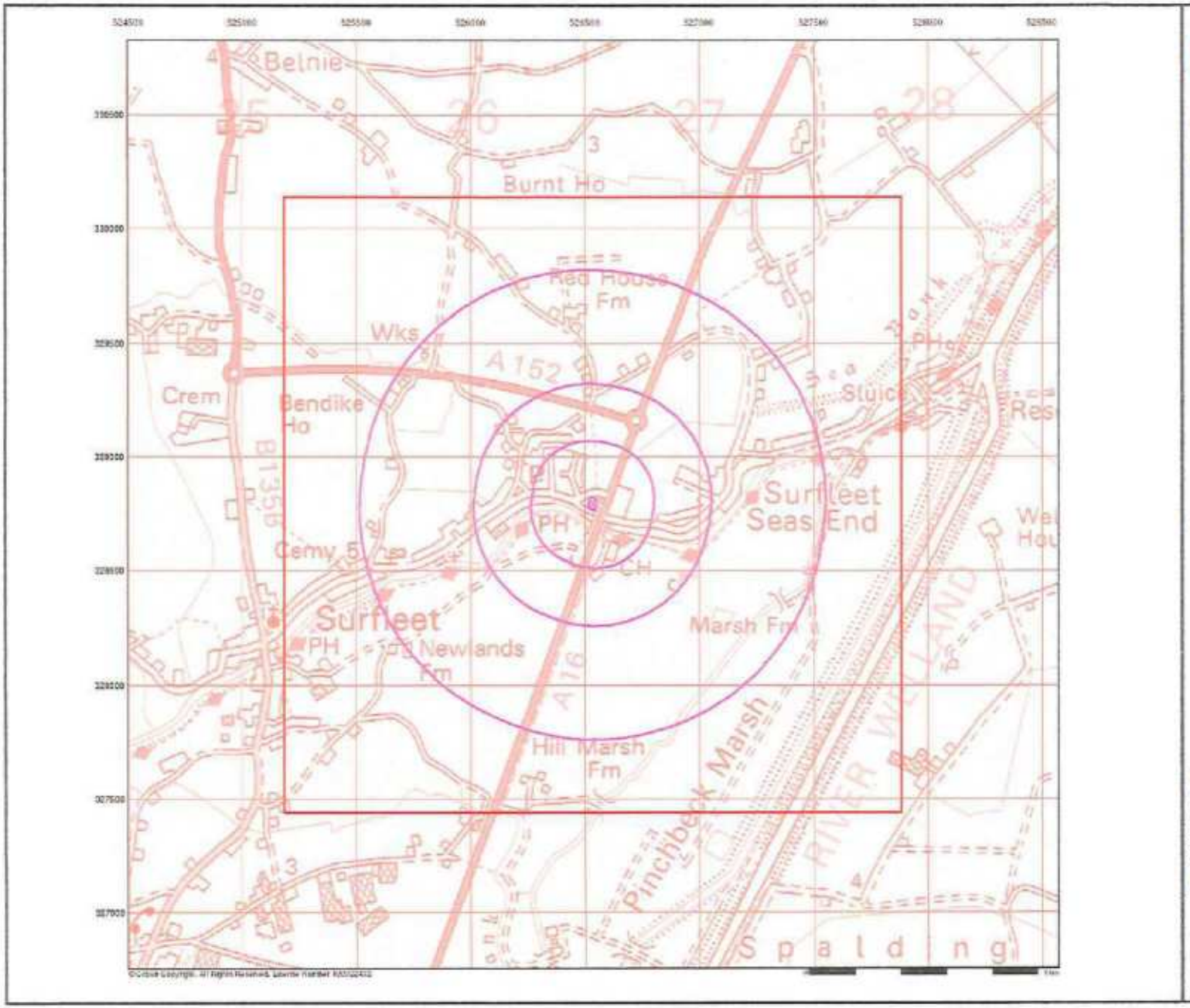


Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG



Superficial Aquifer Designation

General

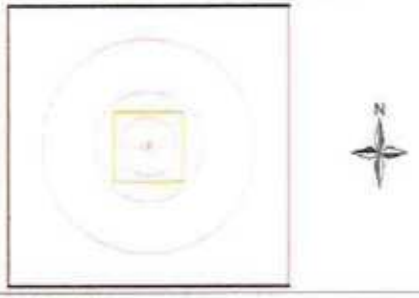
Specified Site | Specified Buffer(s) | Bearing Reference Point
Site | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

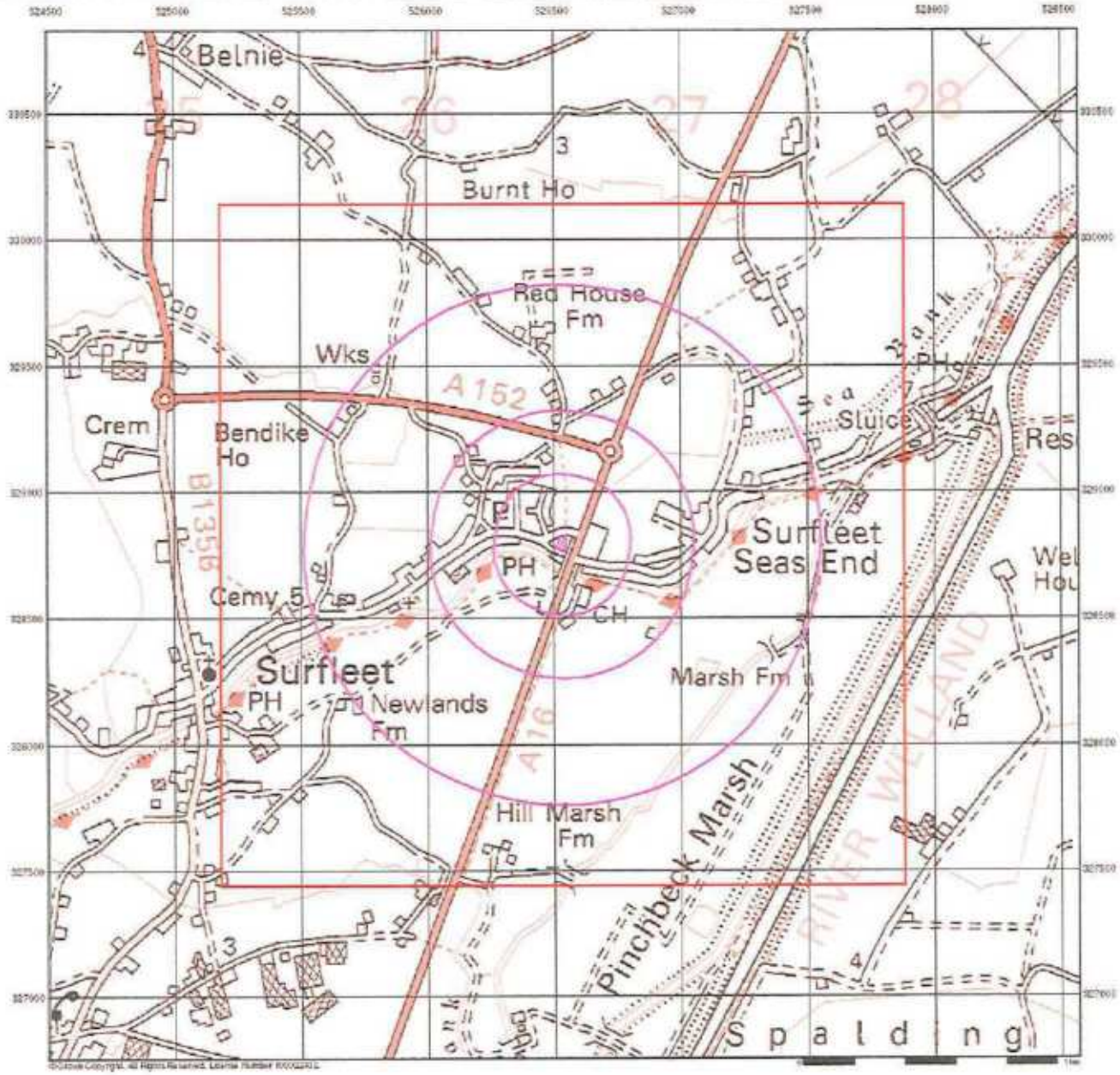


Order Details

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Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG



Source Protection Zones

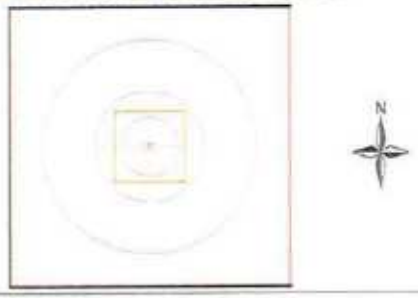
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



