

ID	Location	Details	
-	1733m SW	Status: Historical Licence No: 01/152 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT B, BOREHOLE AT SOUTHFLEET, KENT Data Type: Point Name: Thames Water Utilities Ltd Easting: 561161 Northing: 173057	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 07/07/2002 Expiry Date: 30/09/2004 Issue No: 1 Version Start Date: 07/07/2002 Version End Date: -
-	1738m SW	Status: Historical Licence No: 01/156 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 9198000 Max Daily Volume (m³): 24200 Original Application No: - Original Start Date: 01/10/2004 Expiry Date: 31/03/2010 Issue No: 3 Version Start Date: 01/02/2008 Version End Date: -
-	1738m SW	Status: Historical Licence No: SO/040/0037/006 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 6716000 Max Daily Volume (m³): 24200 Original Application No: - Original Start Date: 23/06/2010 Expiry Date: 31/03/2020 Issue No: 1 Version Start Date: 23/06/2010 Version End Date: -
-	1738m SW	Status: Active Licence No: SO/040/0037/006/R01 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 6716000 Max Daily Volume (m³): 24200 Original Application No: NPS/WR/033754 Original Start Date: 01/04/2020 Expiry Date: 31/03/2026 Issue No: 2 Version Start Date: 20/04/2020 Version End Date: -



ID	Location	Details	
-	1762m SW	Status: Historical Licence No: 9/40/01/0088/B/GR Details: Process water Direct Source: Southern Region Groundwater Point: POINT 1, WELL NR. NEW BARN IN SWANSCOMBE, KENT. Data Type: Point Name: Empire Paper Limited Easting: 561130 Northing: 173050	Annual Volume (m ³): - Max Daily Volume (m ³): - Original Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 30/07/1993 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.7 Surface water abstractions

Records within 2000m	1
----------------------	---

Licensed surface water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on [page 123 >](#)

ID	Location	Details	
8	865m NW	Status: Active Licence No: 9/40/01/0522/S Details: Mineral Washing Direct Source: Southern Region Surface Waters Point: POINT A, TIDAL RIVER THAMES AT SWANSCOMBE. Data Type: Point Name: Robert Brett & Sons Ltd Easting: 561870 Northing: 175100	Annual Volume (m ³): 45500 Max Daily Volume (m ³): 375 Original Application No: 169/872 Original Start Date: 06/02/1990 Expiry Date: - Issue No: 101 Version Start Date: 01/01/2002 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

5.8 Potable abstractions

Records within 2000m	4
----------------------	---

Licensed potable water abstractions for sites extracting more than 20 cubic metres of water a day and includes active and historical records. The data may be for a single abstraction point, a stretch of watercourse or a larger area.

Features are displayed on the Abstractions and Source Protection Zones map on [page 123 >](#)



ID	Location	Details	
-	1733m SW	Status: Historical Licence No: 01/152 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT B, BOREHOLE AT SOUTHFLEET, KENT Data Type: Point Name: Thames Water Utilities Ltd Easting: 561161 Northing: 173057	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 07/07/2002 Expiry Date: 30/09/2004 Issue No: 1 Version Start Date: 07/07/2002 Version End Date: -
-	1738m SW	Status: Historical Licence No: 01/156 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 9198000 Max Daily Volume (m³): 24200 Original Application No: - Original Start Date: 01/10/2004 Expiry Date: 31/03/2010 Issue No: 3 Version Start Date: 01/02/2008 Version End Date: -
-	1738m SW	Status: Historical Licence No: SO/040/0037/006 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 6716000 Max Daily Volume (m³): 24200 Original Application No: - Original Start Date: 23/06/2010 Expiry Date: 31/03/2020 Issue No: 1 Version Start Date: 23/06/2010 Version End Date: -
-	1738m SW	Status: Active Licence No: SO/040/0037/006/R01 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: BOREHOLE POINT F, (EPM) SOUTHFLEET (BOREHOLE & TWO AUDITS) Data Type: Point Name: Thames Water Utilities Ltd Easting: 561160 Northing: 173050	Annual Volume (m³): 6716000 Max Daily Volume (m³): 24200 Original Application No: NPS/WR/033754 Original Start Date: 01/04/2020 Expiry Date: 31/03/2026 Issue No: 2 Version Start Date: 20/04/2020 Version End Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.



5.9 Source Protection Zones

Records within 500m

10

Source Protection Zones define the sensitivity of an area around a potable abstraction site to contamination. Features are displayed on the Abstractions and Source Protection Zones map on [page 123 >](#)

ID	Location	Type	Description
1	On site	1	Inner catchment
2	On site	3	Total catchment
3	On site	2	Outer catchment
A	On site	1	Inner catchment
A	On site	3	Total catchment
A	18m NE	3	Total catchment
A	18m NE	3	Total catchment
A	24m NE	3	Total catchment
A	41m NE	3	Total catchment
6	378m NW	3	Total catchment

This data is sourced from the Environment Agency and Natural Resources Wales.

5.10 Source Protection Zones (confined aquifer)

Records within 500m

0

Source Protection Zones in the confined aquifer define the sensitivity around a deep groundwater abstraction to contamination. A confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place.

This data is sourced from the Environment Agency and Natural Resources Wales.



6 Hydrology



- Site Outline
- Search buffers in metres (m)
- Water Network (OS MasterMap)
- Surface water features (wider than 5m)
- Surface water features (narrower than 5m)
- ⋯ WFD River, canal and surface water transfer water bodies
- WFD Lake water bodies
- WFD Transitional and coastal water bodies
- WFD Surface water body catchments boundaries
- WFD Groundwater body boundaries

6.1 Water Network (OS MasterMap)

Records within 250m

0

Detailed water network of Great Britain showing the flow and precise central course of every river, stream, lake and canal.

This data is sourced from the Ordnance Survey.

6.2 Surface water features

Records within 250m

0

Covering rivers, streams and lakes (some overlap with OS MasterMap Water Network data in previous section) but additionally covers smaller features such as ponds. Rivers and streams narrower than 5m are represented as a single line. Lakes, ponds and rivers or streams wider than 5m are represented as polygons.

This data is sourced from the Ordnance Survey.

6.3 WFD Surface water body catchments

Records on site	1
-----------------	---

The Water Framework Directive is an EU-led framework for the protection of inland surface waters, estuaries, coastal waters and groundwater through river basin-level management planning. In terms of surface water, these basins are broken down into smaller units known as management, operational and water body catchments.

Features are displayed on the Hydrology map on [page 136 >](#)

ID	Location	Type	Water body catchment	Water body ID	Operational catchment	Management catchment
A	On site	Coastal Catchment	Not part of a river WB catchment	130	Lower Medway	Medway

This data is sourced from the Environment Agency and Natural Resources Wales.

6.4 WFD Surface water bodies

Records identified	1
--------------------	---

Surface water bodies under the Directive may be rivers, lakes, estuary or coastal. To achieve the purpose of the Directive, environmental objectives have been set and are reported on for each water body. The progress towards delivery of the objectives is then reported on by the relevant competent authorities at the end of each six-year cycle. The river water body directly associated with the catchment listed in the previous section is detailed below, along with any lake, canal, coastal or artificial water body within 250m of the site. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each water body listed.

Features are displayed on the Hydrology map on [page 136 >](#)

ID	Location	Type	Name	Water body ID	Overall rating	Chemical rating	Ecological rating	Year
1	2m N	Transi	THAMES MIDDLE	GB530603911402 !	Moderate	Fail	Moderate	2019

This data is sourced from the Environment Agency and Natural Resources Wales.

6.5 WFD Groundwater bodies

Records on site

1

Groundwater bodies are also covered by the Directive and the same regime of objectives and reporting detailed in the previous section is in place. Click on the water body ID in the table to visit the EA Catchment Explorer to find out more about each groundwater body listed.

Features are displayed on the Hydrology map on [page 136 >](#)

ID	Location	Name	Water body ID	Overall rating	Chemical rating	Quantitative	Year
A	On site	North Kent Medway Chalk	GB40601G500300 !	Poor	Poor	Poor	2019

This data is sourced from the Environment Agency and Natural Resources Wales.



7 River and coastal flooding



- Site Outline
- Search buffers in metres (m)
- River and coastal flooding:
- High
- Medium
- Low
- Very Low
- Historical Flood Events
- Areas Used for Flood Storage
- Areas Benefiting from Flood Defences
- Flood Defences

7.1 Risk of flooding from rivers and the sea

Records within 50m

2

The chance of flooding from rivers and/or the sea in any given year, based on cells of 50m within the Risk of Flooding from Rivers and Sea (RoFRaS)/Flood Risk Assessment Wales (FRAW) models. Each cell is allocated one of four flood risk categories, taking into account flood defences and their condition. The risk categories for RoFRaS for rivers and the sea and FRAW for rivers are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 100 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 100 chance) or High (greater than or equal to 1 in 30 chance). The risk categories for FRAW for the sea are; Very low (less than 1 in 1000 chance in any given year), Low (less than 1 in 200 but greater than or equal to 1 in 1000 chance), Medium (less than 1 in 30 but greater than or equal to 1 in 200 chance) or High (greater than or equal to 1 in 30 chance).

Features are displayed on the River and coastal flooding map on [page 139 >](#)



Distance	Flood risk category
On site	Very Low
0 - 50m	High

This data is sourced from the Environment Agency and Natural Resources Wales.

7.2 Historical Flood Events

Records within 250m	0
---------------------	---

Records of historic flooding from rivers, the sea, groundwater and surface water. Records began in 1946 when predecessor bodies started collecting detailed information about flooding incidents, although limited details may be included on flooding incidents prior to this date. Takes into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding, and includes flood extents that may have been affected by overtopping, breaches or blockages.

This data is sourced from the Environment Agency and Natural Resources Wales.

7.3 Flood Defences

Records within 250m	2
---------------------	---

Records of flood defences owned, managed or inspected by the Environment Agency and Natural Resources Wales. Flood defences can be structures, buildings or parts of buildings. Typically these are earth banks, stone and concrete walls, or sheet-piling that is used to prevent or control the extent of flooding.

Features are displayed on the River and coastal flooding map on [page 139](#) >

ID	Location	Update
2	On site	08/11/2022
A	8m N	08/11/2022

This data is sourced from the Environment Agency and Natural Resources Wales.

7.4 Areas Benefiting from Flood Defences

Records within 250m	1
---------------------	---

Areas that would benefit from the presence of flood defences in a 1 in 100 (1%) chance of flooding each year from rivers or 1 in 200 (0.5%) chance of flooding each year from the sea.

Features are displayed on the River and coastal flooding map on [page 139](#) >

ID	Location	
3	On site	Area benefiting from flood defences

This data is sourced from the Environment Agency and Natural Resources Wales.

7.5 Flood Storage Areas

Records within 250m	0
---------------------	---

Areas that act as a balancing reservoir, storage basin or balancing pond to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel or to delay the timing of a flood peak so that its volume is discharged over a longer period.

This data is sourced from the Environment Agency and Natural Resources Wales.

River and coastal flooding - Flood Zones



- Site Outline
- Search buffers in metres (m)
- Flood zone 2
- Flood zone 3

© Crown copyright and database rights 2023. Ordnance Survey licence 100035207

7.6 Flood Zone 2

Records within 50m

1

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land between Flood Zone 3 (see next section) and the extent of the flooding from rivers or the sea with a 1 in 1000 (0.1%) chance of flooding each year.

Features are displayed on the River and coastal flooding map on [page 139](#) >

Location	Type
On site	Zone 2 - (Fluvial /Tidal Models)

This data is sourced from the Environment Agency and Natural Resources Wales.



7.7 Flood Zone 3

Records within 50m

1

Areas of land at risk of flooding, when the presence of flood defences are ignored. Covering land with a 1 in 100 (1%) or greater chance of flooding each year from rivers or a 1 in 200 (0.5%) or greater chance of flooding each year from the sea.

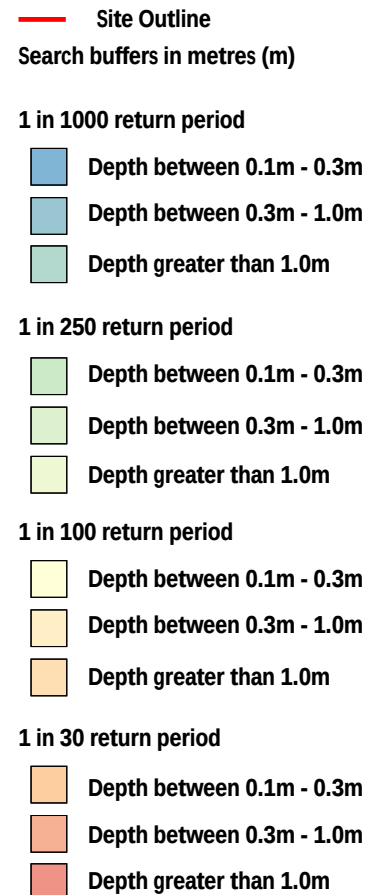
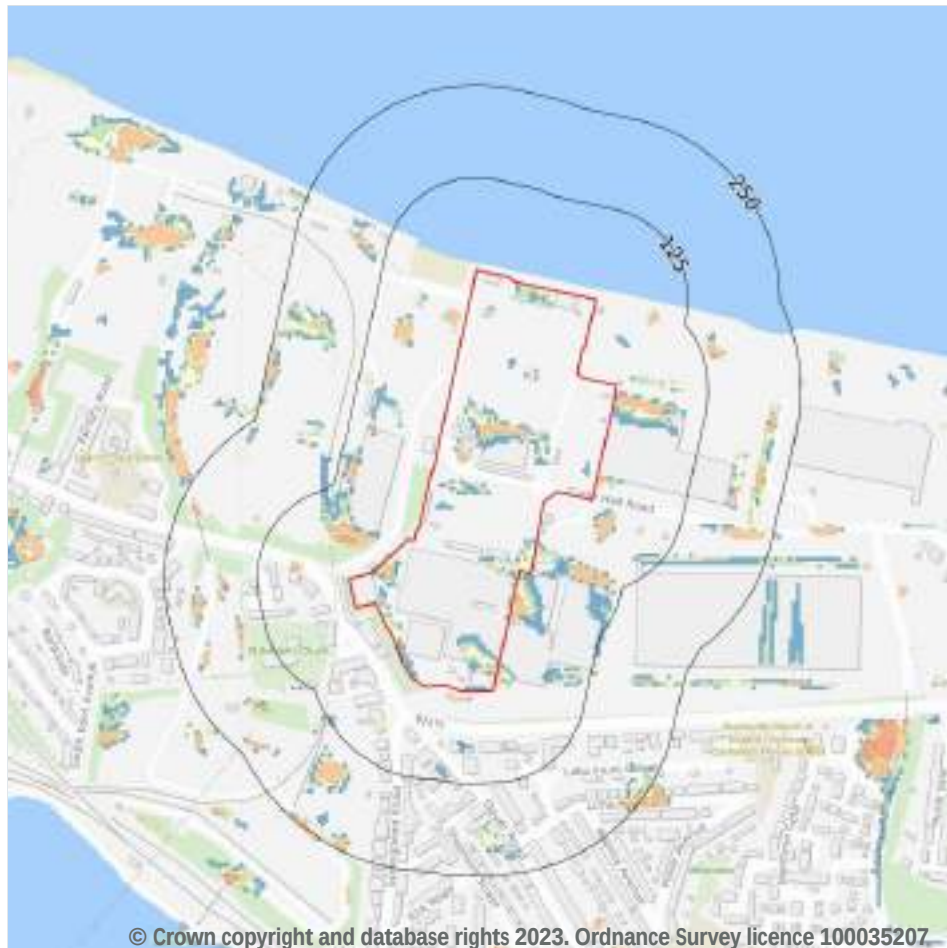
Features are displayed on the River and coastal flooding map on [page 139](#) >

Location	Type
On site	Zone 3 - (Fluvial /Tidal Models)

This data is sourced from the Environment Agency and Natural Resources Wales.



8 Surface water flooding



8.1 Surface water flooding

Highest risk on site

1 in 30 year, 0.1m - 0.3m

Highest risk within 50m

1 in 30 year, 0.3m - 1.0m

Ambiental Risk Analytics surface water (pluvial) FloodMap identifies areas likely to flood as a result of extreme rainfall events, i.e. land naturally vulnerable to surface water ponding or flooding. This data set was produced by simulating 1 in 30 year, 1 in 100 year, 1 in 250 year and 1 in 1,000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though some older ones may flood in a 1 in 5 year rainfall event.

Features are displayed on the Surface water flooding map on [page 144](#) >

The data shown on the map and in the table above shows the highest likelihood of flood events happening at the site. Lower likelihood events may have greater flood depths and hence a greater potential impact on a site.

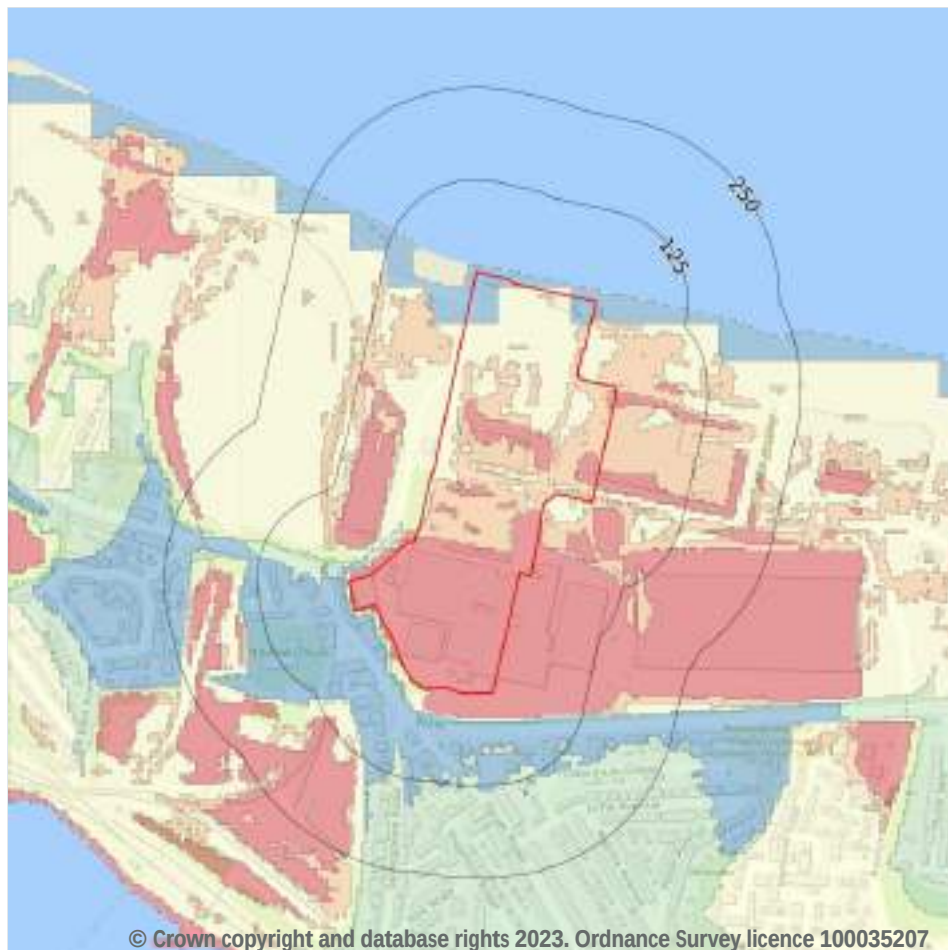
The table below shows the maximum flood depths for a range of return periods for the site.