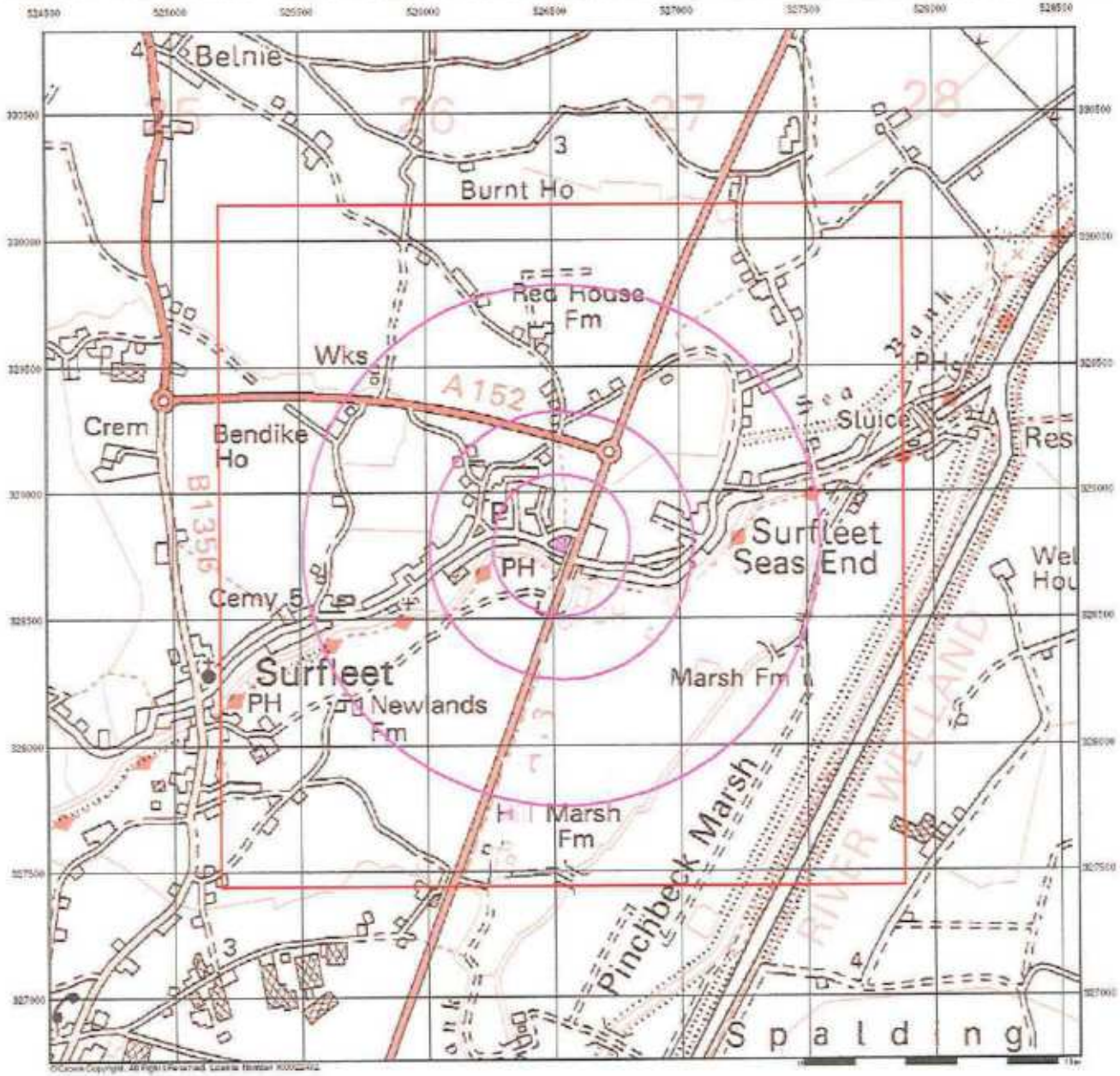
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Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark



eps

BGS Flood GFS Data

General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

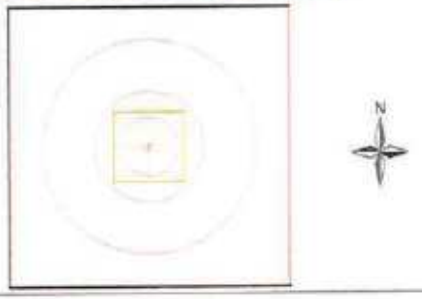
Agency and Hydrological (Flood)

Limited Potential for Groundwater Flooding to Occur

Potential for Groundwater Flooding of Property Situated Below Ground Level

Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A

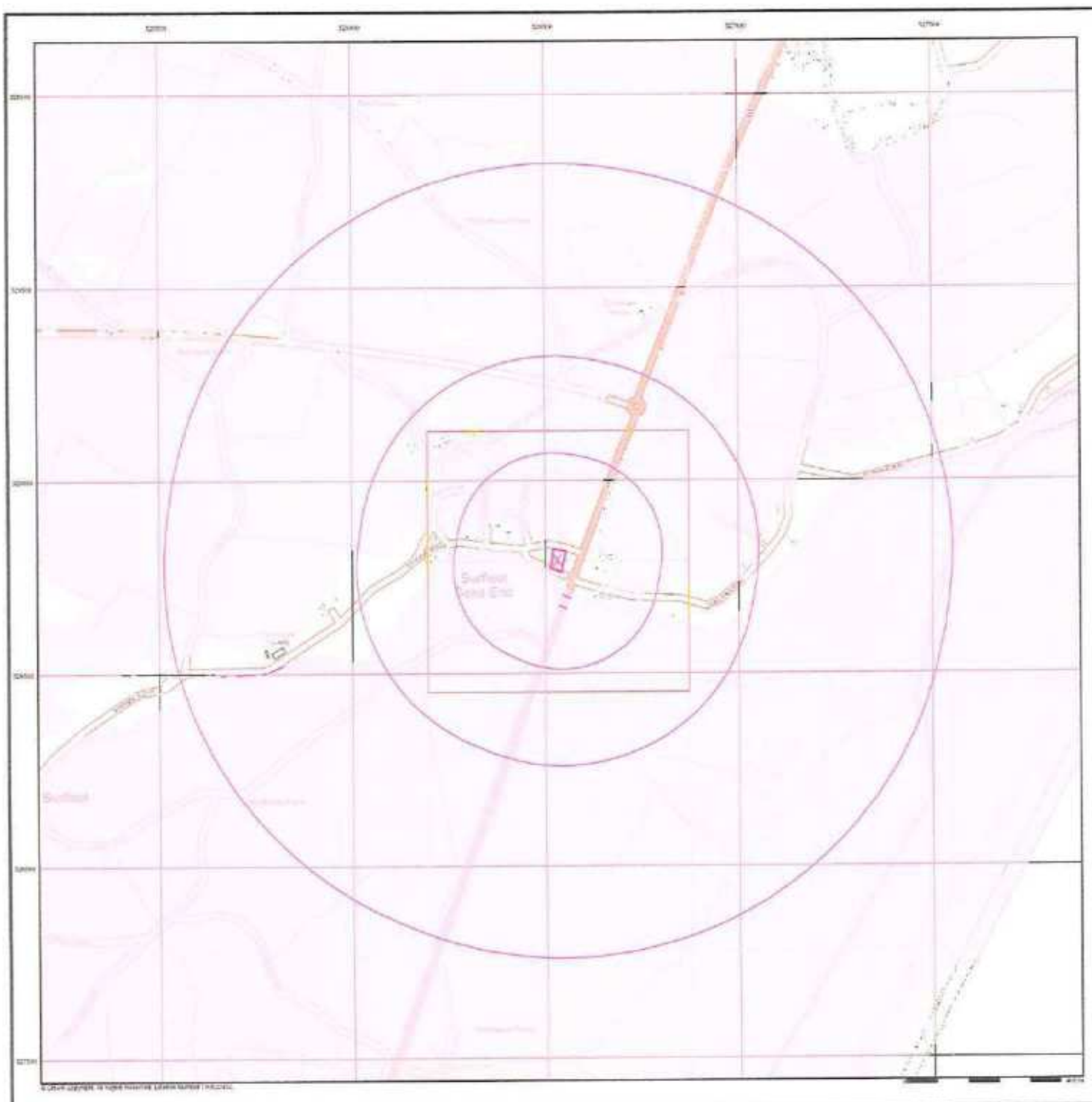


Order Details

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Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG



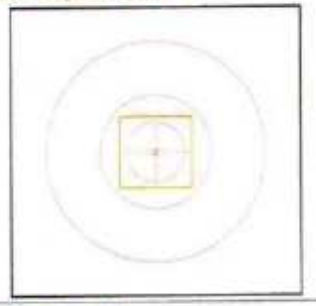
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

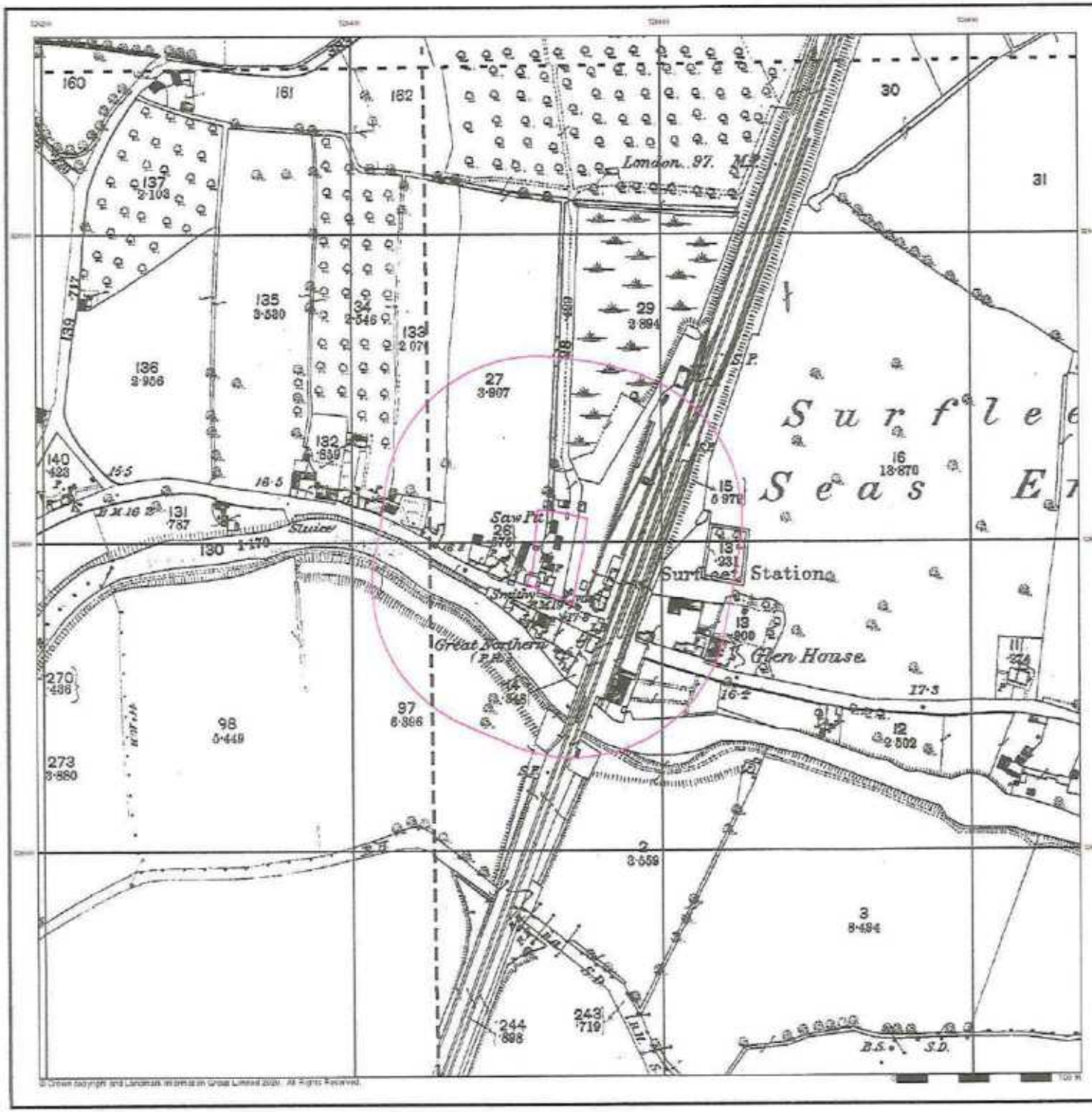
Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