Return period	Maximum modelled depth
1 in 1000 year	Between 0.3m and 1.0m
1 in 250 year	Between 0.3m and 1.0m
1 in 100 year	Between 0.3m and 1.0m
1 in 30 year	Between 0.1m and 0.3m

This data is sourced from Ambiental Risk Analytics.



9 Groundwater flooding



— Site Outline
Search buffers in metres (m)

- High
- Moderate - High
- Moderate
- Low
- Negligible

9.1 Groundwater flooding

Highest risk on site

High

Highest risk within 50m

High

Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

Features are displayed on the Groundwater flooding map on [page 146](#) >

This data is sourced from Ambiantal Risk Analytics.

10 Environmental designations



- Site Outline
- Search buffers in metres (m)
- Sites of Special Scientific Interest (SSSI)
- Green Belt

10.1 Sites of Special Scientific Interest (SSSI)

Records within 2000m

7

Sites providing statutory protection for the best examples of UK flora, fauna, or geological or physiographical features. Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs were re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and (in Scotland) by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2010.

Features are displayed on the Environmental designations map on [page 147 >](#)

ID	Location	Name	Data source
1	1080m SW	Swanscombe Peninsula	Natural England



ID	Location	Name	Data source
2	1103m W	Swanscombe Peninsula	Natural England
3	1178m SW	Swanscombe Peninsula	Natural England
4	1209m SW	Swanscombe Peninsula	Natural England
5	1442m NW	Swanscombe Peninsula	Natural England
-	1503m W	Swanscombe Peninsula	Natural England
-	1966m W	Swanscombe Peninsula	Natural England

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.2 Conserved wetland sites (Ramsar sites)

Records within 2000m	0
----------------------	---

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. They cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. These sites cover a broad definition of wetland; marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, and even some marine areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.3 Special Areas of Conservation (SAC)

Records within 2000m	0
----------------------	---

Areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.4 Special Protection Areas (SPA)

Records within 2000m	0
----------------------	---

Sites classified by the UK Government under the EC Birds Directive, SPAs are areas of the most important habitat for rare (listed on Annex I to the Directive) and migratory birds within the European Union.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.



10.5 National Nature Reserves (NNR)

Records within 2000m

0

Sites containing examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats, provide special opportunities for scientific study or to provide public recreation compatible with natural heritage interests.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.6 Local Nature Reserves (LNR)

Records within 2000m

0

Sites managed for nature conservation, and to provide opportunities for research and education, or simply enjoying and having contact with nature. They are declared by local authorities under the National Parks and Access to the Countryside Act 1949 after consultation with the relevant statutory nature conservation agency.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.7 Designated Ancient Woodland

Records within 2000m

0

Ancient woodlands are classified as areas which have been wooded continuously since at least 1600 AD. This includes semi-natural woodland and plantations on ancient woodland sites. 'Wooded continuously' does not mean there is or has previously been continuous tree cover across the whole site, and not all trees within the woodland have to be old.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.8 Biosphere Reserves

Records within 2000m

0

Biosphere Reserves are internationally recognised by UNESCO as sites of excellence to balance conservation and socioeconomic development between nature and people. They are recognised under the Man and the Biosphere (MAB) Programme with the aim of promoting sustainable development founded on the work of the local community.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.



10.9 Forest Parks

Records within 2000m

0

These are areas managed by the Forestry Commission designated on the basis of recreational, conservation or scenic interest.

This data is sourced from the Forestry Commission.

10.10 Marine Conservation Zones

Records within 2000m

0

A type of marine nature reserve in UK waters established under the Marine and Coastal Access Act (2009). They are designated with the aim to protect nationally important, rare or threatened habitats and species.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

10.11 Green Belt

Records within 2000m

2

Areas designated to prevent urban sprawl by keeping land permanently open.

Features are displayed on the Environmental designations map on [page 147](#) >

ID	Location	Name	Local Authority name
-	1766m SW	London	Dartford
-	1974m S	London	Gravesham

This data is sourced from the Ministry of Housing, Communities and Local Government.

10.12 Proposed Ramsar sites

Records within 2000m

0

Ramsar sites are areas listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention) 1971. The sites here supplied have a status of 'Proposed' having been identified for potential adoption under the framework.

This data is sourced from Natural England.



10.13 Possible Special Areas of Conservation (pSAC)

Records within 2000m

0

Special Areas of Conservation are areas which have been identified as best representing the range and variety within the European Union of habitats and (non-bird) species listed on Annexes I and II to the Directive. SACs are designated under the EC Habitats Directive. Those sites supplied here are those with a status of 'Possible' having been identified for potential adoption under the framework.

This data is sourced from Natural England and Natural Resources Wales.

10.14 Potential Special Protection Areas (pSPA)

Records within 2000m

0

Special Protection Areas (SPAs) are areas designated (or classified) under the European Union Wild Birds Directive for the protection of nationally and internationally important populations of wild birds. Those sites supplied here are those with a status of 'Potential' having been identified for potential adoption under the framework.

This data is sourced from Natural England.

10.15 Nitrate Sensitive Areas

Records within 2000m

0

Areas where nitrate concentrations in drinking water sources exceeded or was at risk of exceeding the limit of 50 mg/l set by the 1980 EC Drinking Water Directive. Voluntary agricultural measures as a means of reducing the levels of nitrate were introduced by DEFRA as MAFF, with payments being made to farmers who complied. The scheme was started as a pilot in 1990 in ten areas, later implemented within 32 areas. The scheme was closed to further new entrants in 1998, although existing agreements continued for their full term. All Nitrate Sensitive Areas fell within the areas designated as Nitrate Vulnerable Zones (NVZs) in 1996 under the EC Nitrate Directive (91/676/EEC).

This data is sourced from Natural England.

10.16 Nitrate Vulnerable Zones

Records within 2000m

1

Areas at risk from agricultural nitrate pollution designated under the EC Nitrate Directive (91/676/EEC). These are areas of land that drain into waters polluted by nitrates. Farmers operating within these areas have to follow mandatory rules to tackle nitrate loss from agriculture.

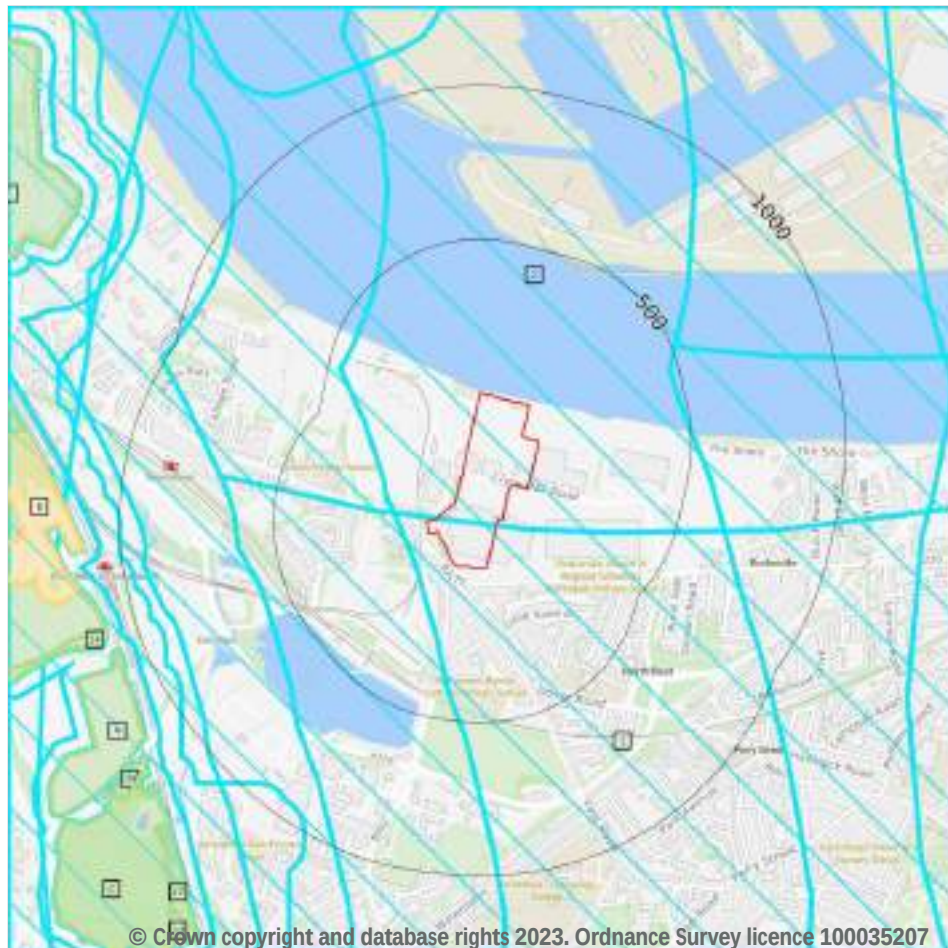
Location	Name	Type	NVZ ID	Status
214m SW	North Kent	Groundwater	65	Existing



This data is sourced from Natural England and Natural Resources Wales.



SSSI Impact Zones and Units



- Site Outline
- Search buffers in metres (m)
- SSSI Impact Risk Zones
- SSSI Units
- Not recorded
- Favourable
- Unfavourable - Recovering
- Unfavourable - No change
- Unfavourable - Declining
- Partially destroyed
- Destroyed

10.17 SSSI Impact Risk Zones

Records on site

2

Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

Features are displayed on the SSSI Impact Zones and Units map on [page 153](#) >

ID	Location	Type of developments requiring consultation
1	On site	Infrastructure - Pipelines, pylons and overhead cables. any transport proposal including road, rail and by water (excluding routine maintenance). airports, helipads and other aviation proposals. Wind and Solar - Solar schemes with footprint > 0.5ha, all wind turbines. Minerals, Oil and Gas - Planning applications for quarries, including: new proposals, review of minerals permissions (romp), extensions, variations to conditions etc. oil & gas exploration/extraction. Rural non-residential - Large non residential developments outside existing settlements/urban areas where footprint exceeds 1ha. Residential - Residential development of 50 units or more. Rural residential - Any residential development of 50 or more houses outside existing settlements/urban areas. Air pollution - Any industrial/agricultural development that could cause air pollution (incl: industrial processes, livestock & poultry units with floorspace > 500m", slurry lagoons & digestate stores > 200m", manure stores > 250t). Combustion - General combustion processes >20mw energy input. incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion. Waste - Landfill. incl: inert landfill, non-hazardous landfill, hazardous landfill. Composting - Any composting proposal with more than 75000 tonnes maximum annual operational throughput. incl: open windrow composting, in-vessel composting, anaerobic digestion, other waste management. Discharges - Any discharge of water or liquid waste of more than 20m³/day to ground (ie to seep away) or to surface water, such as a beck or stream. Water supply - Large infrastructure such as warehousing / industry where total net additional gross internal floorspace following development is 1,000m² or more. Notes: Strategic solutions for recreational impacts are in place. please contact your local planning authority as they have the information to advise on specific requirements.



ID	Location	Type of developments requiring consultation
2	On site	All applications - All planning applications (except householder) outside or extending outside existing settlements/urban areas affecting greenspace, farmland, semi natural habitats or landscape features such as trees, hedges, streams, rural buildings/structures. Infrastructure - Pipelines, pylons and overhead cables. any transport proposal including road, rail and by water (excluding routine maintenance). airports, helipads and other aviation proposals. Wind and Solar - Solar schemes with footprint > 0.5ha, all wind turbines. Minerals, Oil and Gas - Planning applications for quarries, including: new proposals, review of minerals permissions (romp), extensions, variations to conditions etc. oil & gas exploration/extraction. Rural non-residential - Large non residential developments outside existing settlements/urban areas where footprint exceeds 1ha. Residential - Residential development of 50 units or more. Rural residential - Any residential development of 50 or more houses outside existing settlements/urban areas. Air pollution - Any industrial/agricultural development that could cause air pollution (incl: industrial processes, livestock & poultry units with floorspace > 500m", slurry lagoons & digestate stores > 200m", manure stores > 250t). Combustion - General combustion processes >20mw energy input. incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion. Waste - Landfill. incl: inert landfill, non-hazardous landfill, hazardous landfill. Composting - Any composting proposal with more than 75000 tonnes maximum annual operational throughput. incl: open windrow composting, in-vessel composting, anaerobic digestion, other waste management. Discharges - Any discharge of water or liquid waste of more than 20m³/day to ground (ie to seep away) or to surface water, such as a beck or stream. Water supply - Large infrastructure such as warehousing / industry where total net additional gross internal floorspace following development is 1,000m² or more. Notes: Strategic solutions for recreational impacts are in place. please contact your local planning authority as they have the information to advise on specific requirements.

This data is sourced from Natural England.

10.18 SSSI Units

Records within 2000m

16

Divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment, however, the size of units varies greatly depending on the types of management and the conservation interest.

Features are displayed on the SSSI Impact Zones and Units map on [page 153](#) >

ID: A
 Location: 1080m SW
 SSSI name: Swanscombe Peninsula
 Unit name: Station Quarters
 Broad habitat:
 Condition: Favourable



Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: 13
Location: 1103m W
SSSI name: Swanscombe Peninsula
Unit name: Northfleet Landfill, West
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021
Vascular Plant Species: Vicia bithynica, Bithynian Vetch	Favourable	11/03/2021

ID: 14
Location: 1103m W
SSSI name: Swanscombe Peninsula
Unit name: Station Quarters
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021

Feature name	Feature condition	Date of assessment
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: B
Location: 1121m W
SSSI name: Swanscombe Peninsula
Unit name: Baker's Hole
Broad habitat:
Condition: Unfavourable - No change
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
FM - Quaternary of the Thames	Unfavourable - No change	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021

ID: 19
Location: 1178m SW
SSSI name: Swanscombe Peninsula
Unit name: Ebbsfleet Valley, West
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: C
Location: 1209m SW
SSSI name: Swanscombe Peninsula
Unit name: Ebbsfleet Valley, West
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: 22
Location: 1254m SW
SSSI name: Swanscombe Peninsula
Unit name: Ebbsfleet Valley, East
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021

ID: 30
Location: 1344m W
SSSI name: Swanscombe Peninsula
Unit name: Bamber Pit, South
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021

ID: -
Location: 1429m W
SSSI name: Swanscombe Peninsula
Unit name: Bamber Pit, North
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021

ID: F
Location: 1442m NW
SSSI name: Swanscombe Peninsula
Unit name: Botany Marsh East
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021

Feature name	Feature condition	Date of assessment
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Invert. assemblage M311 saltmarsh and transitional brackish marsh	Favourable	11/03/2021
Invert. assemblage W211 open water on disturbed sediments	Favourable	11/03/2021
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: 33
Location: 1447m SW
SSSI name: Swanscombe Peninsula
Unit name: Spring Head
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021

ID: -
Location: 1503m W
SSSI name: Swanscombe Peninsula
Unit name: Sports Field East Quarry
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021

ID: -
Location: 1743m NW
SSSI name: Swanscombe Peninsula
Unit name: Botany Marsh West, South
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Invert. assemblage M311 saltmarsh and transitional brackish marsh	Favourable	11/03/2021
Invert. assemblage W211 open water on disturbed sediments	Favourable	11/03/2021

ID: -
Location: 1818m NW
SSSI name: Swanscombe Peninsula
Unit name: Botany Marsh West, North
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Invert. assemblage M311 saltmarsh and transitional brackish marsh	Favourable	11/03/2021
Invert. assemblage W211 open water on disturbed sediments	Favourable	11/03/2021
Vascular Plant Species: Bupleurum tenuissimum, Slender Hare's-ear	Favourable	11/03/2021
Vascular Plant Species: Carex divisa, Divided Sedge	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021

ID: -
Location: 1952m NW
SSSI name: Swanscombe Peninsula
Unit name: Broadness
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Mixed: Lowland open waters and their margins, Lowland fen and Lowland damp grassland	Favourable	11/03/2021
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Invert. assemblage M311 saltmarsh and transitional brackish marsh	Favourable	11/03/2021
Vascular Plant Species: Bupleurum tenuissimum, Slender Hare's-ear	Favourable	11/03/2021
Vascular Plant Species: Lathyrus aphaca, Yellow Vetchling	Favourable	11/03/2021
Vascular Plant Species: Vicia bithynica, Bithynian Vetch	Favourable	11/03/2021

ID: -
Location: 1966m W
SSSI name: Swanscombe Peninsula
Unit name: Craylands Pit
Broad habitat:
Condition: Favourable
Reportable features:

Feature name	Feature condition	Date of assessment
Assemblages of breeding birds - Scrub	Favourable	11/03/2021
Invert. assemblage F111 bare sand & chalk	Favourable	11/03/2021
Invert. assemblage F112 open short sward	Favourable	11/03/2021
Invert. assemblage M311 saltmarsh and transitional brackish marsh	Favourable	11/03/2021

This data is sourced from Natural England and Natural Resources Wales.



11 Visual and cultural designations



- Site Outline
- Search buffers in metres (m)
- Listed buildings
- Conservation areas
- Conservation areas - no data
- National Parks
- Areas of Outstanding Natural Beauty
- Registered parks and gardens
- Scheduled Monuments
- World Heritage Sites

11.1 World Heritage Sites

Records within 250m

0

Sites designated for their globally important cultural or natural interest requiring appropriate management and protection measures. World Heritage Sites are designated to meet the UK's commitments under the World Heritage Convention.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.2 Area of Outstanding Natural Beauty

Records within 250m

0

Areas of Outstanding Natural Beauty (AONB) are conservation areas, chosen because they represent 18% of the finest countryside. Each AONB has been designated for special attention because of the quality of their flora, fauna, historical and cultural associations, and/or scenic views. The National Parks and Access to the Countryside Act of 1949 created AONBs and the Countryside and Rights of Way Act, 2000 added further regulation and protection. There are likely to be restrictions to some developments within these areas.