APPENDIX F

Selection of Historic Maps



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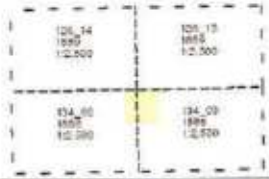
Lincolnshire

Published 1888 - 1889

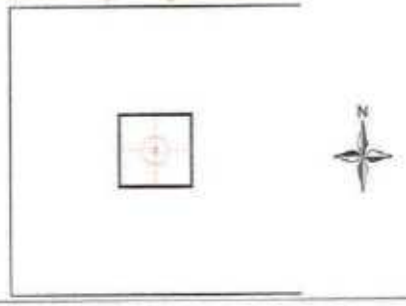
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13

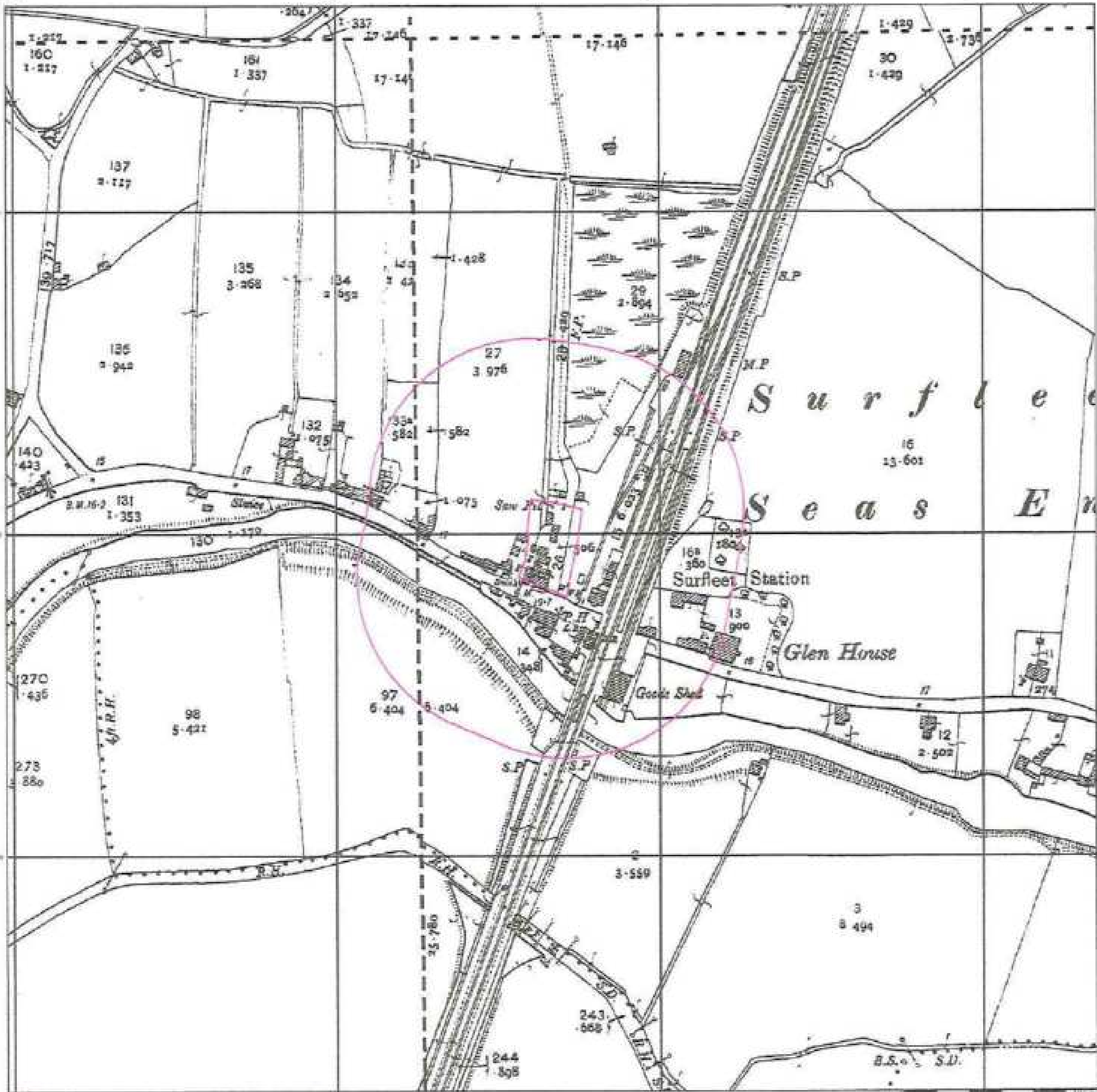


Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 326790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	100

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG



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eps

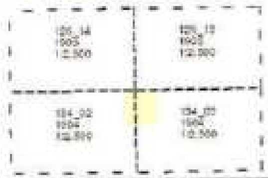
Lincolnshire

Published 1904 - 1905

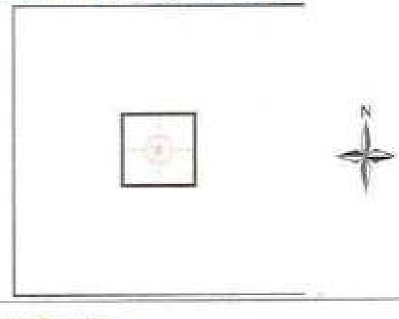
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13

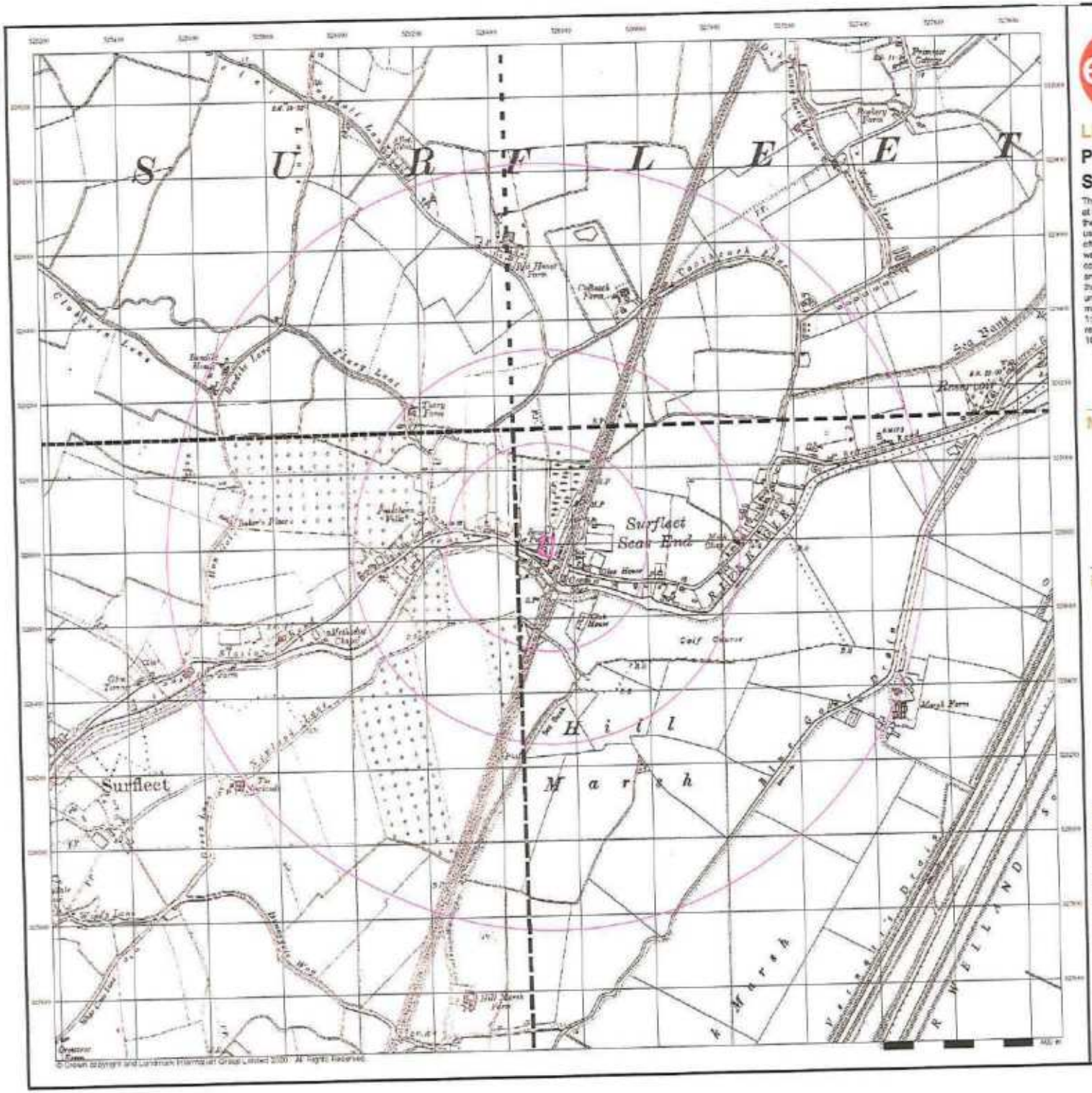


Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	100

Site Details

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eps

Lincolnshire

Published 1951

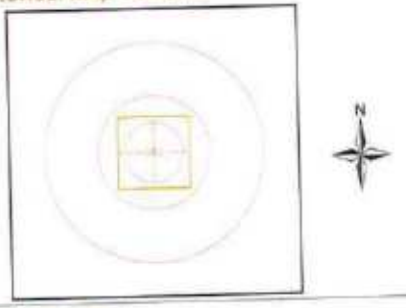
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



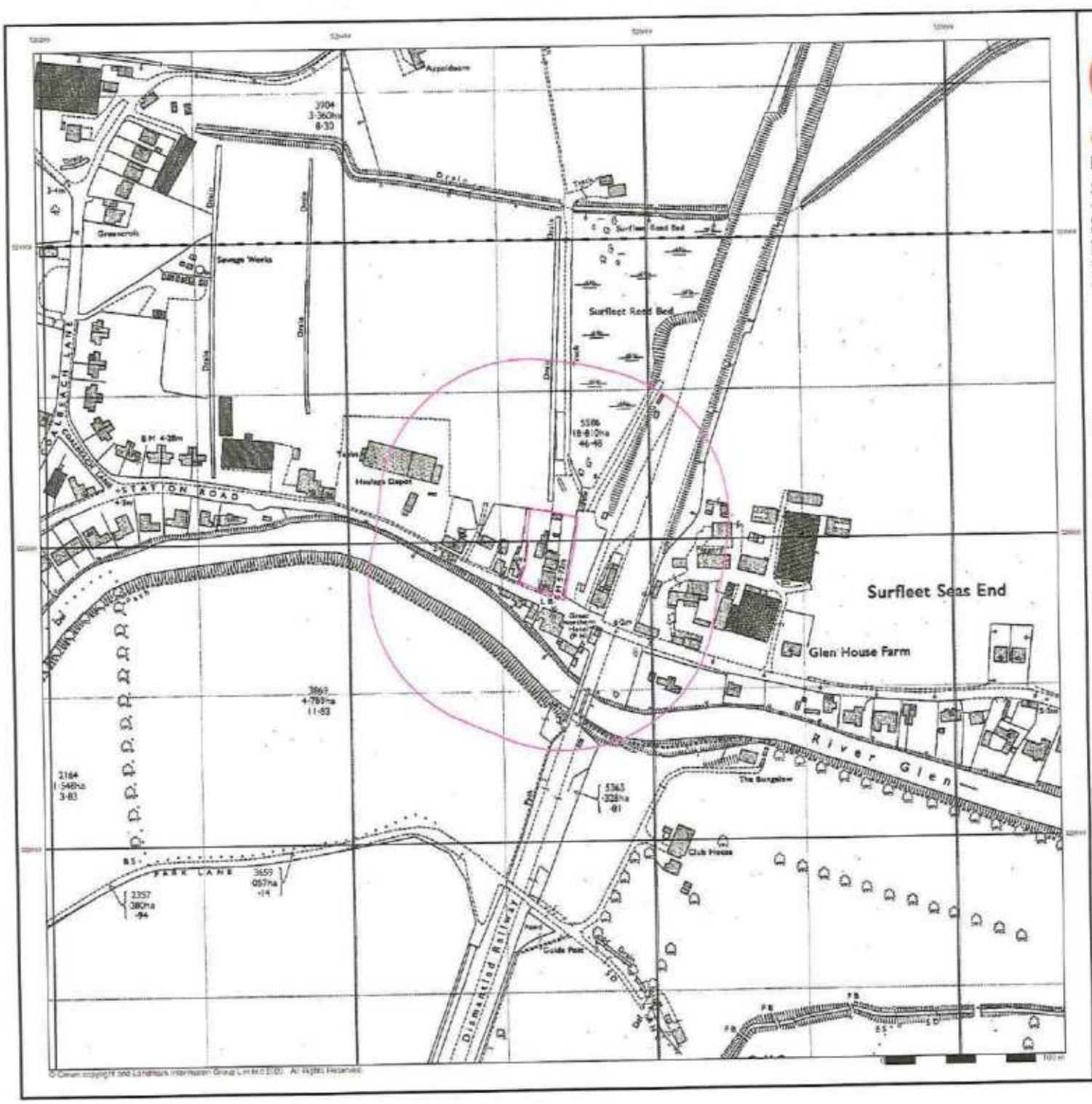
Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark



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eps

Ordnance Survey Plan

Published 1973

Source map scale - 1:2,500

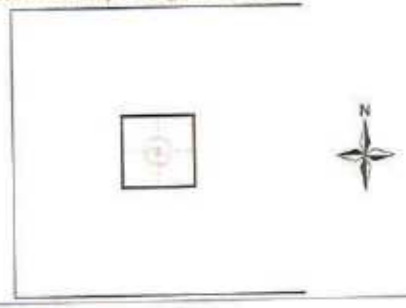
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1936, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

TF2825
1972
1:2,500

TF2528
1973
1:2,500

Historical Map - Segment A13



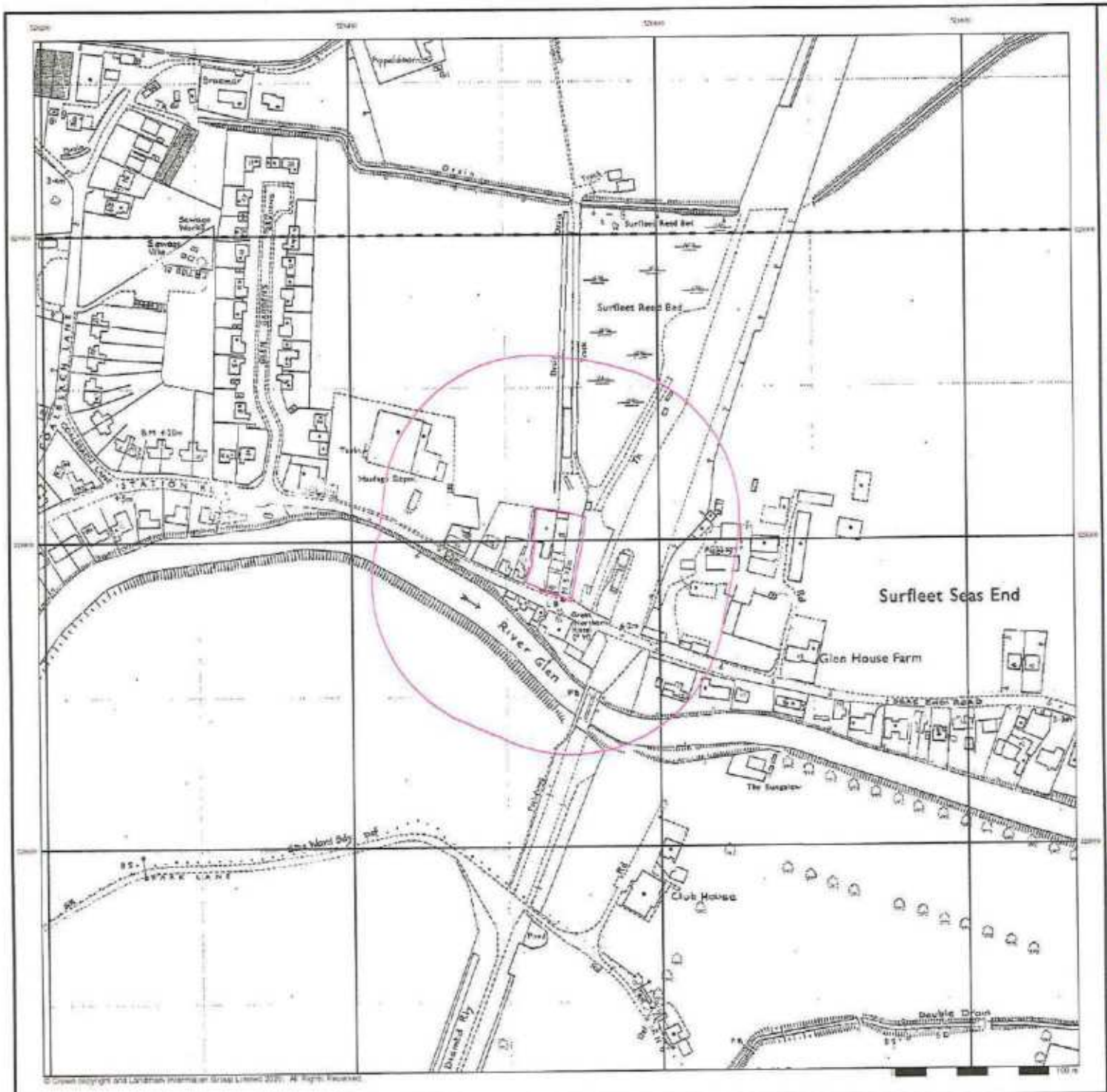
Order Details

Order Number:	237903778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	100

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark



Additional SIMs

Published 1987

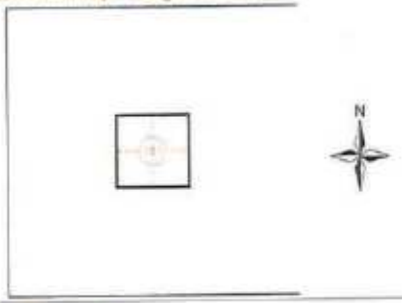
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