This data is sourced from Natural England, Natural Resources Wales and Scottish Natural Heritage.

11.3 National Parks

Records within 250m

0

In England and Wales, the purpose of National Parks is to conserve and enhance landscapes within the countryside whilst promoting public enjoyment of them and having regard for the social and economic well-being of those living within them. In Scotland National Parks have the additional purpose of promoting the sustainable use of the natural resources of the area and the sustainable social and economic development of its communities. The National Parks and Access to the Countryside Act 1949 established the National Park designation in England and Wales, and The National Parks (Scotland) Act 2000 in Scotland.

This data is sourced from Natural England, Natural Resources Wales and the Scottish Government.

11.4 Listed Buildings

Records within 250m

11

Buildings listed for their special architectural or historical interest. Building control in the form of 'listed building consent' is required in order to make any changes to that building which might affect its special interest. Listed buildings are graded to indicate their relative importance, however building controls apply to all buildings equally, irrespective of their grade, and apply to the interior and exterior of the building in its entirety, together with any curtilage structures.

Features are displayed on the Visual and cultural designations map on [page 163 >](#)

ID	Location	Name	Grade	Reference Number	Listed date
1	12m SW	31, The Hill, Northfleet, Gravesham, Kent, DA11	II	1081096	26/07/1983
2	26m SW	K6 Telephone Kiosk, Northfleet, Gravesham, Kent, DA11	II	1083902	31/03/1988
3	40m SW	The Coach and Horses Public House, Northfleet, Gravesham, Kent, DA11	II	1081095	26/07/1983
B	43m SW	Garden Wall and Gate Piers To Nos 1 and 2, Northfleet, Gravesham, Kent, DA11	II	1081090	26/07/1983
A	52m SW	7, The Hill, Northfleet, Gravesham, Kent, DA11	II	1367390	26/07/1983



ID	Location	Name	Grade	Reference Number	Listed date
B	56m SW	1 and 2, Granby Place, Northfleet, Gravesham, Kent, DA11	II	1367458	26/07/1983
4	64m SW	Church of Our Lady of The Assumption, Northfleet, Gravesham, Kent, DA11	II*	1081094	26/07/1983
5	68m S	Ye Olde Leather Bottel, Northfleet, Gravesham, Kent, DA11	II	1350210	26/07/1983
6	72m SW	Northfleet War Memorial, Northfleet, Gravesham, Kent, DA11	II	1430440	23/10/2015
7	95m N	Northfleet Lower Lighthouse, Northfleet, Gravesham, Kent, DA11	II	1392254	01/11/2006
8	130m SW	Parish Church of St Botolph, Northfleet, Gravesham, Kent, DA11	I	1054093	04/07/1952

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.5 Conservation Areas

Records within 250m

1

Local planning authorities are obliged to designate as conservation areas any parts of their own area that are of special architectural or historic interest, the character and appearance of which it is desirable to preserve or enhance. Designation of a conservation area gives broader protection than the listing of individual buildings. All the features within the area, listed or otherwise, are recognised as part of its character. Conservation area designation is the means of recognising the importance of all factors and of ensuring that planning decisions address the quality of the landscape in its broadest sense.

Features are displayed on the Visual and cultural designations map on [page 163](#) >

ID	Location	Name	District	Date of designation
A	7m SW	The Hill, Northfleet	Gravesham	01/02/1990

This data is sourced from Historic England, Cadw and Historic Environment Scotland.

11.6 Scheduled Ancient Monuments

Records within 250m

0

A scheduled monument is an historic building or site that is included in the Schedule of Monuments kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. The Schedule of Monuments has c.20,000 entries and includes sites such as Roman remains, burial mounds, castles, bridges, earthworks, the remains of deserted villages and industrial sites. Monuments are not graded, but all are, by definition, considered to be of national importance.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.



11.7 Registered Parks and Gardens

Records within 250m

0

Parks and gardens assessed to be of particular interest and of special historic interest. The emphasis being on 'designed' landscapes, rather than on planting or botanical importance. Registration is a 'material consideration' in the planning process, meaning that planning authorities must consider the impact of any proposed development on the special character of the landscape.

This data is sourced from Historic England, Cadw and Historic Environment Scotland.



12 Agricultural designations



- Site Outline
- Search buffers in metres (m)
- Grade 1 - excellent quality
- Grade 2 - very good quality
- Grade 3 - good to moderate quality
- Grade 3a - good quality
- Grade 3b - moderate quality
- Grade 4 - poor quality
- Grade 5 - very poor quality
- Non-agricultural land
- Urban land
- Exclusion land
- Tree felling licences
- Open Access land

12.1 Agricultural Land Classification

Records within 250m

1

Classification of the quality of agricultural land taking into consideration multiple factors including climate, physical geography and soil properties. It should be noted that the categories for the grading of agricultural land are not consistent across England, Wales and Scotland.

Features are displayed on the Agricultural designations map on [page 167](#) >

ID	Location	Classification	Description
1	On site	Urban	-

This data is sourced from Natural England.



12.2 Open Access Land

Records within 250m

0

The Countryside and Rights of Way Act 2000 (CROW Act) gives a public right of access to land without having to use paths. Access land includes mountains, moors, heaths and downs that are privately owned. It also includes common land registered with the local council and some land around the England Coast Path. Generally permitted activities on access land are walking, running, watching wildlife and climbing.

This data is sourced from Natural England and Natural Resources Wales.

12.3 Tree Felling Licences

Records within 250m

0

Felling Licence Application (FLA) areas approved by Forestry Commission England. Anyone wishing to fell trees must ensure that a licence or permission under a grant scheme has been issued by the Forestry Commission before any felling is carried out or that one of the exceptions apply.

This data is sourced from the Forestry Commission.

12.4 Environmental Stewardship Schemes

Records within 250m

0

Environmental Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. The schemes identified may be historical schemes that have now expired, or may still be active.

This data is sourced from Natural England.

12.5 Countryside Stewardship Schemes

Records within 250m

0

Countryside Stewardship covers a range of schemes that provide financial incentives to farmers, foresters and land managers to look after and improve the environment. Main objectives are to improve the farmed environment for wildlife and to reduce diffuse water pollution.

This data is sourced from Natural England.

13 Habitat designations



- Site Outline
- Search buffers in metres (m)
- Priority Habitat Inventory
- Open Mosaic Habitat
- Limestone Pavement Orders
- Habitat Networks
- Primary Habitat
- Restorable Habitat
- Associated Habitats
- Habitat Restoration-Creation
- Network Enhancement Zone 1
- Network Enhancement Zone 2

13.1 Priority Habitat Inventory

Records within 250m

9

Habitats of principal importance as named under Natural Environment and Rural Communities Act (2006) Section 41.

Features are displayed on the Habitat designations map on [page 169](#) >

ID	Location	Main Habitat	Other habitats
1	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
2	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
3	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
4	On site	Deciduous woodland	Main habitat: DWOOD (INV > 50%)



ID	Location	Main Habitat	Other habitats
5	14m SW	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
6	30m S	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
9	183m W	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
10	184m W	Deciduous woodland	Main habitat: DWOOD (INV > 50%)
11	193m SE	Deciduous woodland	Main habitat: DWOOD (INV > 50%)

This data is sourced from Natural England.

13.2 Habitat Networks

Records within 250m	1
---------------------	---

Habitat networks for 18 priority habitat networks (based primarily, but not exclusively, on the priority habitat inventory) and areas suitable for the expansion of networks through restoration and habitat creation.

Features are displayed on the Habitat designations map on [page 169 >](#)

ID	Location	Type	Habitat
12	219m N	Network Enhancement Zone 2	Not specified

This data is sourced from Natural England.

13.3 Open Mosaic Habitat

Records within 250m	2
---------------------	---

Sites verified as Open Mosaic Habitat. Mosaic habitats are brownfield sites that are identified under the UK Biodiversity Action Plan as a priority habitat due to the habitat variation within a single site, supporting an array of invertebrates.

Features are displayed on the Habitat designations map on [page 169 >](#)

ID	Location	Site reference	Identification confidence	Primary source	Secondary source	Tertiary source
7	61m E	Rosherville (former works)	High	BugLife All Of A Buzz Data	UK Perspectives Aerial Photography	-



ID	Location	Site reference	Identification confidence	Primary source	Secondary source	Tertiary source
8	82m SW	Northfleet (disused pits); BRITPITS ref: 131039	High	BugLife All Of A Buzz Data	British Geological Survey BRITPITS database	UK Perspectives Aerial Photography

This data is sourced from Natural England.

13.4 Limestone Pavement Orders

Records within 250m	0
---------------------	---

Limestone pavements are outcrops of limestone where the surface has been worn away by natural means over millennia. These rocks have the appearance of paving blocks, hence their name. Not only do they have geological interest, they also provide valuable habitats for wildlife. These habitats are threatened due to their removal for use in gardens and water features. Many limestone pavements have been designated as SSSIs which affords them some protection. In addition, Section 34 of the Wildlife and Countryside Act 1981 gave them additional protection via the creation of Limestone Pavement Orders, which made it a criminal offence to remove any part of the outcrop. The associated Limestone Pavement Priority Habitat is part of the UK Biodiversity Action Plan priority habitat in England.

This data is sourced from Natural England.



14 Geology 1:10,000 scale - Availability



- Site Outline**
- Search buffers in metres (m)**
- Full coverage
 - Partial coverage
 - No coverage

14.1 10k Availability

Records within 500m

2

An indication on the coverage of 1:10,000 scale geology data for the site, the most detailed dataset provided by the British Geological Survey. Either 'Full', 'Partial' or 'No coverage' for each geological theme.

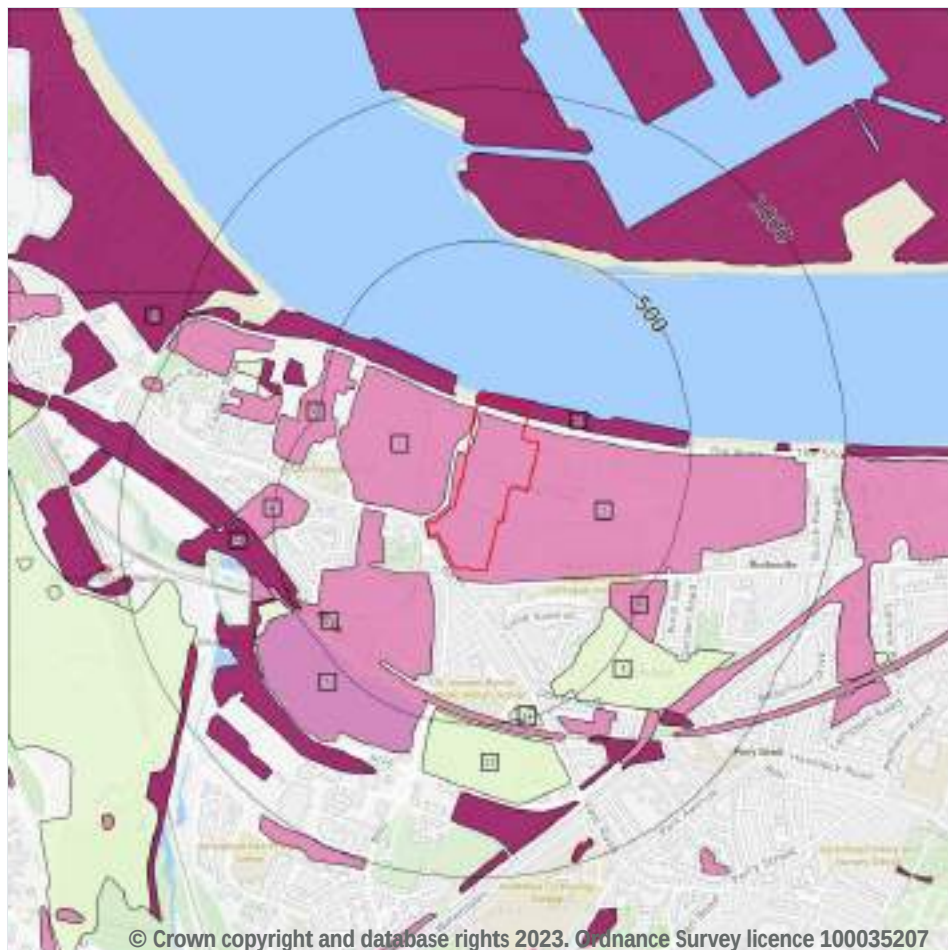
Features are displayed on the Geology 1:10,000 scale - Availability map on [page 172](#) >

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	TQ67SW
2	330m N	Full	Full	Full	No coverage	TQ67NW

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Artificial and made ground



- Site Outline**
- Search buffers in metres (m)**
- Reclaimed ground
 - Made ground
 - Worked ground
 - Infilled ground
 - Disturbed ground
 - Landscaped ground

14.2 Artificial and made ground (10k)

Records within 500m

13

Details of made, worked, infilled, disturbed and landscaped ground at 1:10,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:10,000 scale - Artificial and made ground map on [page 173 >](#)

ID	Location	LEX Code	Description	Rock description
1	On site	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	On site	WGR-VOID	Worked Ground (Undivided)	Void
3	2m N	WGR-VOID	Worked Ground (Undivided)	Void
4	80m N	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit

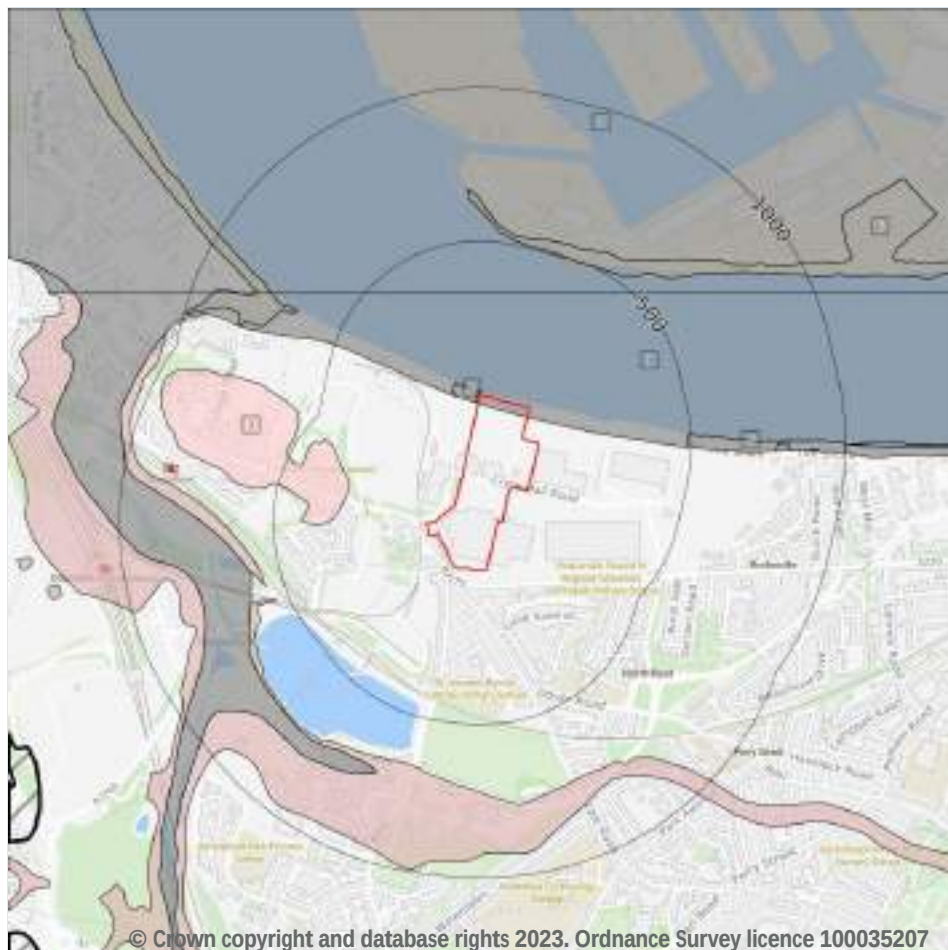


ID	Location	LEX Code	Description	Rock description
5	85m SW	WGR-VOID	Worked Ground (Undivided)	Void
6	390m W	WGR-VOID	Worked Ground (Undivided)	Void
7	392m SE	WMGR-ARTDP	Infilled Ground	Artificial Deposit
8	402m NW	WGR-VOID	Worked Ground (Undivided)	Void
9	404m SE	WGR-VOID	Worked Ground (Undivided)	Void
10	419m SW	WGR-VOID	Worked Ground (Undivided)	Void
11	460m S	WMGR-ARTDP	Infilled Ground	Artificial Deposit
12	462m S	WMGR-ARTDP	Infilled Ground	Artificial Deposit
13	465m SW	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (10k)

Superficial geology (10k)
Please see table for more details.

14.3 Superficial geology (10k)

Records within 500m

6

Superficial geological deposits at 1:10,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:10,000 scale - Superficial map on [page 175](#) >

ID	Location	LEX Code	Description	Rock description
1	On site	ALV-Z	Alluvium - Silt (unlithified Deposits Coding Scheme)	Silt
2	3m N	TRD-Z	Tidal River Or Creek Deposits - Silt	Silt
3	277m W	BHT-XSV	Boyn Hill Gravel Member - Sand And Gravel	Sand And Gravel
4	330m N	ALV-Z	Alluvium - Silt (unlithified Deposits Coding Scheme)	Silt



ID	Location	LEX Code	Description	Rock description
5	483m E	TRD-Z	Tidal River Or Creek Deposits - Silt	Silt
6	498m NE	TRD-Z	Tidal River Or Creek Deposits - Silt	Silt

This data is sourced from the British Geological Survey.