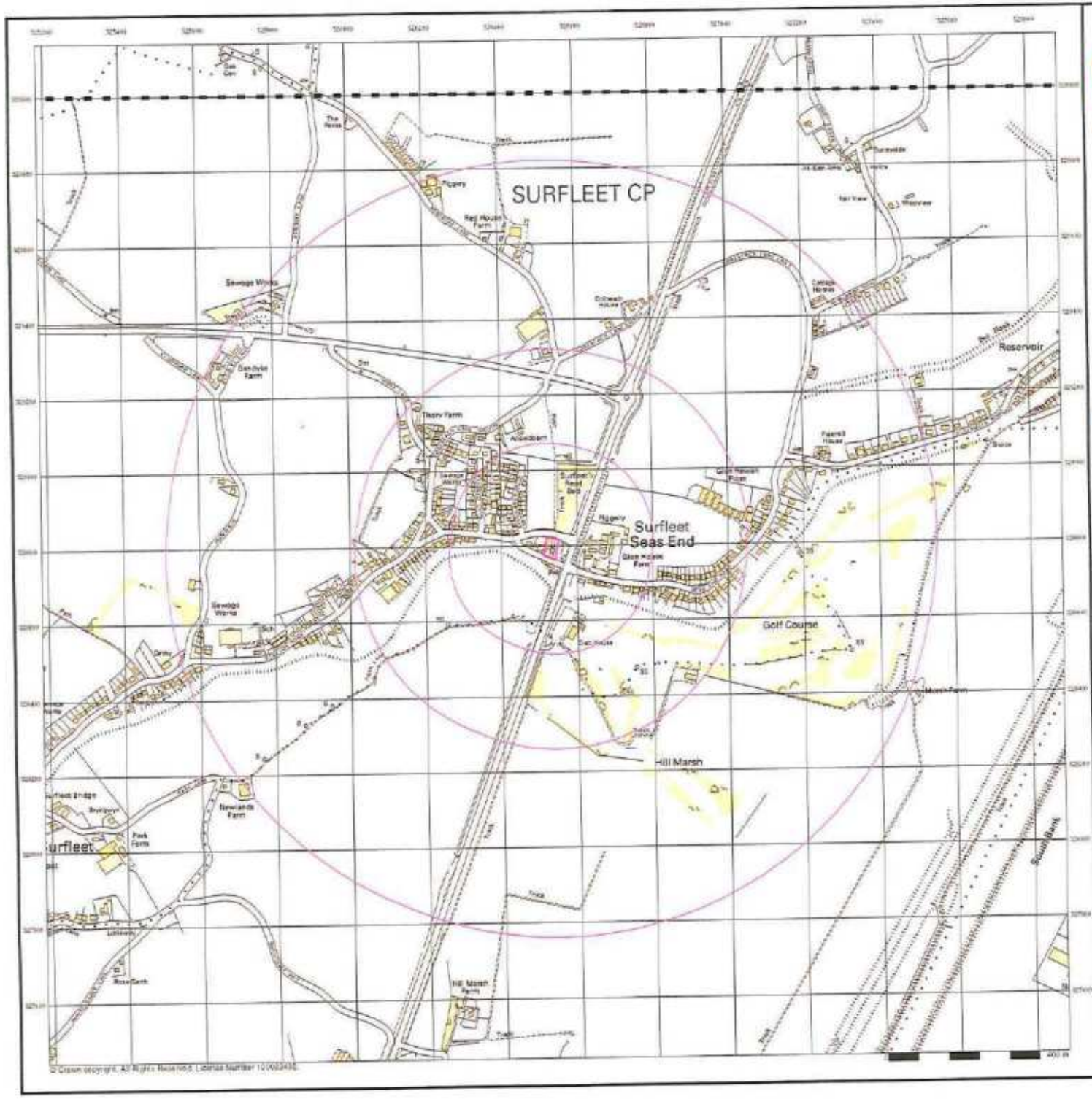
Order Details

Order Number:	237803775_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	100

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

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eps

10k Raster Mapping

Published 2006

Source map scale - 1:10,000

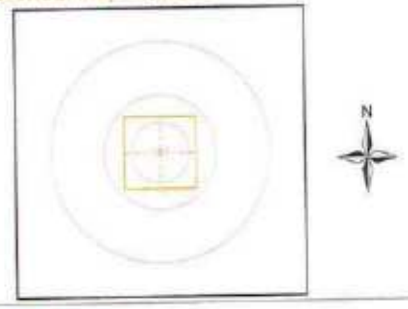
The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TF23SE
2006
1:10,000

TF22NE
2006
1:10,000

Historical Map - Slice A



Order Details

Order Number:	237803778_1_1
Customer Ref:	UK20.4948
National Grid Reference:	526530, 328790
Slice:	A
Site Area (Ha):	0.17
Search Buffer (m):	1000

Site Details

Land off Station Road, Surfleet, Spalding, Lincolnshire, PE11 4DG

Landmark

APPENDIX G

Site Specific Borehole Logs

Borehole Log

Borehole No. **WS01** Sheet 1 of 1

Project Name:	Land off Station Road, Surfleet	Project No. UK20.4948	Co-ords:
Location:	Station Road, Surfleet, Spalding, PE11 4DG		Level:
Client:	Bates Environmental		Dates: 17/03/2020

Hole Type: WLS | Scale: 1:50 | Logged By: MT

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	In Situ Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.30 - 1.00	ES		0.65			MADE GROUND: Brown slightly sandy GRAVEL with rare cobbles. Gravel is sub rounded, medium to coarse natural stones.
					1.20			MADE GROUND: Brownish black very gravelly SILT/CLAY. Gravel is angular fine grained brick fragments and bituminous material.
		1.70 - 1.80	ES		1.70			Brownish black slightly sandy SILT/CLAY. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
		1.80	PID	PID=0.00	2.00			Brown slightly sandy SILT/CLAY. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
					3.00			Brown slightly sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
					3.30			Brown SILT. (TIDAL FLAT DEPOSITS)
					4.00			Brown very sandy SILT. Sand is medium to coarse. (TIDAL FLAT DEPOSITS).
								End of Borehole at 5.000m

Remarks

AGS

Borehole Log

Borehole No. **WS02** Sheet 1 of 1

Project Name:	Land off Station Road, Surfleet	Project No. UK20.4948	Co-ords:
Location:	Station Road, Surfleet, Spalding, PE11 4DG		Level:
Client:	Bates Environmental		Dates: 17/03/2020

Hole Type: WLS
Scale: 1:50
Logged By: MT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.40	ES					MADE GROUND: Brown Gravel. Gravel is angular medium to coarse brick fragments and bituminous material.
		0.50	PID	PID=1.50	0.55			MADE GROUND: Black slightly sandy SILT, with rare brick and charcoal fragments.
		0.70 - 1.00	ES					
		1.50	PID	PID=0.00	1.20			Dark brown sandy clayey SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
	▼							
		2.90 - 3.00	ES		2.40			Brown sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
					3.20			Brown sandy clayey SILT. (TIDAL FLAT DEPOSITS)
					4.00			End of Borehole at 4.000m

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Borehole No. **WS03** Sheet 1 of 1

Project Name:	Land off Station Road, Surfleet	Project No. UK20.4948	Co-ords:
Location:	Station Road, Surfleet, Spalding, PE11 4DG		Level:
Client:	Bates Environmental		Dates: 17/03/2020

Hole Type: WLS
Scale: 1:50
Logged By: MT

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	In Situ Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10 - 0.50	ES		0.30			MADE GROUND: Blackish brown sandy GRAVEL. Gravel is angular to sub-rounded, medium to coarse brick fragments.
		0.50	PID	PID=0.00	0.80			MADE GROUND: Black slightly sandy slightly gravelly clayey SILT. Gravel is angular fine to medium brick and charcoal with rare bituminous material. Sand is fine to medium.
					1.30			MADE GROUND: Black slightly sandy clayey SILT with rare bituminous gravel.
					1.70			Greyish brown slightly sandy CLAY. (TIDAL FLAT DEPOSITS)
	▼	2.00 - 2.30	ES		2.35			Brown sandy CLAY. (TIDAL FLAT DEPOSITS)
					4.00			Brown sandy SILT. (TIDAL FLAT DEPOSITS)
								Becomes very sandy SILT.
								End of Borehole at 4.000m

Remarks

AGS

Borehole Log

Borehole No. **WS04** Sheet 1 of 1

Project Name:	Land off Station Road, Surfleet	Project No. UK20.4948	Co-ords:	Hole Type WLS
Location:	Station Road, Surfleet, Spalding, PE11 4DG		Level:	Scale 1:50
Client:	Bates Environmental		Dates: 17/03/2020	Logged By MT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.20 - 0.60	ES		0.35			MADE GROUND: Brown sandy GRAVEL. Sand is medium to coarse. Gravel is sub-rounded medium to coarse brick. Occasional metal fragments including nuts and bolts.
		0.50	PID	PID=0.00	0.55			MADE GROUND: Black sandy GRAVEL. Sand is medium to coarse. Gravel is sub-angular fine to medium brick and bituminous material.
		0.90 - 1.10	ES		1.00			MADE GROUND: Dark brown/black sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is sub-angular fine to medium brick and tile fragments with rare rootlets.
					1.30			Brown sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
		2.10	PID	PID=0.00	2.20			Brown sandy clayey SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
		4.80 - 4.80	ES		5.00			Brown sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
								End of Borehole at 5.000m

Remarks

AGS

Borehole Log

Borehole No. **WS05** Sheet 1 of 1

Project Name:	Land off Station Road, Surfleet	Project No. UK20.4948	Co-ords:
Location:	Station Road, Surfleet, Spalding, PE11 4DG		Level:
Client:	Bates Environmental		Dates: 17/03/2020

Hole Type: WLS
Scale: 1:50
Logged By: MT

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	In Situ Results	Depth (m)	Level (m)	Legend	Stratum Description
								Competent concrete hardstanding
		0.30 - 1.00	ES		0.30			MADE GROUND: Orangey brown gravelly SAND. Gravel is angular fine to medium concrete fragments. Sand is fine to medium.
		0.60	PID	PID=0.00	0.60			MADE GROUND: light brown/black gravelly SAND. Sand is fine to medium. Gravel is angular to sub-rounded medium to very coarse brick, charcoal, concrete and bituminous material.
					1.00			MADE GROUND: Reddish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to medium. Gravel is sub-angular fine to medium brick fragments and bituminous material. Cobbles are sub-rounded, up to 500 mm across of brick and concrete.
					2.00			Brown sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
	▼	2.40 - 2.70	ES		2.50			Brown sandy silty CLAY. Sand is fine to medium. (TIDAL FLAT DEPOSITS).
		2.50	PID	PID=0.00	3.00			Brown sandy SILT. Sand is fine to medium. (TIDAL FLAT DEPOSITS)
					4.00			End of Borehole at 4.000m

Remarks

AGS

APPENDIX H

Laboratory Results - Environmental

EPS Ltd
7B Caxton House
Broad Street
Cambourne
Cambridgeshire
CB23 6JN

Attention :	Mitchell Tucker
Date :	31st March, 2020
Your reference :	UK20.4948
Our reference :	Test Report 20/4295 Batch 1
Location :	Land Off Station Road,Surfleet
Date samples received :	19th March, 2020
Status :	Final report
Issue :	2

Twelve samples were received for analysis on 19th March, 2020 of which six were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Client Name:	EPS Ltd	**Report :**	**Solid**
Reference:	UK20.4948		
Location:	Land Off Station Road,Surfleet	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Mitchell Tucker		
EMT Job No:	20/4295		

EMT Sample No.	3-4	7-8	13-14	17-18	19-20	21-22							
Sample ID	WS01 ES2	WS02 ES4	WS03 ES7	WS04 ES9	WS04 ES10	WS05 ES11							
Depth	0.3-1.0	0.7-1.0	2.0-2.3	0.9-1.1	4.8-4.9	0.3-1.0							
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J							
Sample Date	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020							
Sample Type	Clay	Clay	Clay	Clayey Loam	Clay	Clay							
Batch Number	1	1	1	1	1	1							
Date of Receipt	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020							
Arsenic [M]	20.2	9.3	2.3	5.3	6.1	-					<0.5	mg/kg	TM30/PM15
Cadmium [M]	0.2	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM30/PM15
Chromium [M]	41.9	33.3	38.2	35.3	47.7	-					<0.5	mg/kg	TM30/PM15
Copper [M]	30	31	6	14	5	-					<1	mg/kg	TM30/PM15
Lead [M]	593	349	5	24	6	-					<5	mg/kg	TM30/PM15
Mercury [M]	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM30/PM15
Nickel [M]	17.0	15.4	9.3	12.1	9.8	-					<0.7	mg/kg	TM30/PM15
Selenium [M]	<1	<1	<1	<1	<1	-					<1	mg/kg	TM30/PM15
Total Sulphate as SO4 [M]	633	390	267	317	332	-					<50	mg/kg	TM50/PM29
Zinc [M]	408	63	26	49	25	-					<5	mg/kg	TM30/PM15
Arsenic	-	-	-	-	-	23.1					<0.5	mg/kg	TM30/PM62
Cadmium	-	-	-	-	-	0.2					<0.1	mg/kg	TM30/PM62
Chromium	-	-	-	-	-	24.3					<0.5	mg/kg	TM30/PM62
Copper	-	-	-	-	-	52					<1	mg/kg	TM30/PM62
Lead	-	-	-	-	-	39					<5	mg/kg	TM30/PM62
Mercury	-	-	-	-	-	<0.1					<0.1	mg/kg	TM30/PM62
Nickel	-	-	-	-	-	52.0					<0.7	mg/kg	TM30/PM62
Selenium	-	-	-	-	-	<1					<1	mg/kg	TM30/PM62
Total Sulphate as SO4	-	-	-	-	-	3974					<50	mg/kg	TM50/PM120
Zinc	-	-	-	-	-	73					<5	mg/kg	TM30/PM62
PAH MS													
Naphthalene [M]	0.19	0.14	<0.04	<0.04	<0.04	0.11					<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.63	<0.03	<0.03	<0.03	<0.03	<0.03					<0.03	mg/kg	TM4/PM8
Acenaphthene [M]	0.10	<0.05	<0.05	<0.05	<0.05	<0.05					<0.05	mg/kg	TM4/PM8
Fluorene [M]	0.20	<0.04	<0.04	<0.04	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Phenanthrene [M]	3.87	0.16	<0.03	0.03	<0.03	0.58					<0.03	mg/kg	TM4/PM8
Anthracene [#]	1.06	<0.04	<0.04	<0.04	<0.04	0.21					<0.04	mg/kg	TM4/PM8
Fluoranthene [M]	9.93	0.06	<0.03	0.20	<0.03	1.07					<0.03	mg/kg	TM4/PM8
Pyrene [#]	8.44	0.06	<0.03	0.18	<0.03	0.99					<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	4.43	0.00	<0.06	0.20	<0.06	0.49					<0.06	mg/kg	TM4/PM8
Chrysene [M]	5.84	0.08	<0.02	0.16	<0.02	0.53					<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [M]	10.37	0.10	<0.07	0.26	<0.07	0.84					<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	5.58	<0.04	<0.04	0.15	<0.04	0.55					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	3.62	<0.04	<0.04	0.07	<0.04	0.31					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	0.86	<0.04	<0.04	<0.04	<0.04	0.06					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	3.70	<0.04	<0.04	0.07	<0.04	0.31					<0.04	mg/kg	TM4/PM8
PAH 16 Total	58.8	0.7	<0.6	1.3	<0.6	6.1					<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	7.47	0.07	<0.05	0.19	<0.05	0.60					<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	2.90	0.03	<0.02	0.07	<0.02	0.24					<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	95	95	99	100	99	89					<0	%	TM4/PM8
Methyl Tertiary Butyl Ether [#]	-	-	-	-	-	<2					<2	ug/kg	TM15/PM10
Benzene [#]	-	-	-	-	-	<3					<3	ug/kg	TM15/PM10

Please see attached notes for all abbreviations and acronyms

Client Name:	EPS Ltd	**Report :**	**Solid**
Reference:	UK20.4948		
Location:	Land Off Station Road,Surfleet	Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Mitchell Tucker		
EMT Job No:	20/4295		

EMT Sample No.	3-4	7-8	13-14	17-18	19-20	21-22					Please see attached notes for all abbreviations and acronyms		
Sample ID	WS01 ES2	WS02 ES4	WS03 ES7	WS04 ES9	WS04 ES10	WS05 ES11							
Depth	0.3-1.0	0.7-1.0	2.0-2.3	0.9-1.1	4.6-4.8	0.3-1.0							
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J							
Sample Date	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020							
Sample Type	Clay	Clay	Clay	Clayey Loam	Clay	Clay							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020							
Toluene #	-	-	-	-	-	<3					<3	ug/kg	TM15/PM10
Ethylbenzene #	-	-	-	-	-	<3					<3	ug/kg	TM15/PM10
m/p-Xylene #	-	-	-	-	-	7					<5	ug/kg	TM15/PM10
o-Xylene #	-	-	-	-	-	<3					<3	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	-	-	-	-	-	83					<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	-	-	-	-	-	63					<0	%	TM15/PM10
TPH CWG													
Aliphatics													
>C5-C6 #M	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>C6-C8 #M	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>C10-C12 #M	<0.2	-	-	-	-	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #M	<4	-	-	-	-	<4					<4	mg/kg	TM5/PM8/PM16
>C16-C21 #M	9	-	-	-	-	15					<7	mg/kg	TM5/PM8/PM16
>C21-C35 #M	80	-	-	-	-	100					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35	89	-	-	-	-	115					<19	mg/kg	
Aromatics													
>C5-EC7 #	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>EC8-EC10 #M	<0.1 SV	-	-	-	-	<0.1 SV					<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	1.6	-	-	-	-	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	11	-	-	-	-	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	70	-	-	-	-	27					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	342	-	-	-	-	200					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 #	426	-	-	-	-	227					<19	mg/kg	
Total aliphatics and aromatics(C5-35)	514	-	-	-	-	342					<38	mg/kg	
MTBE #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
Benzene #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
Toluene #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
Ethylbenzene #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
m/p-Xylene #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
o-Xylene #	<5 SV	-	-	-	-	-					<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15					<0.15	mg/kg	TM26/PM21
Natural Moisture Content	12.5	25.7	32.0	14.9	44.6	23.3					<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #M	0.0556	<0.0015	0.0115	0.0287	0.0232	-					<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	-	-	-	-	1.4066					<0.0015	g/l	TM38/PM20
Chromium III	41.9	33.3	38.2	35.3	47.7	-					<0.5	mg/kg	NONE/NONE
Chromium III	-	-	-	-	-	24.3					<0.5	mg/kg	NONE/NONE

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All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	EPS Ltd
Reference:	UK20.4948
Location:	Land Off Station Road,Surfleet
Contact:	Mitchell Tucker
EMT Job No:	20/4295

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	3-4	7-8	13-14	17-18	19-20	21-22					LOD/LOR	Units	Method No.
Sample ID	WS01 ES2	WS02 ES4	WS03 ES7	WS04 ES9	WS04 ES10	WS05 ES11							
Depth	0.3-1.0	0.7-1.0	2.0-2.3	0.9-1.1	4.8-4.9	0.3-1.0							
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J							
Sample Date	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020	17/03/2020							
Sample Type	Clay	Clay	Clay	Clayey Loam	Clay	Clay							
Batch Number	1	1	1	1	1	1							
Date of Receipt	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020							
Total Cyanide [EM]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5					<0.5	mg/kg	TM89/PM45
Organic Matter	6.7	3.6	0.6	1.3	0.9	NDP					<0.2	%	TM21/PM24
Organic Matter	-	-	-	-	-	NDP					<0.2	%	TM21/PM89
pH [EM]	8.33	8.03	8.61	8.37	8.37	8.93					<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	Clay	Clayey Loam	Clay	Clay						None	PM13/PM0
Sample Colour	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown						None	PM13/PM0
Other Items	stones, sand	stones	silt, water	vegetation	silt, water	stones						None	PM13/PM0

Please see attached notes for all abbreviations and acronyms

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	EPS Ltd
Reference:	UK20.4948
Location:	Land Off Station Road,Surfleet
Contact:	Mitchell Tucker
EMT Job No:	20/4295

VOC Report : **Solid**

EMT Sample No.	21-22													
Sample ID	WS65-ES11													
Depth	0.3-1.0													
COC No / misc														
Containers	V J													
Sample Date	17/03/2020													
Sample Type	Clay													
Batch Number	1													
Date of Receipt	19/03/2020													

Please see attached notes for all abbreviations and acronyms

		LOD/LOR	Units	Method No.
VOC MS				
Dichlorodifluoromethane	<2	<2	ug/kg	TM15/PM10
Methyl Tertiary Butyl Ether #	<2	<2	ug/kg	TM15/PM10
Chloromethane #	<3	<3	ug/kg	TM15/PM10
Vinyl Chloride	<2	<2	ug/kg	TM15_APM10
Bromomethane	<1	<1	ug/kg	TM15/PM10
Chloroethane #	<2	<2	ug/kg	TM15/PM10
Trichlorofluoromethane #	<2	<2	ug/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<8	<8	ug/kg	TM15/PM10
Dichloromethane (DCM) #	<30	<30	ug/kg	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	ug/kg	TM15/PM10
1,1-Dichloroethane #	<3	<3	ug/kg	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	ug/kg	TM15/PM10
2,2-Dichloropropane	<4	<4	ug/kg	TM15/PM10
Bromochloromethane #	<3	<3	ug/kg	TM15/PM10
Chloroform #	<3	<3	ug/kg	TM15/PM10
1,1,1-Trichloroethane #	<3	<3	ug/kg	TM15/PM10
1,1-Dichloropropene #	<3	<3	ug/kg	TM15/PM10
Carbon tetrachloride #	<4	<4	ug/kg	TM15/PM10
1,2-Dichloroethane #	<4	<4	ug/kg	TM15/PM10
Benzene #	<3	<3	ug/kg	TM15/PM10
Trichloroethene (TCE) #	<3	<3	ug/kg	TM15/PM10
1,2-Dichloropropane #	<6	<6	ug/kg	TM15/PM10
Dibromomethane #	<3	<3	ug/kg	TM15/PM10
Bromodichloromethane #	<3	<3	ug/kg	TM15/PM10
cis-1-3-Dichloropropene	<4	<4	ug/kg	TM15/PM10
Toluene #	<3	<3	ug/kg	TM15/PM10
trans-1-3-Dichloropropene	<3	<3	ug/kg	TM15/PM10
1,1,2-Trichloroethane #	<3	<3	ug/kg	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	ug/kg	TM15/PM10
1,3-Dichloropropane #	<3	<3	ug/kg	TM15/PM10
Dibromochloromethane #	<3	<3	ug/kg	TM15/PM10
1,2-Dibromoethane #	<3	<3	ug/kg	TM15/PM10
Chlorobenzene #	<3	<3	ug/kg	TM15/PM10
1,1,1,2-Tetrachloroethane #	<3	<3	ug/kg	TM15/PM10
Ethylbenzene #	<3	<3	ug/kg	TM15/PM10
m/p-Xylene #	7	<5	ug/kg	TM15/PM10
o-Xylene #	<3	<3	ug/kg	TM15/PM10
Styrene	<3	<3	ug/kg	TM15_APM10
Bromoform	<3	<3	ug/kg	TM15/PM10
Isopropylbenzene #	<3	<3	ug/kg	TM15/PM10
1,1,2,2-Tetrachloroethane #	<3	<3	ug/kg	TM15/PM10
Bromobenzene	<2	<2	ug/kg	TM15/PM10
1,2,3-Trichloropropane #	<4	<4	ug/kg	TM15/PM10
Propylbenzene #	<4	<4	ug/kg	TM15/PM10
2-Chlorotoluene	<3	<3	ug/kg	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	ug/kg	TM15/PM10
4-Chlorotoluene	<3	<3	ug/kg	TM15/PM10
tert-Butylbenzene #	<5	<5	ug/kg	TM15/PM10
1,2,4-Trimethylbenzene #	<6	<6	ug/kg	TM15/PM10
sec-Butylbenzene #	<4	<4	ug/kg	TM15/PM10
4-Isopropyltoluene #	<4	<4	ug/kg	TM15/PM10
1,3-Dichlorobenzene #	<4	<4	ug/kg	TM15/PM10
1,4-Dichlorobenzene #	<4	<4	ug/kg	TM15/PM10
n-Butylbenzene #	<4	<4	ug/kg	TM15/PM10
1,2-Dichlorobenzene #	<4	<4	ug/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<4	<7	ug/kg	TM15/PM10
1,2,4-Trichlorobenzene #	<7	<4	ug/kg	TM15/PM10
Hexachlorobutadiene	<4	<27	ug/kg	TM15/PM10
Naphthalene	<27	<7	ug/kg	TM15/PM10
1,2,3-Trichlorobenzene #	<7	<0	%	TM15/PM10
Surrogate Recovery Toluene D8	83	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	63			