14.4 Landslip (10k)

Records within 500m

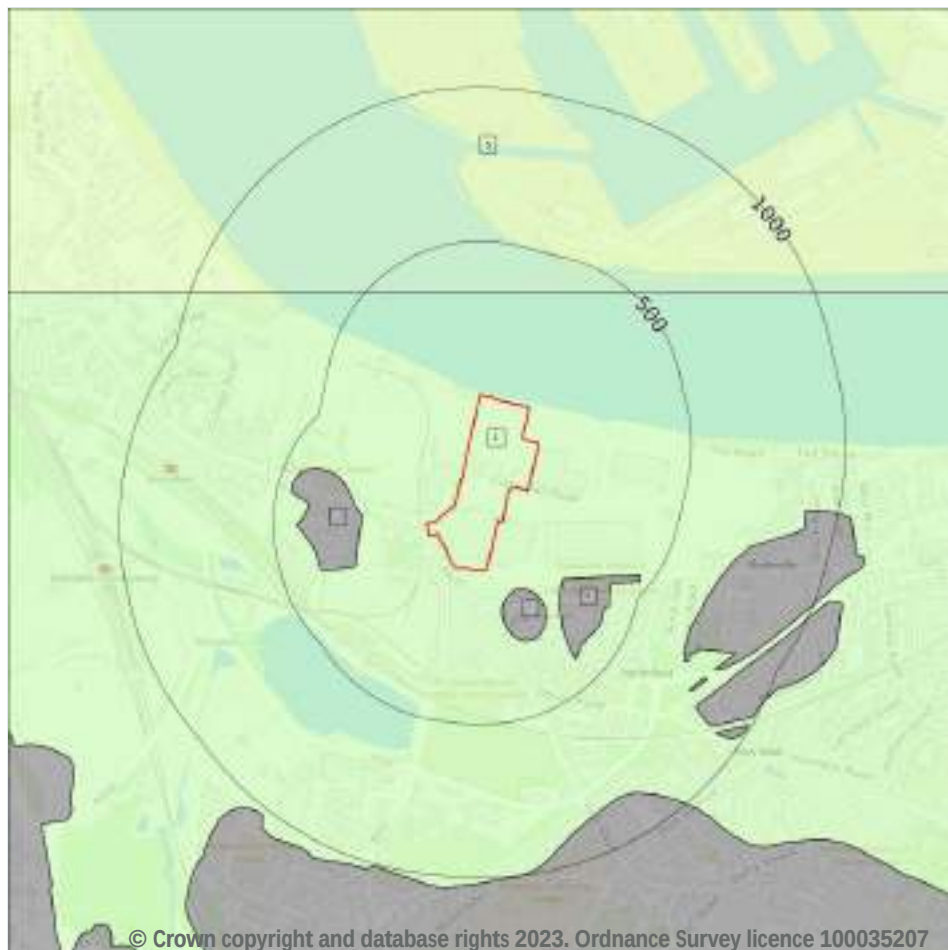
0

Mass movement deposits on BGS geological maps at 1:10,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.



Geology 1:10,000 scale - Bedrock



Site Outline

Search buffers in metres (m)

Bedrock faults and other linear features (10k)

Bedrock geology (10k)
Please see table for more details.

14.5 Bedrock geology (10k)

Records within 500m

5

Bedrock geology at 1:10,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:10,000 scale - Bedrock map on [page 177](#) >

ID	Location	LEX Code	Description	Rock age
1	On site	SECK-CHLK	Seafood Chalk Formation - Chalk	Santonian Age - Coniacian Age
2	108m S	TAB-SANDU	Thanet Sand Formation - Sand	Thanetian Age
3	213m W	TAB-SANDU	Thanet Sand Formation - Sand	Thanetian Age
4	248m SE	TAB-SANDU	Thanet Sand Formation - Sand	Thanetian Age

ID	Location	LEX Code	Description	Rock age
5	330m N	CK-CHLK	Chalk Group - Chalk	Maastrichtian Age - Cenomanian Age

This data is sourced from the British Geological Survey.

14.6 Bedrock faults and other linear features (10k)

Records within 500m	0
---------------------	---

Linear features at the ground or bedrock surface at 1:10,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.



15 Geology 1:50,000 scale - Availability



- Site Outline
- Search buffers in metres (m)
- ☐ Geological map tile

15.1 50k Availability

Records within 500m

1

An indication on the coverage of 1:50,000 scale geology data for the site. Either 'Full' or 'No coverage' for each geological theme.

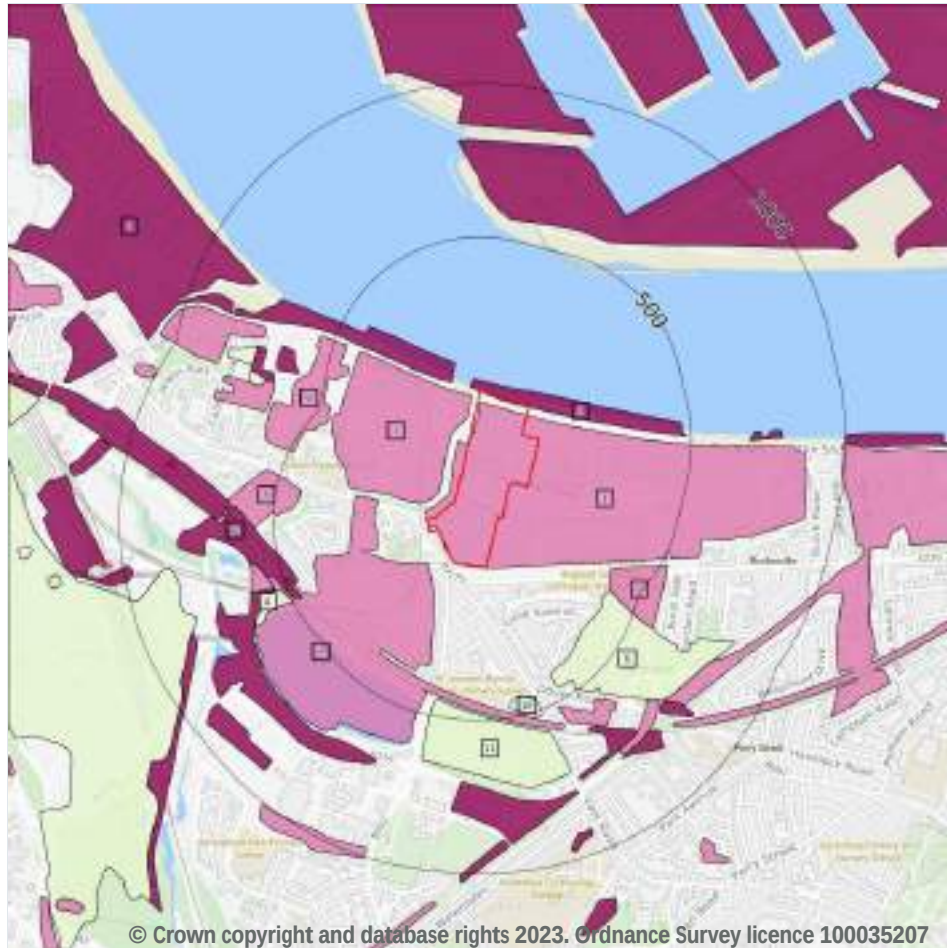
Features are displayed on the Geology 1:50,000 scale - Availability map on [page 179](#) >

ID	Location	Artificial	Superficial	Bedrock	Mass movement	Sheet No.
1	On site	Full	Full	Full	Full	EW271_dartford_v4

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Artificial and made ground



- Site Outline**
- Search buffers in metres (m)**
- Made ground
 - Worked ground
 - Infilled ground
 - Disturbed ground
 - Landscaped ground

© Crown copyright and database rights 2023. Ordnance Survey licence 100035207

15.2 Artificial and made ground (50k)

Records within 500m

13

Details of made, worked, infilled, disturbed and landscaped ground at 1:50,000 scale. Artificial ground can be associated with potentially contaminated material, unpredictable engineering conditions and instability.

Features are displayed on the Geology 1:50,000 scale - Artificial and made ground map on [page 180](#) >

ID	Location	LEX Code	Description	Rock description
1	On site	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
2	On site	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
3	20m N	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
4	75m SW	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID



ID	Location	LEX Code	Description	Rock description
5	94m N	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
6	371m SE	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
7	381m SE	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
8	419m W	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
9	432m NW	WGR-VOID	WORKED GROUND (UNDIVIDED)	VOID
10	440m S	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
11	441m S	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT
12	457m SW	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
A	498m SW	WMGR-ARTDP	INFILLED GROUND	ARTIFICIAL DEPOSIT

This data is sourced from the British Geological Survey.

15.3 Artificial ground permeability (50k)

Records within 50m	1
--------------------	---

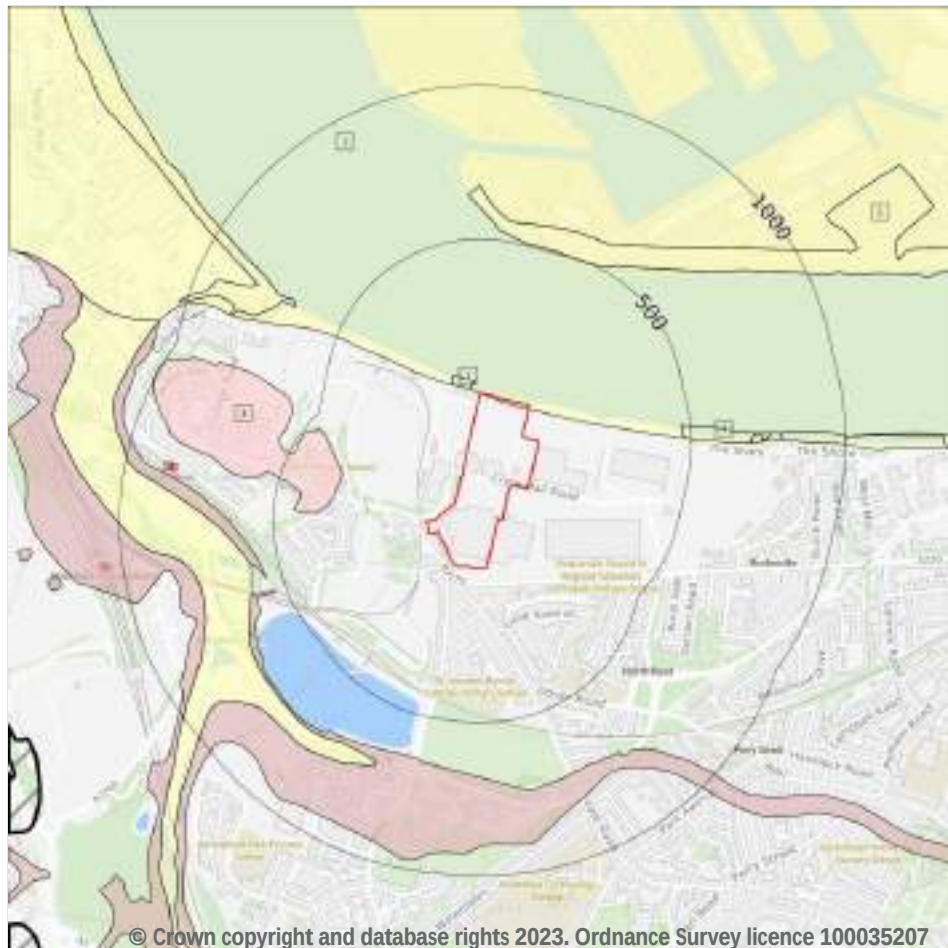
A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any artificial deposits (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Mixed	Very High	Low

This data is sourced from the British Geological Survey.



Geology 1:50,000 scale - Superficial



Site Outline

Search buffers in metres (m)

Landslip (50k)

Superficial geology (50k)
Please see table for more details.

15.4 Superficial geology (50k)

Records within 500m

5

Superficial geological deposits at 1:50,000 scale. Also known as 'drift', these are the youngest geological deposits, formed during the Quaternary. They rest on older deposits or rocks referred to as bedrock.

Features are displayed on the Geology 1:50,000 scale - Superficial map on [page 182](#) >

ID	Location	LEX Code	Description	Rock description
1	On site	ALV-XCZSP	ALLUVIUM	CLAY, SILT, SAND AND PEAT
2	34m N	TRD-XCZ	TIDAL RIVER OR CREEK DEPOSITS	CLAY AND SILT
3	310m W	BHT-XSV	BOYN HILL GRAVEL MEMBER	SAND AND GRAVEL
4	467m E	TRD-XCZ	TIDAL RIVER OR CREEK DEPOSITS	CLAY AND SILT



ID	Location	LEX Code	Description	Rock description
5	498m NE	TRD-XCZ	TIDAL RIVER OR CREEK DEPOSITS	CLAY AND SILT

This data is sourced from the British Geological Survey.

15.5 Superficial permeability (50k)

Records within 50m	2
--------------------	---

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Intergranular	Moderate	Very Low
34m N	Intergranular	Low	Very Low

This data is sourced from the British Geological Survey.

15.6 Landslip (50k)

Records within 500m	0
---------------------	---

Mass movement deposits on BGS geological maps at 1:50,000 scale. Primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground.

This data is sourced from the British Geological Survey.

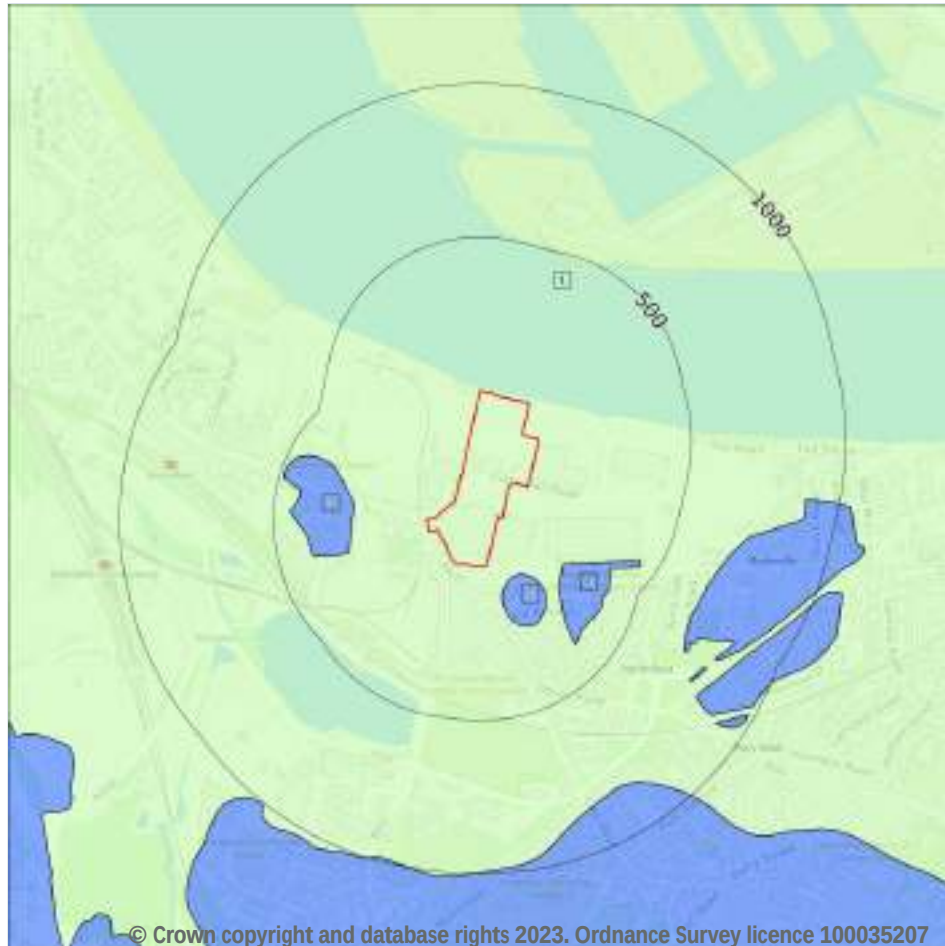
15.7 Landslip permeability (50k)

Records within 50m	0
--------------------	---

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any landslip deposits (the zone between the land surface and the water table).

This data is sourced from the British Geological Survey.

Geology 1:50,000 scale - Bedrock



— Site Outline

Search buffers in metres (m)

.... Bedrock faults and other linear features (50k)

Bedrock geology (50k)
Please see table for more details.

15.8 Bedrock geology (50k)

Records within 500m

4

Bedrock geology at 1:50,000 scale. The main mass of rocks forming the Earth and present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

Features are displayed on the Geology 1:50,000 scale - Bedrock map on [page 184](#) >

ID	Location	LEX Code	Description	Rock age
1	On site	LSNCK-CHLK	LEWES NODULAR CHALK FORMATION, SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION (UNDIFFERENTIATED) - CHALK	TURONIAN
2	85m S	TAB-S	THANET FORMATION - SAND	THANETIAN
3	240m W	TAB-S	THANET FORMATION - SAND	THANETIAN

ID	Location	LEX Code	Description	Rock age
4	241m SE	TAB-S	THANET FORMATION - SAND	THANETIAN

This data is sourced from the British Geological Survey.

15.9 Bedrock permeability (50k)

Records within 50m	1
--------------------	---

A qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of bedrock (the zone between the land surface and the water table).

Location	Flow type	Maximum permeability	Minimum permeability
On site	Fracture	Very High	Very High

This data is sourced from the British Geological Survey.

15.10 Bedrock faults and other linear features (50k)

Records within 500m	0
---------------------	---

Linear features at the ground or bedrock surface at 1:50,000 scale of six main types; rock, fault, fold axis, mineral vein, alteration area or landform. Features are either observed or inferred, and relate primarily to bedrock.

This data is sourced from the British Geological Survey.



16 Boreholes



— Site Outline
Search buffers in metres (m)

- Confidential
- 0 - 10m
- 10 - 30m
- 30m+
- Unknown

16.1 BGS Boreholes

Records within 250m

37

The Single Onshore Boreholes Index (SOBI); an index of over one million records of boreholes, shafts and wells from all forms of drilling and site investigation work held by the British Geological Survey. Covering onshore and nearshore boreholes dating back to at least 1790 and ranging from one to several thousand metres deep.

Features are displayed on the Boreholes map on [page 186](#) >

ID	Location	Grid reference	Name	Length	Confidential	Web link
A	On site	562800 174500	NORTHFLEET OLD DOCKYARD 2	60.96	N	838297 !
A	On site	562800 174500	NORTHFLEET OLD DOCKYARD 1	91.44	N	838296 !
A	On site	562800 174500	NORTHFLEET OLD DOCKYARD 4	45.72	N	838299 !



ID	Location	Grid reference	Name	Length	Confidential	Web link
A	On site	562800 174500	NORTHFLEET OLD DOCKYARD 3	78.18	N	838298 !
A	5m NE	562800 174520	CRETE HALL RD NORTHFLEET BH11	10.0	N	838738 !
A	7m NE	562810 174520	CRETE HALL RD NORTHFLEET BH10	3.0	N	838737 !
1	38m NE	562820 174550	CRETE HALL RD NORTHFLEET BH9	10.0	N	838736 !
2	42m SW	562450 174170	NORTHFLEET WORKS T7	28.65	N	838662 !
3	48m SW	562410 174280	NORTHFLEET WORKS T5	26.52	N	838660 !
B	64m NE	562840 174570	CRETE HALL RD NORTHFLEET BH8	20.0	N	838735 !
4	67m W	562470 174340	NORTHFLEET WORKS 25	18.59	N	838655 !
5	69m NE	562880 174500	CRETE HALL RD NORTHFLEET BH3	20.0	N	838730 !
B	76m NE	562860 174570	CRETE HALL RD NORTHFLEET BH5	10.0	N	838732 !
6	77m SW	562430 174140	NORTHFLEET WORKS T8	27.88	N	838663 !
7	84m NW	562490 174460	NORTHFLEET WORKS 5	17.52	N	838635 !
8	88m NE	562890 174550	CRETE HALL RD NORTHFLEET BH4	15.0	N	838731 !
9	90m W	562360 174270	NORTHFLEET WORKS T6	26.67	N	838661 !
B	91m NE	562870 174600	CRETE HALL RD NORTHFLEET BH7	20.0	N	838734 !
10	93m SE	562830 174280	NORTHFLEET POWER STATION	1.52	N	838854 !
B	93m NE	562870 174590	CRETE HALL RD NORTHFLEET BH6	10.0	N	838733 !
11	100m NE	562910 174510	CRETE HALL RD NORTHFLEET BH1	1.0	N	838729 !
12	142m NW	562470 174640	NORTHFLEET WORKS 24	36.58	N	838654 !
13	173m W	562280 174290	NORTHFLEET WORKS T4	26.82	N	838659 !
14	176m W	562310 174360	NORTHFLEET WORKS 1	17.83	N	838631 !
15	178m S	562610 173920	BREWERY TAP DOVER ROAD NORTHFLEET	106.68	N	838344 !
16	197m W	562320 174400	NORTHFLEET WORKS 2	15.85	N	838632 !
17	201m E	562970 174300	BOWATER PAPER MILLS GRAVESEND	76.2	N	838301 !
18	220m E	562980 174270	BOWATERS, NORTHFLEET	45.72	N	838826 !
19	225m E	563000 174320	NORTHFLEET POWER STATION	6.09	N	838832 !
20	229m E	563040 174500	BRITISH ELECTRICITY AUTH NORTHFLEET	13.71	N	838368 !
21	231m E	563040 174540	NORTHFLEET POWER STATION	12.19	N	838805 !

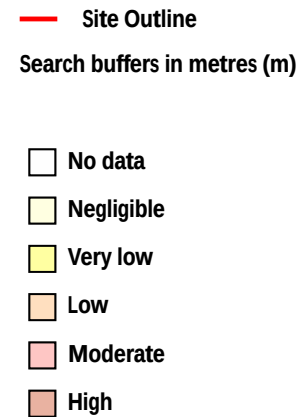
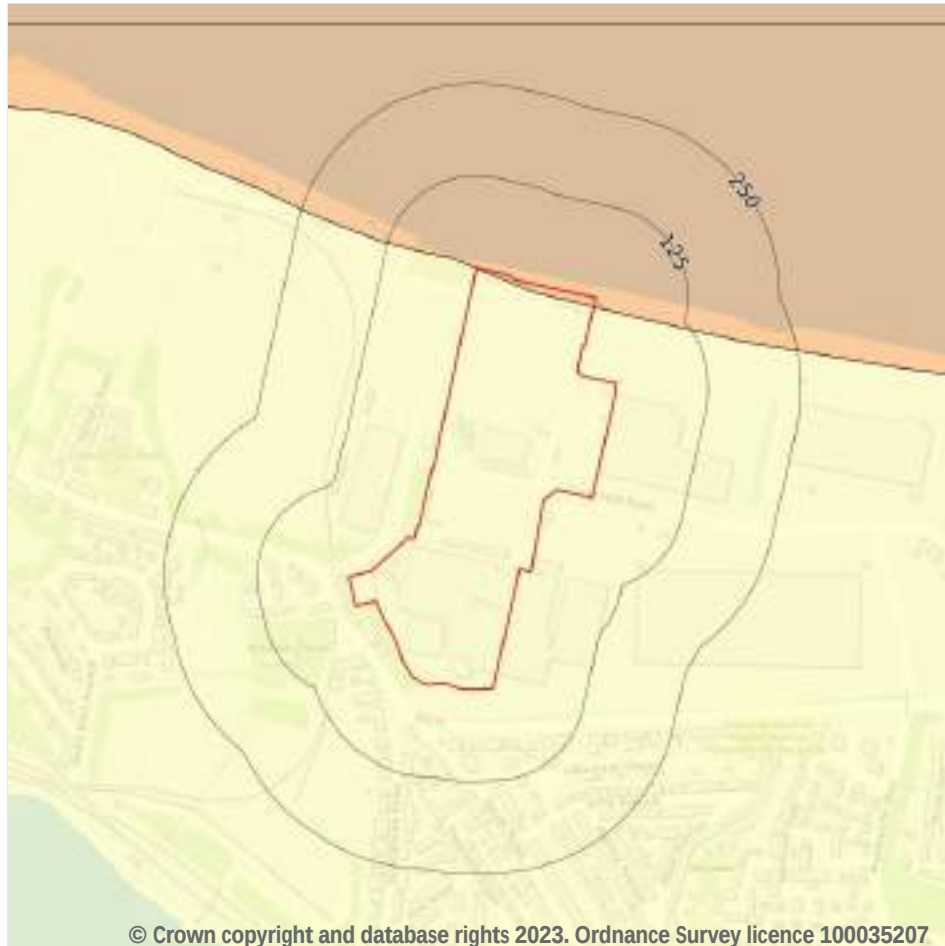


ID	Location	Grid reference	Name	Length	Confidential	Web link
C	234m NW	562380 174660	NORTHFLEET WORKS 23	36.58	N	838653 !
22	234m NW	562360 174570	NORTHFLEET WORKS 4	19.35	N	838634 !
23	239m W	562340 174500	NORTHFLEET WORKS 3	21.34	N	838633 !
C	242m NW	562370 174650	NORTHFLEET WORKS 6	19.2	N	838636 !
24	242m SW	562350 173959	CHANNEL TUNNEL RAIL LINK TP7835	4.0	N	15616248 !
25	242m SE	562990 174240	NORTHFLEET POWER STATION	4.87	N	838833 !

This data is sourced from the British Geological Survey.



17 Natural ground subsidence - Shrink swell clays



© Crown copyright and database rights 2023. Ordnance Survey licence 100035207

17.1 Shrink swell clays

Records within 50m

2

The potential hazard presented by soils that absorb water when wet (making them swell), and lose water as they dry (making them shrink). This shrink-swell behaviour is controlled by the type and amount of clay in the soil, and by seasonal changes in the soil moisture content (related to rainfall and local drainage).

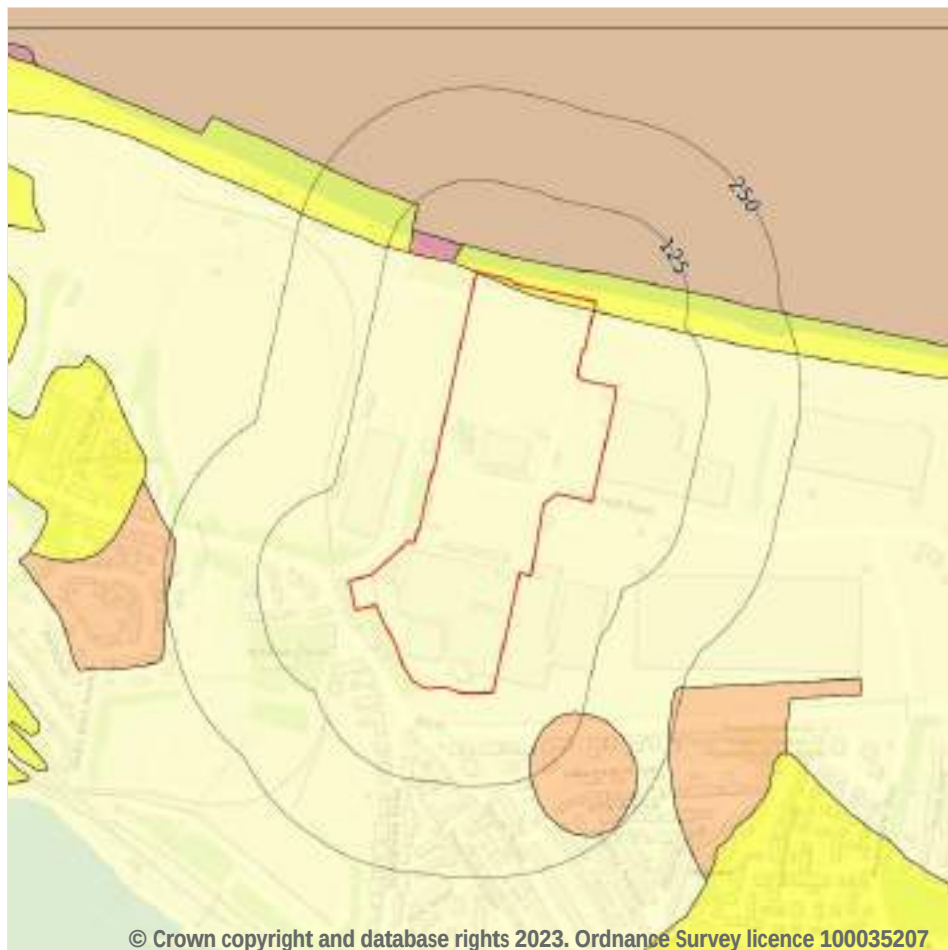
Features are displayed on the Natural ground subsidence - Shrink swell clays map on [page 189](#) >

Location	Hazard rating	Details
On site	Negligible	Ground conditions predominantly non-plastic.
On site	Low	Ground conditions predominantly medium plasticity.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Running sands



- Site Outline**
- Search buffers in metres (m)**
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

© Crown copyright and database rights 2023. Ordnance Survey licence 100035207

17.2 Running sands

Records within 50m

4

The potential hazard presented by rocks that can contain loosely-packed sandy layers that can become fluidised by water flowing through them. Such sands can 'run', removing support from overlying buildings and causing potential damage.

Features are displayed on the Natural ground subsidence - Running sands map on [page 190](#) >

Location	Hazard rating	Details
On site	Negligible	Running sand conditions are not thought to occur whatever the position of the water table. No identified constraints on lands use due to running conditions.

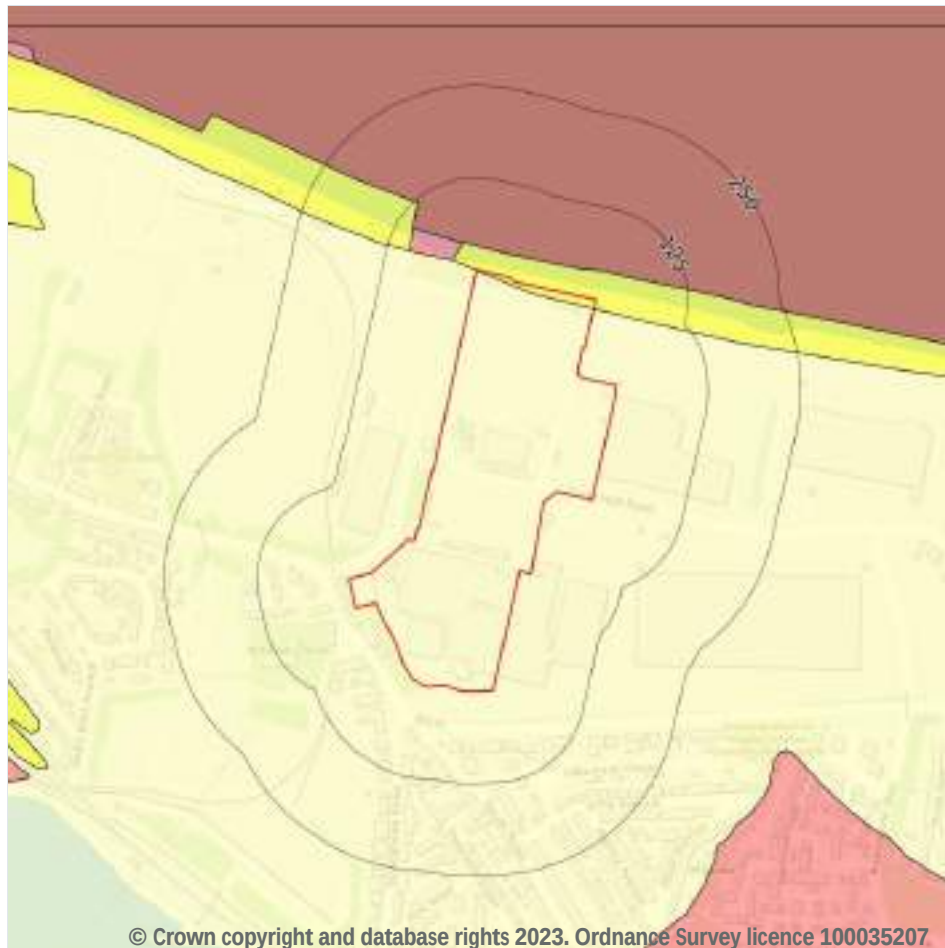


Location	Hazard rating	Details
On site	Very low	Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.
30m N	Low	Running sand conditions may be present. Constraints may apply to land uses involving excavation or the addition or removal of water.
34m N	Moderate	Running sand conditions are probably present. Constraints may apply to land uses involving excavation or the addition or removal of water.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Compressible deposits



- Site Outline**
- Search buffers in metres (m)**
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.3 Compressible deposits

Records within 50m

4

The potential hazard presented by types of ground that may contain layers of very soft materials like clay or peat and may compress if loaded by overlying structures, or if the groundwater level changes, potentially resulting in depression of the ground and disturbance of foundations.

Features are displayed on the Natural ground subsidence - Compressible deposits map on [page 192](#) >

Location	Hazard rating	Details
On site	Negligible	Compressible strata are not thought to occur.
On site	Very low	Compressibility and uneven settlement problems are not likely to be significant on the site for most land uses.

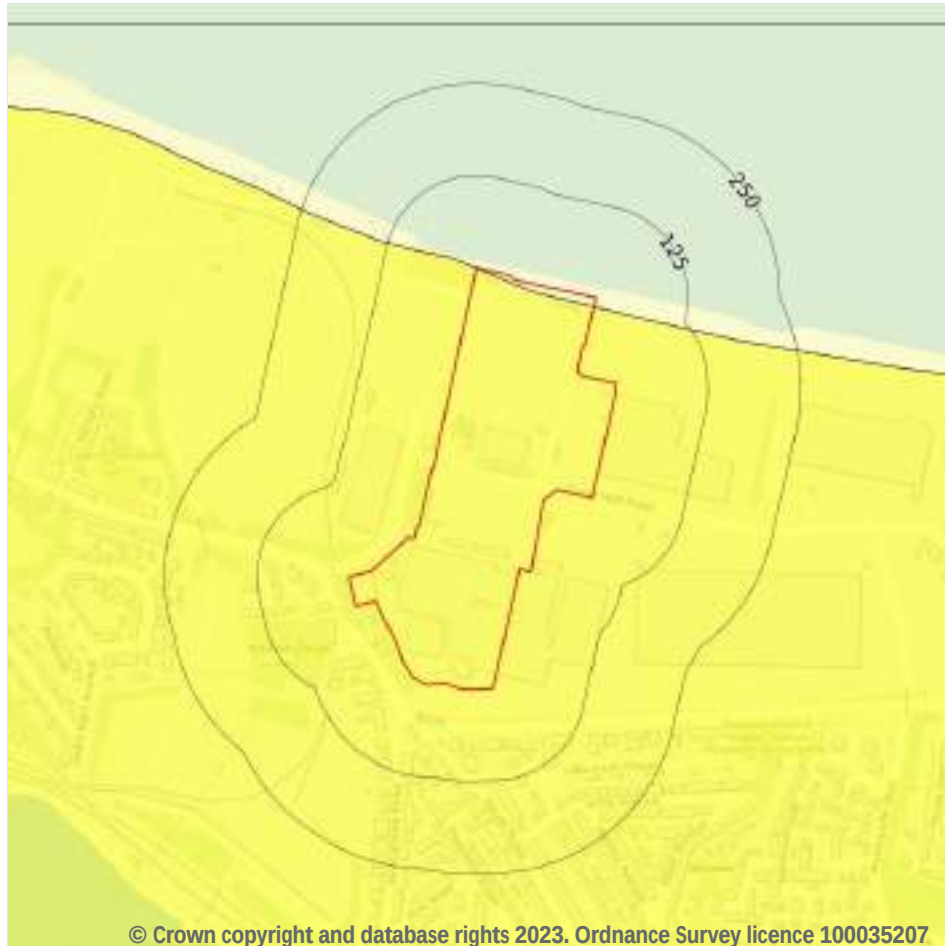


Location	Hazard rating	Details
30m N	High	Highly compressible strata present. Significant constraint on land use depending on thickness.
34m N	Moderate	Compressibility and uneven settlement hazards are probably present. Land use should consider specifically the compressibility and variability of the site.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Collapsible deposits



- Site Outline**
- Search buffers in metres (m)**
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.4 Collapsible deposits

Records within 50m

2

The potential hazard presented by natural deposits that could collapse when a load (such as a building) is placed on them or they become saturated with water.