EPH Interpretation Report

Matrix : Solid

Client Name: EPS Ltd
Reference: UK20.4948
Location: Land Off Station Road,Surfleet
Contact: Mitchell Tucker

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
20/4295	1	WS01 ES2	0.3-1.0	3-4	PAH's & Lubricating oil
20/4295	1	WS05-ES11	0.3-1.0	21-22	PAH's & Lubricating oil

Please include all sections of this report if it is reproduced

Client Name: EPS Ltd
Reference: UK20.4948
Location: Land Off Station Road,Surfleet
Contact: Mitchell Tucker

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/4295	1	WS01 ES2	0.3-1.0	4	20/03/2020	**General Description (Bulk Analysis)**	soil-stones
					20/03/2020	**Asbestos Fibres**	NAD
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos Type**	NAD
					20/03/2020	**Asbestos Level Screen**	NAD
20/4295	1	WS02 ES4	0.7-1.0	8	20/03/2020	**General Description (Bulk Analysis)**	soil-stones
					20/03/2020	**Asbestos Fibres**	NAD
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos Type**	NAD
					20/03/2020	**Asbestos Level Screen**	NAD
20/4295	1	WS03 ES7	2.0-2.3	14	20/03/2020	**General Description (Bulk Analysis)**	soil-stones
					20/03/2020	**Asbestos Fibres**	NAD
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos Type**	NAD
					20/03/2020	**Asbestos Level Screen**	NAD
20/4295	1	WS04 ES9	0.9-1.1	18	20/03/2020	**General Description (Bulk Analysis)**	Soil/Stones
					20/03/2020	**Asbestos Fibres**	NAD
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos Type**	NAD
					20/03/2020	**Asbestos Level Screen**	NAD
20/4295	1	WS04 ES10	4.6-4.8	20	20/03/2020	**General Description (Bulk Analysis)**	Soil/Stones
					20/03/2020	**Asbestos Fibres**	NAD
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos Type**	NAD
					20/03/2020	**Asbestos Level Screen**	NAD
20/4295	1	WS05-ES11	0.3-1.0	22	20/03/2020	**General Description (Bulk Analysis)**	Soil/Stones
					20/03/2020	**Asbestos Fibres**	Fibre Bundles
					20/03/2020	**Asbestos Fibres (2)**	Fibre Bundles
					20/03/2020	**Asbestos ACM**	NAD
					20/03/2020	**Asbestos ACM (2)**	Insulation Debris
					20/03/2020	**Asbestos Type**	Chrysotile
					20/03/2020	**Asbestos Type (2)**	Amosite
					20/03/2020	**Asbestos Level Screen**	Asbestos level cannot be determined from Screen. Quantification required.

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Client Name: EPS Ltd
Reference: UK20.4948
Location: Land Off Station Road,Surfleet
Contact: Mitchell Tucker

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/4295	1	WS05-ES11	0.3-1.0	22	27/03/2020	Total ACM Gravimetric Quantification (% Ash)	<0.001 (mass %)
					27/03/2020	Total Detailed Gravimetric Quantification (% Ash)	0.023 (mass %)
					27/03/2020	Total Gravimetric Quantification (ACM + Detailed) (% Ash)	0.023 (mass %)
					27/03/2020	Asbestos PCOM Quantification (Fibres)	<0.001 (mass %)
					27/03/2020	Asbestos Gravimetric & PCOM Total	0.023 (mass %)

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NDP Reason Report

Matrix : Solid

Client Name: EPS Ltd
Reference: UK20.4948
Location: Land Off Station Road,Surfleet
Contact: Mitchell Tucker

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Method No.	NDP Reason
20/4295	1	WS05-ES11	0.3-1.0	21-22	TM21/PM24	Asbestos detected in sample
20/4295	1	WS05-ES11	0.3-1.0	21-22	TM21/PM89	Asbestos detected in sample

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Client Name: EPS Ltd
Reference: UK20.4948
Location: Land Off Station Road,Surfleet
Contact: Mitchell Tucker

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/4295						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

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NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/4295

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 20/4295

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	No

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EMT Job No: 20/4295

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM89	Preparation of positive asbestos samples for Eltra analysis			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (50:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes

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EMT Job No: 20/4295

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes	Yes	AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM129	A hot hydrochloric acid digest is performed on an as received sample, and the resulting liquor is analysed.			AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes	Yes	AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes	Yes	AR	Yes
TM131	Quantification of Asbestos Fibres and ACM, based on HSG248 and SCA method.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

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EMT Job No: 20/4295

Test Method No.	Description	Prep Method No. (If appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	NONE	No Method Code			AR	Yes
TM15_A	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds. Vinyl Chloride & Styrene by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

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APPENDIX I

Generic Screening Criteria

EPS Generic Quantitative Risk Assessment - Residential Land Use

Contaminant	Soil Targets			Groundwater Targets	
	Human Health	Controlled Waters		Controlled Waters	
		LGwRP	HGwRP	LGwRP	HGwRP
Unit	mg/kg			ug/l	
Arsenic	See C4SL	n/c	n/c	50	10
Cadmium	See C4SL	n/c	n/c	5	5
Chromium III	910	n/c	n/c	250	50
Chromium VI	See C4SL	n/c	n/c	n/c	n/c
Copper	2400	n/c	n/c	28	28
Mercury (elemental)	1.2	n/c	n/c	1	1
Nickel	180	n/c	n/c	200	50
Lead	See C4SL	n/c	n/c	250	10
Selenium	250	n/c	n/c	10	10
Zinc	3700	n/c	n/c	500	500
Benzene	See C4SL	0.252	0.008	30	1
Toluene	130	1.17	1.17	50	50
Ethylbenzene	47	15.0	10.0	300	200
Xylene (para)	56	0.885	0.885	30	30
MTBE#	49	0.138	0.0276	75	15
Benzo(a)Pyrene	See C4SL	10	1.44	0.7	0.1
Naphthalene	2.3	0.934	0.02	10	0.1
Dibenz(ah)anthracene	0.24	n/c	n/c	n/c	n/c
Aliphatic C5-C6	42	5.27	1.05	50	10
Aliphatic C6-C8	100	23.2	4.64	50	10
Aliphatic C8-C10	27	175	35.1	50	10
Aliphatic C10-C12	130(48)*	1380	276	50	10
Aliphatic C12-C16	1100(8.46)**	27500	5490	50	10
Aliphatic C16-C35	65000 (8.46)**	3.46E+06	6.91E+05	50	10
Aromatic C8-C10	34	8.74	1.75	50	10
Aromatic C10-C12	74	13.8	2.76	50	10
Aromatic C12-C16	140	27.5	5.5	50	10
Aromatic C16-C21	260	86.9	17.4	50	10
Aromatic C21-C35	1100	690	138	50	10

Notes:
LGwRP - Low Groundwater Resource Potential HGwRP - High Groundwater Resource Potential
f = Oral, dermal and inhalation exposure compared with oral HCV N/C = Not Calculated
* = S4UL exceeds vapour saturation limit (in brackets) ** = S4UL exceeds solubility saturation limit (in brackets)

Soil Targets

Targets for Human Health have been taken from *S4ULs 'Suitable For Use Levels for Human Health Risk Assessment' – LQM and CIEH (2014)* derived using standard sandy loam soil with 1% SOM, except (#) = *EIC/AGS/CL:AIRE GAC 'Soil Generic Assessment Criteria' (2010)*. For sites where ground conditions differ significantly from sandy loam or site-specific SOM and pH are available, the generic human health targets may be revised.

Targets for Controlled waters have been derived using EA Remedial Targets Worksheet (v3.1) - using standard Sandy Loam ground conditions as described in Science Report SC050021/SR3, assuming no degradation for a 10m compliance distance with criteria of EQS or UKDWS for LGwRP and HGwRP respectively (see notes for GW targets).