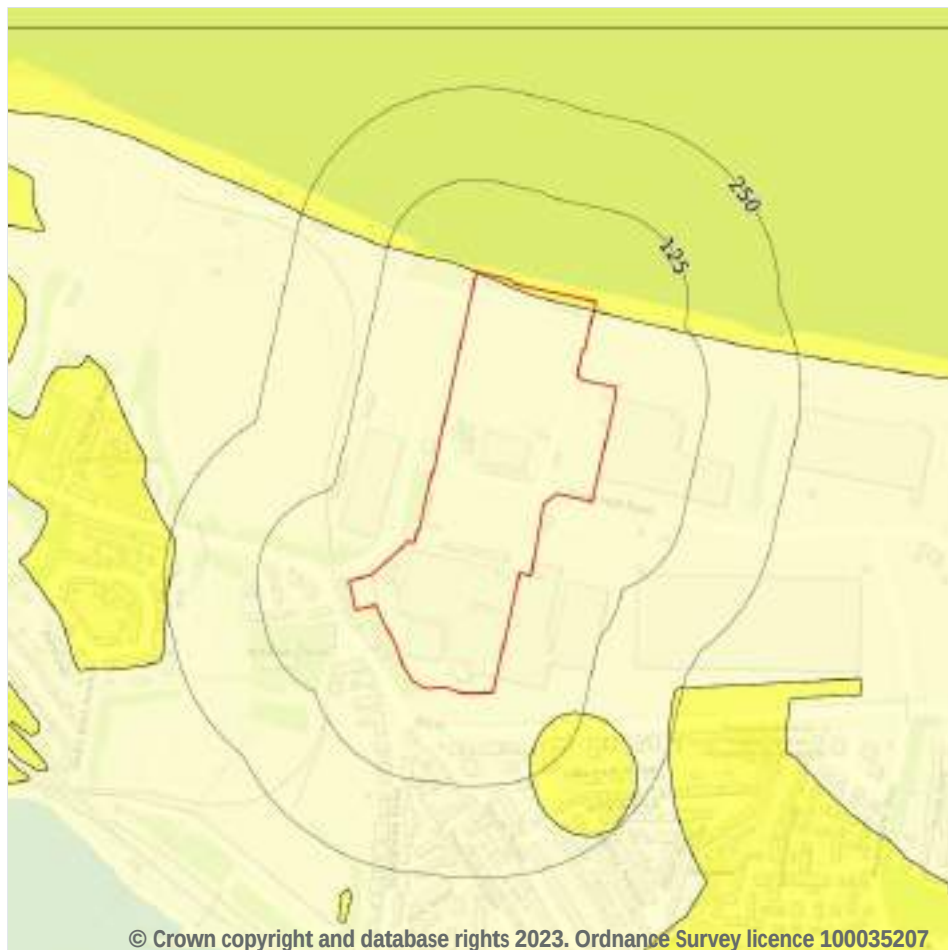
Features are displayed on the Natural ground subsidence - Collapsible deposits map on [page 194](#) >

Location	Hazard rating	Details
On site	Negligible	Deposits with potential to collapse when loaded and saturated are believed not to be present.
On site	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Landslides



- Site Outline**
- Search buffers in metres (m)**
- ☐ No data
 - ☐ Negligible
 - ☐ Very low
 - ☐ Low
 - ☐ Moderate
 - ☐ High

17.5 Landslides

Records within 50m

2

The potential for landsliding (slope instability) to be a hazard assessed using 1:50,000 scale digital maps of superficial and bedrock deposits, combined with information from the BGS National Landslide Database and scientific and engineering reports.

Features are displayed on the Natural ground subsidence - Landslides map on [page 195 >](#)

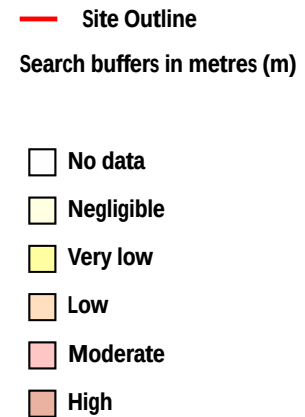
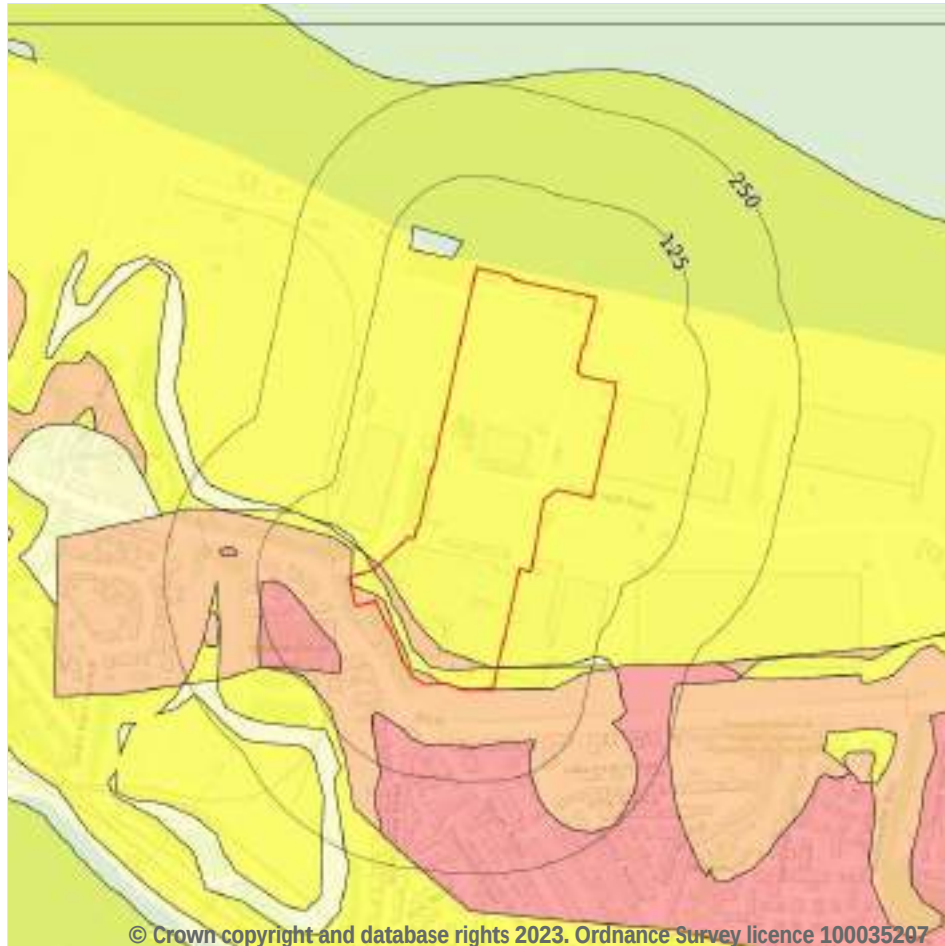
Location	Hazard rating	Details
On site	Negligible	Slope instability problems are not thought to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.

Location	Hazard rating	Details
On site	Very low	Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.

This data is sourced from the British Geological Survey.



Natural ground subsidence - Ground dissolution of soluble rocks



© Crown copyright and database rights 2023. Ordnance Survey licence 100035207

17.6 Ground dissolution of soluble rocks

Records within 50m

5

The potential hazard presented by ground dissolution, which occurs when water passing through soluble rocks produces underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

Features are displayed on the Natural ground subsidence - Ground dissolution of soluble rocks map on [page 197 >](#)

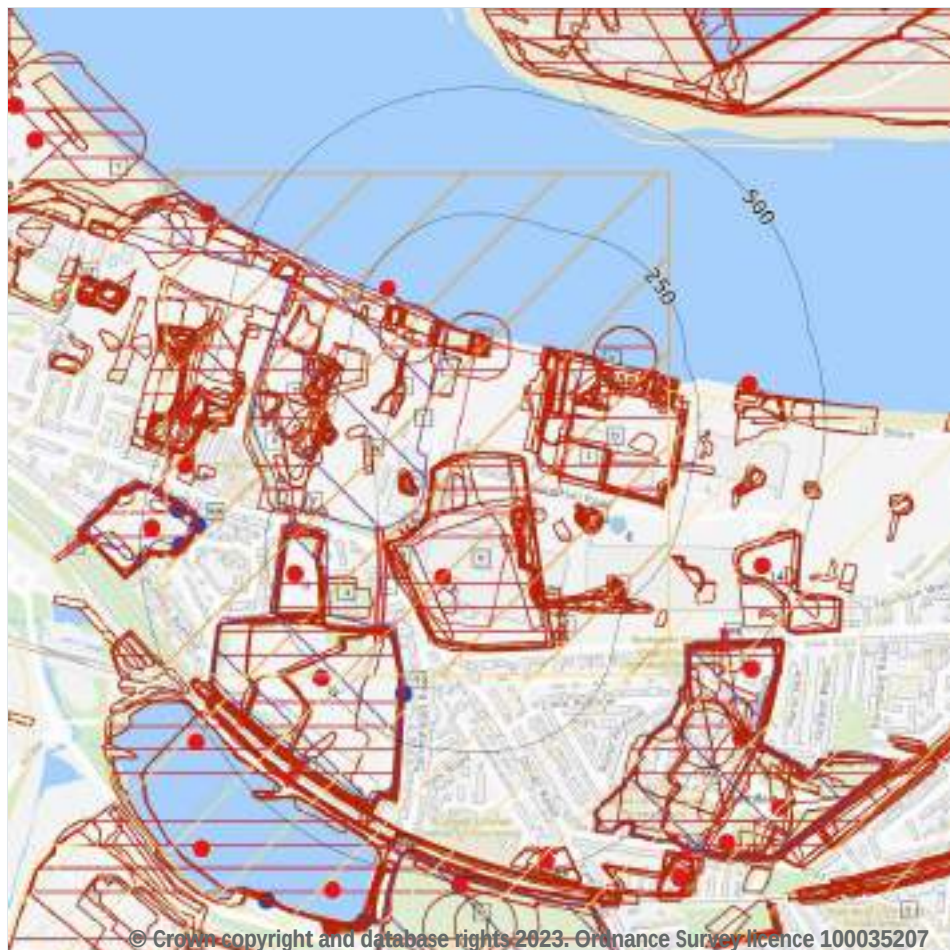
Location	Hazard rating	Details
On site	Very low	Soluble rocks are present within the ground. Few dissolution features are likely to be present. Potential for difficult ground conditions or localised subsidence are at a level where they need not be considered.

Location	Hazard rating	Details
On site	Low	Soluble rocks are present within the ground. Some dissolution features may be present. Potential for difficult ground conditions are at a level where they may be considered, localised subsidence need not be considered except in exceptional circumstances.
17m S	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.
26m SW	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.
34m N	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.

This data is sourced from the British Geological Survey.



18 Mining, ground workings and natural cavities



- Site Outline
- Search buffers in metres (m)
- Natural cavities (Area)
- Natural cavities (Point)
- BritPits
- Surface ground workings
- Underground workings
- Historical Mineral Planning Areas
- Mining Cavities
- Non Coal Mining
- Sporadic underground mining of restricted extent possible
- Localised small scale underground mining possible
- Small scale mining possible
- Underground mining known or likely within or in close proximity
- Underground mining known within or in very close proximity

18.1 Natural cavities

Records within 500m

5

Industry recognised national database of natural cavities. Sinkholes and caves are formed by the dissolution of soluble rock, such as chalk and limestone, gulls and fissures by cambering. Ground instability can result from movement of loose material contained within these cavities, often triggered by water.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199](#) >

ID	Location	Details	Source
7	161m S	Type: Solution Pipe x2 Superficial Geology: - Bedrock Geology: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Simple Bibliography: Stantec UK Ltd (RLE Channel Tunnel Rail Link Geotechnical Feedback Report, November 2001) Full Bibliography: - Confidentiality: Data source can be revealed, data can be used freely
AM	388m W	Type: Gulls/Fissures due to Cambering x1 Superficial Geology: Boyn Hill Gravel Bedrock Geology: Thanet Formation (Sands), Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Simple Bibliography: Stantec UK Ltd (RLE Channel Tunnel Rail Link Geotechnical Feedback Report, November 2001) Full Bibliography: - Confidentiality: Data source can be revealed, data can be used freely
AM	388m W	Type: Solution Pipe x1 Superficial Geology: Boyn Hill Gravel Bedrock Geology: Thanet Formation (Sands), Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Simple Bibliography: Stantec UK Ltd (RLE Channel Tunnel Rail Link Geotechnical Feedback Report, November 2001) Full Bibliography: - Confidentiality: Data source can be revealed, data can be used freely
AM	420m W	Type: Gulls/Fissures due to Cambering x1 Superficial Geology: - Bedrock Geology: Thanet Formation (Sands), Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Simple Bibliography: Stantec UK Ltd (RLE Channel Tunnel Rail Link Geotechnical Feedback Report, November 2001) Full Bibliography: - Confidentiality: Data source can be revealed, data can be used freely
AM	430m W	Type: Solution Pipe x1 Superficial Geology: Boyn Hill Gravel Bedrock Geology: Thanet Formation (Sands), Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Simple Bibliography: Stantec UK Ltd (RLE Channel Tunnel Rail Link Geotechnical Feedback Report, November 2001) Full Bibliography: - Confidentiality: Data source can be revealed, data can be used freely

This data is sourced from Stantec UK Ltd.

18.2 BritPits

Records within 500m

10

BritPits (an abbreviation of British Pits) is a database maintained by the British Geological Survey of currently active and closed surface and underground mineral workings. Details of major mineral handling sites, such as wharfs and rail depots are also held in the database.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199](#) >



ID	Location	Details	Description
A	On site	Name: The Hill Brick Works Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority
U	197m SW	Name: Northfleet Chalk Pit Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority
8	206m NW	Name: 42 Wharf Address: NORTHFLEET, Kent Commodity: Mineral Status: Inactive	Type: Sea, river or canal wharf where mineral commodities are unloaded and stored Status description: Site which, at date of entry, is not extracting minerals, but which still has a valid planning permission to do so, and can restart at any time. May be considered Mothballed by operator. May be considered to have Active or Dormant planning permission
Q	254m SW	Name: Northfleet Chalk Pit Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority
AE	355m E	Name: Red Lion Wharf Address: NORTHFLEET, Kent Commodity: Crushed Rock Status: Active	Type: Sea, river or canal wharf where mineral commodities are unloaded and stored Status description: Site which is actively extracting mineral products, or in the case of wharfs and rail depots, is actively handing minerals
AE	355m E	Name: Red Lion Wharf Address: NORTHFLEET, Kent Commodity: Marine Sand & Gravel Status: Active	Type: Sea, river or canal wharf where mineral commodities are unloaded and stored Status description: Site which is actively extracting mineral products, or in the case of wharfs and rail depots, is actively handing minerals
14	430m E	Name: London Road Whiting Works Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority



ID	Location	Details	Description
AK	441m W	Name: Lower Fleet Brick Field Address: Lower Northfleet, NORTHFLEET, Kent Commodity: Clay & Shale Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority
AM	478m W	Name: High Street Quarry Address: NORTHFLEET, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority
AX	481m S	Name: Northfleet Chalk Pit Address: Northfleet, GRAVESEND, Kent Commodity: Chalk Status: Ceased	Type: A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site Status description: Site which, at date of entry, has ceased to extract minerals. May be considered as Closed by operator. May be considered to have Active, Dormant or Expired planning permissions by Mineral Planning Authority

This data is sourced from the British Geological Survey.

18.3 Surface ground workings

Records within 250m	217
---------------------	-----

Historical land uses identified from Ordnance Survey mapping that involved ground excavation at the surface. These features may or may not have been subsequently backfilled.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199](#) >

ID	Location	Land Use	Year of mapping	Mapping scale
1	On site	Unspecified Heap	1916	1:10560
A	On site	Unspecified Heap	1865	1:10560
B	On site	Unspecified Pit	1977	1:10000
B	On site	Unspecified Pit	1971	1:10000
B	On site	Unspecified Pit	1966	1:10560
B	On site	Unspecified Pit	1955	1:10560
C	On site	Old Dock	1923	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
C	On site	Old Dock	1907	1:10560
C	On site	Old Dock	1895	1:10560
C	On site	Dock Yard	1865	1:10560
C	On site	Unspecified Ground Workings	1955	1:10560
C	On site	Old Dock	1916	1:10560
C	On site	Old Dock	1888	1:10560
C	On site	Old Dock	1898	1:10560
C	On site	Old Dock	1898	1:10560
D	On site	Disused Dock	1923	1:10560
D	On site	Disused Dockyard	1907	1:10560
D	On site	Disused Dockyard	1895	1:10560
D	On site	Disused Dockyard	1895	1:10560
D	On site	Old Dock	1895	1:10560
D	On site	Disused Dockyard	1916	1:10560
D	On site	Disused Dockyard	1888	1:10560
D	On site	Disused Dockyard	1898	1:10560
D	On site	Disused Dockyard	1898	1:10560
E	On site	Unspecified Heap	1938	1:10560
E	On site	Unspecified Heap	1938	1:10560
E	On site	Unspecified Ground Workings	1946	1:10560
E	On site	Unspecified Heap	1895	1:10560
E	On site	Unspecified Heap	1865	1:10560
E	On site	Unspecified Heap	1938	1:10560
E	On site	Unspecified Heap	1955	1:10560
E	On site	Unspecified Ground Workings	1888	1:10560
E	On site	Unspecified Ground Workings	1898	1:10560
E	On site	Unspecified Ground Workings	1898	1:10560
F	On site	Unspecified Wharves	1938	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
F	On site	Unspecified Wharves	1938	1:10560
F	On site	Unspecified Wharves	1938	1:10560
F	On site	Unspecified Wharves	1938	1:10560
F	On site	Unspecified Wharf	1865	1:10560
F	On site	Unspecified Wharf	1955	1:10560
F	On site	Unspecified Wharves	1888	1:10560
F	On site	Unspecified Wharves	1898	1:10560
F	On site	Unspecified Wharves	1898	1:10560
G	On site	Unspecified Ground Workings	1938	1:10560
G	On site	Unspecified Ground Workings	1938	1:10560
G	On site	Unspecified Ground Workings	1916	1:10560
H	On site	Brick Works	1923	1:10560
H	On site	Brick Works	1923	1:10560
H	On site	Brick Works	1907	1:10560
H	On site	Brick Works	1895	1:10560
H	On site	Brick Works	1895	1:10560
H	On site	Brick Works	1916	1:10560
H	On site	Brick Works	1888	1:10560
H	On site	Brick Works	1898	1:10560
H	On site	Brick Works	1898	1:10560
I	On site	Unspecified Ground Workings	1946	1:10560
I	On site	Unspecified Heap	1955	1:10560
J	On site	Unspecified Ground Workings	1932	1:10560
C	1m NE	Cuttings	1865	1:10560
K	3m NE	Unspecified Wharf	1955	1:10560
F	6m N	Unspecified Wharf	1966	1:10560
F	8m N	Unspecified Wharves	1907	1:10560
F	11m N	Unspecified Wharves	1946	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
F	12m N	Unspecified Wharves	1932	1:10560
E	23m SE	Unspecified Heap	1865	1:10560
3	26m N	Unspecified Wharves	1923	1:10560
C	27m NE	Unspecified Ground Workings	1907	1:10560
C	27m NE	Unspecified Ground Workings	1895	1:10560
C	28m NE	Unspecified Ground Workings	1888	1:10560
C	31m NE	Unspecified Ground Workings	1898	1:10560
C	31m NE	Unspecified Ground Workings	1898	1:10560
C	32m NE	Unspecified Ground Workings	1895	1:10560
C	36m NE	Unspecified Ground Workings	1916	1:10560
O	42m E	Unspecified Heap	1938	1:10560
O	42m E	Unspecified Heap	1938	1:10560
O	44m E	Unspecified Ground Workings	1938	1:10560
O	44m E	Unspecified Heap	1938	1:10560
O	44m E	Unspecified Heap	1938	1:10560
O	45m E	Unspecified Ground Workings	1946	1:10560
O	45m E	Unspecified Heap	1932	1:10560
O	45m E	Unspecified Heap	1907	1:10560
O	45m E	Unspecified Heap	1895	1:10560
O	47m E	Unspecified Ground Workings	1916	1:10560
O	49m SE	Unspecified Heap	1865	1:10560
O	49m E	Unspecified Ground Workings	1898	1:10560
O	49m E	Unspecified Ground Workings	1898	1:10560
O	50m E	Unspecified Heap	1955	1:10560
P	51m W	Unspecified Heap	1888	1:10560
O	51m E	Unspecified Ground Workings	1895	1:10560
O	51m E	Unspecified Ground Workings	1865	1:10560
O	55m E	Unspecified Heap	1923	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
P	57m W	Unspecified Heap	1898	1:10560
P	57m W	Unspecified Heap	1898	1:10560
P	60m W	Unspecified Heap	1938	1:10560
P	60m W	Unspecified Heap	1938	1:10560
P	60m W	Unspecified Heap	1938	1:10560
P	61m W	Unspecified Heap	1916	1:10560
P	61m W	Unspecified Heap	1946	1:10560
P	61m W	Unspecified Heap	1932	1:10560
P	61m W	Unspecified Heap	1907	1:10560
P	61m W	Unspecified Heap	1895	1:10560
P	61m W	Unspecified Heap	1938	1:10560
P	61m W	Unspecified Heap	1938	1:10560
O	64m E	Unspecified Ground Workings	1888	1:10560
P	64m W	Unspecified Heap	1895	1:10560
J	64m S	Unspecified Heap	1955	1:10560
J	64m S	Unspecified Heap	1946	1:10560
4	65m SW	Grave Yard	1865	1:10560
K	67m NE	Unspecified Wharf	1990	1:10000
K	67m NE	Unspecified Wharf	1977	1:10000
K	67m NE	Unspecified Wharf	1971	1:10000
K	67m NE	Unspecified Wharf	1966	1:10560
J	67m S	Unspecified Heap	1938	1:10560
J	69m S	Unspecified Heap	1938	1:10560
J	69m S	Unspecified Heap	1938	1:10560
J	74m S	Unspecified Heap	1888	1:10560
F	75m N	Unspecified Wharves	1888	1:10560
F	75m N	Unspecified Wharves	1895	1:10560
F	79m N	Unspecified Wharves	1898	1:10560

ID	Location	Land Use	Year of mapping	Mapping scale
F	79m N	Unspecified Wharves	1898	1:10560
F	80m N	Unspecified Wharf	1955	1:10560
Q	82m SW	Chalk Pit	1938	1:10560
Q	83m SW	Unspecified Disused Pit	1990	1:10000
Q	83m SW	Unspecified Disused Pit	1977	1:10000
Q	83m SW	Burial Ground	1977	1:10000
F	83m N	Unspecified Wharves	1938	1:10560
F	83m N	Unspecified Wharves	1938	1:10560
Q	83m SW	Chalk Pit	1916	1:10560
Q	84m SW	Chalk Pit	1898	1:10560
Q	84m SW	Chalk Pit	1898	1:10560
Q	85m SW	Chalk Pit	1907	1:10560
Q	86m SW	Chalk Pit	1938	1:10560
Q	86m SW	Old Chalk Pit	1938	1:10560
Q	86m SW	Burial Ground	1966	1:10560
Q	86m SW	Burial Ground	1955	1:10560
Q	87m SW	Chalk Pit	1923	1:10560
Q	88m SW	Chalk Pit	1895	1:10560
D	88m E	Unspecified Pit	1865	1:10560
Q	89m SW	Old Chalk Pit	1946	1:10560
Q	92m SW	Chalk Pit	1895	1:10560
Q	93m SW	Old Chalk Pit	1932	1:10560
Q	99m SW	Chalk Pit	1888	1:10560
R	101m SE	Unspecified Heap	1955	1:10560
F	108m NW	Unspecified Wharves	1888	1:10560
D	118m E	Unspecified Pit	1865	1:10560
S	120m NW	Unspecified Ground Workings	1966	1:10560
S	120m NW	Unspecified Ground Workings	1955	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
S	122m NW	Unspecified Ground Workings	1932	1:10560
S	123m NW	Unspecified Heap	1938	1:10560
S	123m NW	Unspecified Heap	1938	1:10560
F	126m NW	Unspecified Wharves	1938	1:10560
F	126m NW	Unspecified Wharves	1938	1:10560
T	128m SE	Unspecified Heap	1946	1:10560
U	132m W	Old Chalk Pit	1888	1:10560
U	132m W	Old Chalk Pit	1895	1:10560
S	133m NW	Unspecified Ground Workings	1938	1:10560
S	133m NW	Unspecified Ground Workings	1938	1:10560
R	133m SE	Unspecified Ground Workings	1888	1:10560
T	134m SE	Unspecified Heap	1955	1:10560
U	135m W	Unspecified Disused Pit	1990	1:10000
U	135m W	Unspecified Disused Pit	1977	1:10000
U	135m W	Old Chalk Pit	1898	1:10560
U	135m W	Old Chalk Pit	1898	1:10560
U	137m W	Unspecified Pit	1923	1:10560
U	138m W	Unspecified Pit	1966	1:10560
U	138m W	Unspecified Pit	1955	1:10560
U	144m W	Old Chalk Pit	1895	1:10560
V	145m W	Unspecified Ground Workings	1865	1:10560
W	148m W	Unspecified Pit	1966	1:10560
W	148m W	Unspecified Pit	1955	1:10560
F	155m NW	Unspecified Wharves	1898	1:10560
F	155m NW	Unspecified Wharves	1898	1:10560
R	156m SE	Unspecified Ground Workings	1895	1:10560
F	159m NW	Unspecified Wharves	1932	1:10560
R	161m SE	Unspecified Ground Workings	1932	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
F	164m NW	Unspecified Wharf	1865	1:10560
W	179m W	Unspecified Heaps	1966	1:10560
W	179m W	Unspecified Heaps	1955	1:10560
X	184m NW	Unspecified Wharves	1946	1:10560
Y	189m NW	Unspecified Wharf	1895	1:10560
Z	196m W	Brick Works	1895	1:10560
R	197m SE	Unspecified Pit	1865	1:10560
N	199m NW	Brick Works	1895	1:10560
R	199m SE	Unspecified Heap	1938	1:10560
R	199m SE	Unspecified Heap	1938	1:10560
R	199m SE	Unspecified Heap	1938	1:10560
R	203m SE	Unspecified Ground Workings	1898	1:10560
R	203m SE	Unspecified Ground Workings	1898	1:10560
R	203m SE	Unspecified Heap	1946	1:10560
R	203m SE	Unspecified Heap	1895	1:10560
R	206m SE	Unspecified Heap	1907	1:10560
V	207m W	Unspecified Ground Workings	1865	1:10560
R	210m SE	Unspecified Heap	1923	1:10560
9	211m W	Unspecified Pit	1895	1:10560
Z	217m W	Gravel Pit	1966	1:10560
Z	217m W	Refuse Heap	1955	1:10560
X	227m NW	Unspecified Wharves	1938	1:10560
X	227m NW	Unspecified Wharves	1938	1:10560
X	228m NW	Unspecified Wharves	1932	1:10560
Z	234m W	Unspecified Heap	1907	1:10560
Z	234m W	Unspecified Heap	1895	1:10560
Z	237m W	Unspecified Heap	1898	1:10560
Z	237m W	Unspecified Heap	1898	1:10560



ID	Location	Land Use	Year of mapping	Mapping scale
Z	237m W	Unspecified Heap	1916	1:10560
Z	239m W	Unspecified Heap	1938	1:10560
Z	239m W	Unspecified Heap	1938	1:10560
Z	240m W	Unspecified Heap	1938	1:10560
Z	240m W	Refuse Heap	1907	1:10560
Z	242m W	Unspecified Heap	1946	1:10560
Z	242m W	Unspecified Ground Workings	1932	1:10560
Z	243m W	Unspecified Ground Workings	1938	1:10560
Z	243m W	Unspecified Ground Workings	1938	1:10560
Z	245m W	Unspecified Heap	1895	1:10560
Z	246m W	Refuse Heap	1895	1:10560
Z	246m W	Unspecified Heap	1946	1:10560
Z	249m W	Refuse Heap	1898	1:10560
Z	249m W	Refuse Heap	1898	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

18.4 Underground workings

Records within 1000m

25

Historical land uses identified from Ordnance Survey mapping that indicate the presence of underground workings e.g. mine shafts.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199](#) >

ID	Location	Land Use	Year of mapping	Mapping scale
L	13m SW	Tunnel	1971	1:10000
L	13m SW	Tunnel	1990	1:10000
M	21m SW	Tunnels	1865	1:10560
M	22m SW	Tunnels	1865	1:10560
V	182m W	Tunnel	1971	1:10000
AL	383m SW	Tunnel	1990	1:10000



ID	Location	Land Use	Year of mapping	Mapping scale
AL	383m SW	Tunnel	1977	1:10000
AL	387m SW	Tunnel	1946	1:10560
AL	389m SW	Tunnel	1932	1:10560
AN	421m SE	Tunnel	1932	1:10560
AN	422m SE	Tunnel	1946	1:10560
AN	428m SE	Tunnel	1923	1:10560
AR	457m S	Tunnel	1946	1:10560
AK	472m W	Tunnel	1923	1:10560
AK	481m W	Tunnel	1946	1:10560
AK	483m W	Tunnel	1932	1:10560
AK	483m W	Tunnel	1907	1:10560
AK	487m W	Tunnel	1938	1:10560
BD	586m SE	Tunnel	1938	1:10560
BD	593m SE	Tunnel	1907	1:10560
BD	597m SE	Tunnel	1923	1:10560
BL	609m W	Tunnel	1971	1:10000
BL	609m W	Tunnel	1990	1:10000
BL	609m W	Tunnel	1977	1:10000
BT	792m NW	Tunnel	1923	1:10560

This is data is sourced from Ordnance Survey/Groundsure.

18.5 Historical Mineral Planning Areas

Records within 500m

5

Boundaries of mineral planning permissions for England and Wales. This data was collated between the 1940s (and retrospectively to the 1930s) and the mid 1980s. The data includes permitted, withdrawn and refused permissions.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199](#) >



ID	Location	Site Name	Mineral	Type	Planning Status	Planning Status Date
N	37m W	Northfleet	Cement	Surface mineral working	Valid	Not available
Q	76m SW	Southfleet	Chalk	Surface mineral working	Valid	Not available
AH	385m SE	Southfleet	Chalk	Surface mineral working	Valid	Not available
AM	390m W	Southfleet	Chalk	Surface mineral working	Valid	Not available
AY	463m S	Southfleet	Chalk	Surface mineral working	Valid	Not available

This data is sourced from the British Geological Survey.

18.6 Non-coal mining

Records within 1000m	2
----------------------	---

The potential for historical non-coal mining to have affected an area. The assessment is drawn from expert knowledge and literature in addition to the digital geological map of Britain. Mineral commodities may be divided into seven general categories - vein minerals, chalk, oil shale, building stone, bedded ores, evaporites and 'other' commodities (including ball clay, jet, black marble, graphite and chert).

Features are displayed on the Mining, ground workings and natural cavities map on [page 199 >](#)

ID	Location	Name	Commodity	Class	Likelihood
2	On site	Not available	Chalk	C	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered
5	98m S	Not available	Chalk	A	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

This data is sourced from the British Geological Survey.

18.7 Mining cavities

Records within 1000m	4
----------------------	---

Industry recognised national database of mining cavities. Degraded mines may result in hazardous subsidence (crown holes). Climatic conditions and water escape can also trigger subsidence over mine entrances and workings.

Features are displayed on the Mining, ground workings and natural cavities map on [page 199 >](#)



ID	Location	Mine Address	Mineral	Data source	Publisher
E	On site	Northfleet, Kent	Chalk	-	-
M	17m SW	Northfleet, Kent	Chalk	-	-
6	135m E	Northfleet, Kent	Chalk	-	-
AN	412m SE	Northfleet, Kent	Chalk	-	-

This data is sourced from Stantec UK Ltd.

18.8 JPB mining areas

Records on site	0
-----------------	---

Areas which could be affected by former coal and other mining. This data includes some mine plans unavailable to the Coal Authority.

This data is sourced from Johnson Poole and Bloomer.

18.9 Coal mining

Records on site	0
-----------------	---

Areas which could be affected by past, current or future coal mining.

This data is sourced from the Coal Authority.

18.10 Brine areas

Records on site	0
-----------------	---

The Cheshire Brine Compensation District indicates areas that may be affected by salt and brine extraction in Cheshire and where compensation would be available where damage from this mining has occurred. Damage from salt and brine mining can still occur outside this district, but no compensation will be available.

This data is sourced from the Cheshire Brine Subsidence Compensation Board.

18.11 Gypsum areas

Records on site	0
-----------------	---

Generalised areas that may be affected by gypsum extraction.

This data is sourced from British Gypsum.

18.12 Tin mining

Records on site	0
-----------------	---

Generalised areas that may be affected by historical tin mining.

This data is sourced from Groundsure.

18.13 Clay mining

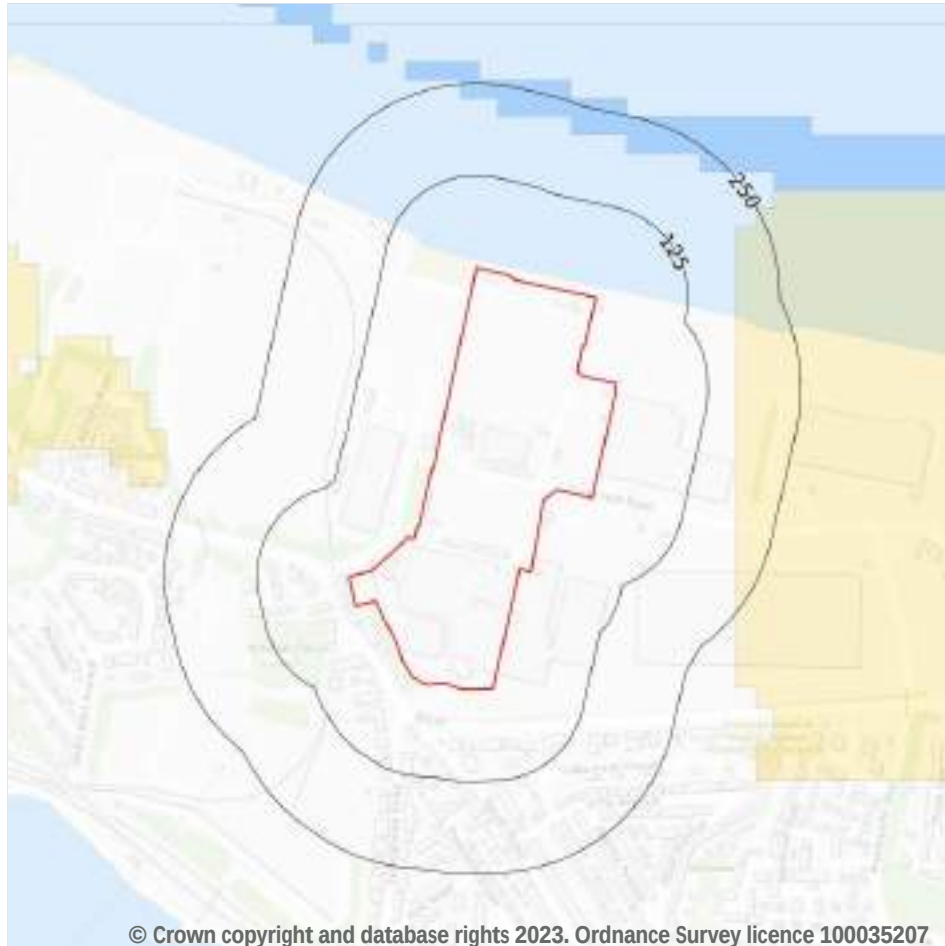
Records on site	0
-----------------	---

Generalised areas that may be affected by kaolin and ball clay extraction.

This data is sourced from the Kaolin and Ball Clay Association (UK).



19 Radon



— Site Outline
Search buffers in metres (m)

- Greater than 30%
- Between 10% and 30%
- Between 5% and 10%
- Between 3% and 5%
- Between 1% and 3%
- Less than 1%

19.1 Radon

Records on site

1

The Radon Potential data classifies areas based on their likelihood of a property having a radon level at or above the Action Level in Great Britain. The dataset is intended for use at 1:50,000 scale and was derived from both geological assessments and indoor radon measurements (more than 560,000 records). A minimum 50m buffer should be considered when searching the maps, as the smallest detectable feature at this scale is 50m. The findings of this section should supersede any estimations derived from the Indicative Atlas of Radon in Great Britain (1:100,000 scale).

Features are displayed on the Radon map on [page 215 >](#)

Location	Estimated properties affected	Radon Protection Measures required
On site	Less than 1%	None



This data is sourced from the British Geological Survey and UK Health Security Agency.



20 Soil chemistry

20.1 BGS Estimated Background Soil Chemistry

Records within 50m

5

The estimated values provide the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km². In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km²; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

Location	Arsenic	Bioaccessible Arsenic	Lead	Bioaccessible Lead	Cadmium	Chromium	Nickel
On site	15 - 25 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
On site	15 - 25 mg/kg	No data	200 - 300 mg/kg	120 - 240 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
On site	15 - 25 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
On site	15 - 25 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg
34m N	15 - 25 mg/kg	No data	100 - 200 mg/kg	60 - 120 mg/kg	1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg

This data is sourced from the British Geological Survey.

20.2 BGS Estimated Urban Soil Chemistry

Records within 50m

0

Estimated topsoil chemistry of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc and bioaccessible Arsenic and Lead in 23 urban centres across Great Britain. These estimates are derived from interpolation of the measured urban topsoil data referred to above and provide information across each city between the measured sample locations (4 per km²).

This data is sourced from the British Geological Survey.



20.3 BGS Measured Urban Soil Chemistry

Records within 50m

0

The locations and measured total concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Tin and Zinc in urban topsoil samples from 23 urban centres across Great Britain. These are collected at a sample density of 4 per km².

This data is sourced from the British Geological Survey.



21 Railway infrastructure and projects



- Site Outline
- Search buffers in metres (m)**
- C1 Crossrail 1 Stations
- Crossrail 1 Route
- C2 Crossrail 2 Stations
- Crossrail 2 Route
- Crossrail 2 Worksites
- Crossrail 2 Safeguarding
- Crossrail 2 Headhouses
- Railway stations
- Active railways
- Active tunnels
- Abandoned railways
- Historic railways
- Historic tunnels
- Underground stations
- Underground Lines
- Royal Mail tunnels
- HS2 optimised route
- HS2 Stations
- HS2 Depots
- HS2 Surface Safeguarding
- HS2 Subsurface Safeguarding

21.1 Underground railways (London)

Records within 250m

0

Details of all active London Underground lines, including approximate tunnel roof depth and operational hours.