Groundwater Targets

For LGwRP, targets have been taken as Freshwater EQS where available. For Ethylbenzene and BaP the WHO Health limit has been used and for MTBE and individual TPH fractions a 5 times multiplier of taste threshold and UKDWS has been taken repectively.
For HGwRP, targets have been taken as UKDWS where available, with the exception of Copper and Zinc where the EQS is lower than the DWS and therefore the EQS has been used as the groundwater target. For Ethylbenzene the upper WHO ATO limit has been used. For Toluene and Xylene, the WHO ATO limit is higher than the EQS and so the lower value has been taken. For MTBE the taste threshold has been taken.
Work carried out to calculate generic screening criteria for concentrations of contaminant in groundwater with respect of risks to Human Health has generally found that criteria far exceed (by at least 2 orders of magnitude) those listed for the protection of either LGwRP and HGwRP receptors. On this basis, the above Groundwater criteria are also considered protective of human health and further evaluation of these risks should be considered alongside any detailed quantitative risk assessments carried out for groundwater on a site specific basis.

EPS Generic Quantitative Risk Assessment

Generic Screening Criteria (C4SLs) - All Land Uses

Contaminant	Soil Targets					
	Residential		Allotments	Commercial	Public Open Spaces	
	With Home Grown Produce	Without Home Grown Produce			Residential	Parks
Unit	mg/kg					
Arsenic	37	40	49	640	79	168
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5	5.3	5.7	76	10	21
Cadmium	26	149	4.9	410	220	880
Chromium (VI)	21	21	170	49	23	250
Lead	200	310	80	2330	630	1300

Notes:

Targets for Human Health have been taken from the publicly available Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination issued by DEFRA in December 2013.

Within the modelling for C4SLs, a Soil Organic Matter content of 6% has been used. Reference to site-specific data should be made where possible. EPS have carried out a sensitivity analysis in-house and the contaminant benzene is the current C4SL most susceptable to changes in SOM and therefore any risk assessment for this compound must account for this aspect.

APPENDIX J

Statistical Analysis

Test Results

Client/client ref: Bates Environr Site ref: Land off Station Road, Surfleet
Project ref: UK20.4948 Data description:
Date: 25-Mar-2020
User details: MT

Dataset: Benzo(a)pyrene

Sample mean,	1.3750
Sample standard deviation, s	2.6758
Sample size, n	4
Critical concentration, Cc	5

& non-detects

Use Normal distribution to test fc

ent?	YES
evel	
oved?	0
	0

5%

Normality test

Significance level:	
Non-normal distributi	5%
Use:	

Chebychev

Test scena

Null hypothesis:	The true mea
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

Planning: is true mean lower than critical concentration (μ < Cc)?

Evidence against Null hypothesis:	**87%**
n:	2
equired:	**95%**
ability?	N/A
othesis?	No
nough evidence	

evidence level

Test Results

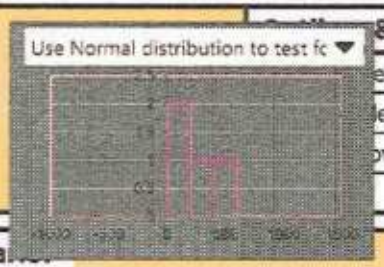
Client/client ref: Bates Environr Site ref: Land off Station Road, Surfleet Date: 25-Mar-2020
Project ref: UK20.4948 Data description: User details: MT

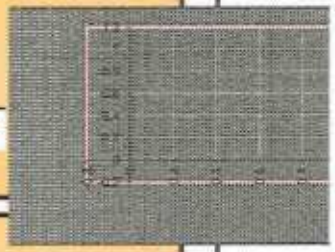
Dataset:	Lead
Sample mean, $\bar{x}$	231.25
Sample standard deviation, s	272.67
Sample size, n	4
Critical concentration, Cc	200

& non-detects	
ent?	NO
evel	
oved?	0
	0

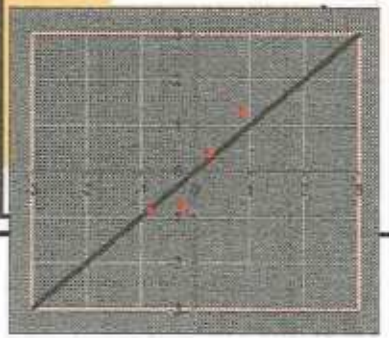
Use Normal distribution to test fc

5%





Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



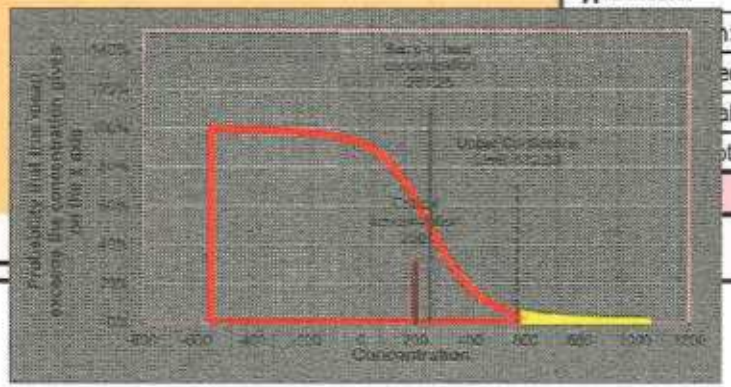
Test scenario

Null hypothesis:	The true mea
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

Planning: is true mean lower than critical concentration (μ < Cc)?

Evidence against Null hypothesis:	37%
n:	2
equired:	95%
ability?	N/A
othesis?	No
μ ≥ Cc	

evidence level



APPENDIX K

Cover System Calculations

Calculations based on mixed zone (M)	600	mm

Contaminant	Site Data				Expressed as a Factor of Target Guideline Value				Cover Thickness Required for Compliance to Specified Target Guideline Value	
	Contamination of Ground (Cg)	Contamination of Cover (Cc)	Target Guideline Value 1	Target Guideline Value 2	Soil / Target Guideline Value 1	Cover / Target Guideline Value 1	Soil / Target Guideline Value 2	Cover / Target Guideline Value 2	Target Guideline Value 1	Target Guideline Value 2
	Units		Units		Fraction				(mm)	
Lead	572	40	200		2.9	0.2	No TV	No TV	420	No TV
BaP	7.4	1	5		1.5	0.2	No TV	No TV	225	No TV

Summary		
	Target Guideline Value 1	Target Guideline Value 2
Number of contaminants	2	2
Number of contaminants **with no** thickness calculation	0	2
Breakdown - Number for which no TV specfied	0	2
Breakdown - Number for which no soil specified	0	0
Breakdown - Number for which no cover specified	0	0
Breakdown - Number for which cover > TV	0	0
Number of contaminants **with** thickness calculation	2	0
Breakdown - Number for which no cover required	0	0
Breakdown - Number for which cover required	2	0

Overall thickness of cover required	420	0

APPENDIX L

Cover Soils Checklist

ADVISORY NOTE

SOILS FOR USE IN COVER SYSTEMS

This assessment has recommended a control measure in the form of a defined thickness of clean soil to be used in gardens and soft landscaped areas in order to reduce risks from underlying contamination (a 'cover system'). The thickness presented is what EPS consider sufficient provided the soil forming the cover system is good quality, as it is assumed that over time this soil will become intermixed with the underlying soils and therefore needs to have the necessary 'diluting' effect. The aim being that an acceptable reduction in exposure to contamination is achieved, rather than absolute prevention.

These simple cover systems are designed in general accordance with the BRE 2004 guidance *'Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land'*. In many cases guidance from the relevant Local Planning Authority or NHBC/Approved Inspector may also apply and need to be taken into account. In most cases, to design the cover system EPS have to assume a certain quality of cover soils in advance. In these circumstances, we utilise what we consider to represent 'good quality soil' in that the soil could never be considered 'contaminated' but is also pragmatic and does not represent an unrealistic or unsustainable objective for much of the soils in the UK. In numerical terms, this standard typically equates to around 25% of the adopted screening value in the risk assessment.

For the cover system itself, EPS would usually carry out a verification process of your site to demonstrate the control measure has been implemented as intended to satisfy all interested parties such as planning authorities, the NHBC and the future property owner. To document this process, EPS will prepare a Verification Report. If you wish for EPS to do this, we will need the following points confirmed relating to the soils preferably before they are installed in gardens.

If there are any queries, please contact EPS before purchasing any soil.

EPS Contact Details:

Tel: 01954 710666

Email: info@epsstrategies.co.uk

Pre-Verification Cover System Checklist		Yes?
Soil Source	The soil must not be a waste. Please confirm that the soil is not a waste and has never been deemed as such in the past.	
	Has the source of the soil been provided?	
	Have all the delivery notes confirming the source, volume and type of soil been provided for all that is to be used?	
Soil Quality	The soils are free of invasive plant species such as Japanese Knotweed, and have not been sourced from an affected area?	
	Do the soils look clean and of a high quality? I.e. the soil must not have an odour or contain any visual evidence of contamination, including oils, asbestos, glass, plastic, rubble, metal, ash, tarmac/bitumen?	
	Testing to 'BS 3882:2015 *Specification for topsoil and requirements for use*' is preferable but generally not essential for public health regulation, provided you can confirm the soils comply with the above points, are suitable for their intended purpose and will provide an adequate growing medium?	
	Has the soil been chemically tested prior to it arriving at site? Any soil test results presented to EPS by a third party must be current and clearly relate to the soil used, i.e. the testing must generally be dated within 6 weeks of delivery. The quantity of testing will be dependent on how much confidence is generated in the quality of the material, as well any specific local regulatory requirements. If the soil is clean soil from an established source such as British Sugar, the testing they provide at source may be sufficient alone. For other soils, EPS can advise on the likely testing frequencies but as a rule of thumb, anticipate at least one sample per plot. The testing would usually comprise the following: Heavy Metals, Poly Aromatic Hydrocarbons, Asbestos and Total Petroleum Hydrocarbons at an accredited lab. If adequate testing has not been completed, then EPS will need to test it from stockpiles prior to installation.	
Cover Thickness	Are all excavations ready which will allow the necessary thickness of cover soils to be installed?	
	If yes, can you provide waste transfer documentation for any excavated soils?	

APPENDIX M

Method Statement for Encountering Unexpected Contamination

METHOD STATEMENT

ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

If at any point during intrusive groundworks at a site, evidence of unforeseen contamination is encountered in the form of significant noxious odours, discolouration, or instability within soils or sheen/ discolouration in groundwater, the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered
- In cases where EPS consider the unforeseen contamination likely to pose a significant risk of significant harm to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken
- Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and validation samples obtained and conclusions and recommendations for any further actions considered necessary
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

EPS Contact Details:

Giles Lock	Director	Tel: 0781 253 9656
Will Evans	Director	Tel: 0781 253 9655
Steve Bullock	Director	Tel: 0786 694 9221

Email: info@epsstrategies.co.uk (Automatically forwarded to the above and office-based personnel)

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