This data is sourced from publicly available information by Groundsure.

21.2 Underground railways (Non-London)

Records within 250m

0

Details of the Merseyrail system, the Tyne and Wear Metro and the Glasgow Subway. Not all parts of all systems are located underground. The data contains location information only and does not include a depth assessment.



This data is sourced from publicly available information by Groundsure.

21.3 Railway tunnels

Records within 250m

1

Railway tunnels taken from contemporary Ordnance Survey mapping.

Features are displayed on the Railway infrastructure and projects map on [page 219 >](#)

Location	Type
21m SW	Railway Tunnel

This data is sourced from the Ordnance Survey.

21.4 Historical railway and tunnel features

Records within 250m

132

Railways and tunnels digitised from historical Ordnance Survey mapping as scales of 1:1,250, 1:2,500, 1:10,000 and 1:10,560.

Features are displayed on the Railway infrastructure and projects map on [page 219 >](#)

Location	Land Use	Year of mapping	Mapping scale
On site	Railway Sidings	1959	1250
On site	Railway Sidings	1960	1250
On site	Railway Sidings	1973	1250
On site	Railway Sidings	1972	1250
On site	Railway Sidings	1952	1250
On site	Railway Sidings	1964	2500
On site	Tramway Sidings	1897	2500
On site	Tramway Sidings	1909	2500
On site	Tramway Sidings	1933	2500
On site	Tramway Sidings	1939	2500
On site	Disused Railway Sidings	1973	1250
On site	Mineral Railway Sidings	1952	1250
On site	Mineral Railway Sidings	1952	2500



Location	Land Use	Year of mapping	Mapping scale
On site	Railway Sidings	1898	2500
On site	Railway Sidings	1909	2500
On site	Railway Sidings	1938	10560
On site	Mineral Railway Sidings	1955	10560
On site	Mineral Railway Sidings	1966	10560
On site	Railway Sidings	1865	10560
On site	Railway Sidings	1907	10560
On site	Railway Sidings	1895	10560
On site	Railway Sidings	1971	10000
On site	Railway Sidings	1898	10560
On site	Railway Sidings	1888	10560
On site	Tramway Sidings	1923	10560
On site	Tramway Sidings	1946	10560
On site	Tramway Sidings	1938	10560
On site	Tramway Sidings	1932	10560
On site	Tramway Sidings	1916	10560
On site	Railway Sidings	1977	10000
11m SW	Tunnels	1865	2500
12m SW	Tunnels	1865	2500
13m SW	Tunnel	1971	10000
13m SW	Railway Sidings	1971	10000
13m SW	Tunnel	1990	10000
13m SW	Railway Sidings	1990	10000
14m SW	Tunnel	1952	2500
16m SW	Tunnel	1972	1250
16m SW	Tunnel	1980	1250
16m SW	Tunnel	1994	1250
18m SW	Tunnel	1964	2500



Location	Land Use	Year of mapping	Mapping scale
18m SW	Tunnel	1952	2500
18m SW	Tunnel	1952	1250
21m SW	Tunnels	1865	10560
22m SW	Tramway Sidings	1932	10560
22m SW	Tunnels	1865	10560
23m SW	Railway Sidings	1907	10560
23m SW	Railway Sidings	1895	10560
24m S	Tunnel	1964	2500
25m S	Tunnel	1959	1250
25m S	Tunnel	1973	1250
30m SW	Tramway Sidings	1923	10560
31m SW	Railway Sidings	1888	10560
32m S	Tunnel	1993	1250
33m SW	Tramway Sidings	1946	10560
34m SW	Tramway Sidings	1897	2500
34m SW	Mineral Railway Sidings	1952	2500
36m SW	Railway Sidings	1898	10560
38m SW	Tramway Sidings	1916	10560
47m SW	Railway Sidings	1895	10560
49m SW	Tunnel	1980	1250
49m SW	Tunnel	1994	1250
50m SW	Tunnel	1972	1250
62m E	Railway Sidings	1971	10000
63m W	Railway Sidings	1977	10000
74m S	Tramway Sidings	1865	2500
82m N	Railway Sidings	1932	2500
82m N	Railway Sidings	1939	2500
82m N	Railway Sidings	1898	2500



Location	Land Use	Year of mapping	Mapping scale
83m NW	Railway Sidings	1938	10560
83m N	Railway Sidings	1938	10560
85m SW	Tramway Sidings	1907	10560
87m SE	Railway Sidings	1959	1250
89m W	Mineral Railway Sidings	1964	2500
89m SW	Tramway Sidings	1946	10560
95m SW	Railway Sidings	1895	10560
95m SW	Tramway Sidings	1938	10560
99m SW	Railway Sidings	1888	10560
99m SW	Tramway Sidings	1932	10560
100m SW	Tramway Sidings	1938	10560
101m SW	Tramway Sidings	1938	10560
102m W	Mineral Railway Sidings	1966	10560
102m SW	Railway Sidings	1898	10560
104m NW	Railway Sidings	1972	1250
105m SW	Tramway Sidings	1916	10560
107m SW	Tramway Sidings	1933	2500
107m SW	Tramway Sidings	1939	2500
108m SW	Railway Sidings	1897	2500
108m SW	Tramway Sidings	1909	2500
111m SW	Mineral Railway Sidings	1966	10560
114m SW	Tramway Sidings	1923	10560
114m NW	Railway Sidings	1952	1250
136m NW	Railway Sidings	1898	2500
137m NW	Tunnel	1964	2500
137m NW	Tunnel	1952	2500
138m NW	Tunnel	1952	1250
138m NW	Railway Sidings	1909	2500



Location	Land Use	Year of mapping	Mapping scale
159m W	Railway Sidings	1895	10560
163m W	Railway Sidings	1888	10560
164m NW	Tramway Sidings	1865	10560
170m W	Railway Sidings	1898	10560
182m SW	Mineral Railway Sidings	1952	2500
182m W	Tunnel	1971	10000
184m W	Tunnel	1980	1250
185m W	Tunnel	1972	1250
186m W	Tunnel	1865	2500
186m W	Tunnel	1994	1250
188m W	Tramway Sidings	1865	2500
190m NW	Tramway Sidings	1865	10560
193m W	Railway Sidings	1888	10560
195m NW	Railway Sidings	1898	2500
195m NW	Railway Sidings	1909	2500
196m NE	Railway Sidings	1965	1250
196m NE	Railway Sidings	1952	1250
198m W	Railway Sidings	1898	10560
198m NW	Tramway Sidings	1897	2500
198m NW	Tramway Sidings	1909	2500
200m W	Tramway Sidings	1897	2500
203m W	Railway Sidings	1895	10560
205m W	Tunnel	1952	1250
205m W	Tunnel	1952	2500
206m W	Tunnel	1964	2500
223m E	Railway Sidings	1865	10560
227m E	Railway Sidings	1907	10560
229m W	Railway Sidings	1952	1250



Location	Land Use	Year of mapping	Mapping scale
229m NW	Railway Sidings	1938	10560
229m NW	Railway Sidings	1938	10560
229m NW	Railway Sidings	1916	10560
230m NW	Railway Sidings	1909	2500
231m E	Tramway Sidings	1865	2500
234m E	Railway Sidings	1916	10560
243m E	Tramway Sidings	1909	2500

This data is sourced from Ordnance Survey/Groundsure.

21.5 Royal Mail tunnels

Records within 250m 0

The Post Office Railway, otherwise known as the Mail Rail, is an underground railway running through Central London from Paddington Head District Sorting Office to Whitechapel Eastern Head Sorting Office. The line is 10.5km long. The data includes details of the full extent of the tunnels, the depth of the tunnel, and the depth to track level.

This data is sourced from Groundsure/the Postal Museum.

21.6 Historical railways

Records within 250m 3

Former railway lines, including dismantled lines, abandoned lines, disused lines, historic railways and razed lines.

Features are displayed on the Railway infrastructure and projects map on [page 219 >](#)

Location	Description
184m W	Dismantled
190m W	Dismantled
223m W	Abandoned

This data is sourced from OpenStreetMap.



21.7 Railways

Records within 250m

11

Currently existing railway lines, including standard railways, narrow gauge, funicular, trams and light railways. Features are displayed on the Railway infrastructure and projects map on [page 219 >](#)

Location	Name	Type
19m SW	Northfleet freight link	rail
22m SW	Northfleet freight link	rail
47m SW	Northfleet freight link	rail
48m SW	Not given	Multi Track
48m SW	Northfleet freight link	rail
54m W	Northfleet freight link	rail
89m W	Northfleet freight link	rail
124m SW	Northfleet freight link	rail
125m SW	Not given	Single Track
125m SW	Not given	Single Track
127m SW	Northfleet freight link	rail

This data is sourced from Ordnance Survey and OpenStreetMap.

21.8 Crossrail 1

Records within 500m

0

The Crossrail railway project links 41 stations over 100 kilometres from Reading and Heathrow in the west, through underground sections in central London, to Shenfield and Abbey Wood in the east.

This data is sourced from publicly available information by Groundsure.

21.9 Crossrail 2

Records within 500m

0

Crossrail 2 is a proposed railway linking the national rail networks in Surrey and Hertfordshire via an underground tunnel through London.

This data is sourced from publicly available information by Groundsure.



21.10 HS2

Records within 500m

0

HS2 is a proposed high speed rail network running from London to Manchester and Leeds via Birmingham. Main civils construction on Phase 1 (London to Birmingham) of the project began in 2019, and it is currently anticipated that this phase will be fully operational by 2026. Construction on Phase 2a (Birmingham to Crewe) is anticipated to commence in 2021, with the service fully operational by 2027. Construction on Phase 2b (Crewe to Manchester and Birmingham to Leeds) is scheduled to begin in 2023 and be operational by 2033.

This data is sourced from HS2 Ltd.



Data providers

Groundsure works with respected data providers to bring you the most relevant and accurate information. To find out who they are and their areas of expertise see <https://www.groundsure.com/sources-reference> ! .

Terms and conditions

Groundsure's Terms and Conditions can be accessed at this link: <https://www.groundsure.com/terms-and-conditions-april-2023/> ! .





Appendix D

Detailed Unexploded Ordnance (UXO) Risk Assessment Report



Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Northfleet, Gravesend, Kent
Client	GVR Geoservices Ltd
Site Address	Northfleet, Gravesend, Kent, DA11 9AD
Report Reference	DA11104a-00
Date	19/05/23
Authored by	CJ
Revised by	HJ
Final Check	AT



Executive Summary

Site Location and Description

The site is located in Northfleet, in the borough of Gresham, Kent.

The site comprises a large section of an industrial and commercial wharf area, located on the south side of the Thames estuary. Within the southern section is several large industrial and commercial warehouse structures of the former Kimberley-Clark Factory and associated hard ground. The northern section of the site comprises partially of a large warehouse structure, various smaller industrial structures, associated hard-ground, and wharf structures adjacent to the Thames River.

The site is bordered to the north by the remainder of a wharf adjacent to the Thames River, to the east by a combination of commercial structures, warehouses and hard-ground, including roadways and car parking space. To the south the site is bound by foliage and hard standing car parking space adjacent to London Road, and to the west by Granby Road and associated foliage and shrubbery.

The site is approximately centred on the OS grid reference: TQ 62680 74392.

Proposed Works

The client is undertaking a Phase 1 Geoenvironmental Desk Study to ascertain the historical and current land use history of the Northfleet Kimberley Clark Papermill site and the potential for ground and groundwater contamination at the site. The desk study is a non-intrusive geoenvironmental assessment not requiring site works.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to comprise Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock formed approximately 72 to 94 million years ago in the Cretaceous Period.

Site-specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is a Low-Medium Risk from items of German air delivered UXO across the site. This assessment is based on the following factors:

- During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing with an average of 103.2 items of ordnance falling per 1,000 acres according to official Home Office bombing statistics. This was mainly due to the industrial capacity of the town and its position on the River Thames, with numerous factories and commercial ports located along the harbour area
- Kent Daily Bomb Mapping records numerous bomb incidents within the Northfleet area, although the mapping was recorded on small scale maps and thus it is not possible to determine the exact locations of individual bomb strikes, beyond establishing the approximate locality of the incidents.
- Northfleet and Medway Group War Diary written records record several bomb incidents within the vicinity of the site, most notably at the location of the Paper Mills directly north-east of the site.. No bomb incidents are recorded directly within the site boundary, although there are no major structures within the site boundary from which to identify the location of a bomb strike.
- Anecdotal evidence corroborates these written records, confirming Bowater Paper Mill did indeed suffer several bomb strikes.
- WWII-era aerial photography of the site from 1944 shows no obvious indications of bomb damage such as craters, or ground disturbances in the undeveloped portions of the site. The housing, situated in the south-eastern section of the site, also appears externally intact and undamaged. There is evidence of bomb damage in the vicinity of the site, and roofing repairs can be observed on the Paper Mills factory to the north-east of the site- see Annex M2.

UXO Risk Assessment

- The south of the site is not considered to have had ground cover conducive to the detection of UXO as it was occupied by predominantly undeveloped ground. UXO entry holes, which could be as small as 20cm in diameter and could have easily been obscured by the vegetation present within the site and its surrounds. The ground cover in the north of the site is considered to have been more conducive to the detection of UXO. This is because the site comprised of more developed land, including landscaped allotments, small structures and roadways
- The access frequency of access to the site is not considered to have been homogenous. The southern section of the site, comprising of predominantly undeveloped ground, is considered to have experienced a low degree of access, owing to the lack of structures. The northern section of the site is considered to have experienced a higher degree of access, due to the presence of on-site structures and roadways, and the proximity of the nearby Paper Mills factory. How often the allotment gardens in this area were accessed is wholly dependent upon how often each owner visited their allotment garden. The south-eastern section of the site was occupied by residential housing. It appears that the housing survived the war structurally intact. Therefore, it is thought likely that residents would have continued to live there and therefore conduct post-raid checks, for evidence of UXO. Generally, more frequent access increases the likelihood UXO could go noticed and reported
- To summarise, no positive evidence of on-site bomb strikes or bomb damage could be found. However, there is evidence of bomb strikes and bomb damage to roads and structures within the wider vicinity of the site, particularly in relation to the nearby former Bowater Paper Mill factory. Subsequently, although the evidence available does not indicate the UXO risk on site to be significantly elevated above the 'background level' of risk for Gravesend, the risk from UXO cannot be entirely discounted and has been designed as Low-Medium. As a result of this risk level, it is recommended that a UXO risk management plan is in place prior to intrusive works taking place and that any staff undertaking such works receive UXO awareness briefings.
-

The Risk from Allied UXO

- Anecdotal evidence sourced online suggests that the Bowater Paper Mills, situated immediately east of the northern section of the site, may have been requisitioned during the war for the production of weaponry. It has not been possible to completely verify the information, but is it considered likely that this would have involved the large-scale use and storage of explosives, as the available evidence indicates that the factory was used to build the components of weapons. The factory was also outside the site boundary. This factor is thus not considered to have any significant impact on the risk of Allied UXO contamination on-site.
- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

Post-WWII Redevelopment

- The site has been significantly redeveloped post-war. Historical OS mapping and current satellite imagery indicates that a large area of industrial structures and associated hard-ground has been developed on the previously mostly undeveloped land within the site boundary, which has subsequently been redeveloped. 1st Line Defence has found no evidence to suggest that any items of UXO were encountered during these prior post-war works on site.
- The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Northfleet site:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded

Contents

Executive Summary	II
Glossary	IV
Contents.....	V
Annexes	VII
Appendices	VII
1. Introduction	1
1.1. Background.....	1
2. Method Statement	2
2.1. Report Objectives.....	2
2.2. Risk Assessment Process.....	2
2.3. Sources of Information	2
3. Background to Bombing Records.....	3
3.1. General Considerations of Historical Research	3
3.2. German Bombing Records	3
3.3. Allied Records	3
4. UK Regulatory Environment and Guidelines	4
4.1. General	4
4.2. CDM Regulations 2015	4
4.3. The 1974 Health and Safety at Work etc. Act.....	4
4.4. CIRIA C681	5
4.5. Additional Legislation	5
5. The Role of Commercial UXO Contractors and The Authorities	6
5.1. Commercial UXO Specialists	6
5.2. The Authorities	6
6. The Site	7
6.1. Site Location	7
6.2. Site Description.....	7
7. Scope of the Proposed Works.....	7
7.1. General	7
8. Ground Conditions	7
8.1. General Geology	7
8.2. Site-Specific Geology.....	7
9. Site History	8
9.1. Introduction	8
9.2. Ordnance Survey Historical Maps.....	8
9.3. Pre-WWII Photography of the Site	9
10. Introduction to German Air Delivered Ordnance	10
10.1. General	10
10.2. Generic Types of WWII German Air Delivered Ordnance	10
10.3. Failure Rate of German Air Delivered Ordnance	11
10.4. UXB Ground Penetration	11

10.4.1.	<i>The J-Curve Effect Principle</i>	11
10.4.2.	<i>WWII UXB Ground Penetration Studies</i>	11
10.4.3.	<i>Site Specific Bomb Penetration Considerations</i>	12
10.5.	<i>V-Weapons</i>	12
11.	<i>The Likelihood of Contamination from German Air Delivered UXBs</i>	13
11.1.	<i>World War I</i>	13
11.2.	<i>World War II Bombing of the Urban District of Northfleet</i>	13
11.3.	<i>WWII Home Office Bombing Statistics</i>	14
11.4.	<i>Kent Daily Bomb Maps</i>	14
11.5.	<i>V-1 and Shells Daily Bomb Census Map</i>	15
11.6.	<i>Northfleet and Medway Group War Diary</i>	15
11.8.	<i>WWII-Era Aerial Photography</i>	16
11.9.	<i>Abandoned Bombs</i>	17
11.10.	<i>Bomb Disposal Tasks</i>	17
11.11.	<i>Evaluation of German Air Delivered UXO Records</i>	17
12.	<i>Introduction to Allied Ordnance</i>	19
12.1.	<i>General</i>	19
12.2.	<i>Defending the UK From Aerial Attack</i>	19
12.2.1.	<i>Anti-Aircraft Artillery (AAA)</i>	19
13.	<i>The Likelihood of Contamination from Allied Ordnance</i>	21
13.1.	<i>Introduction</i>	21
13.2.	<i>Military History of the Site of Proposed Works</i>	21
13.3.	<i>Evaluation of Contamination Risk from Allied UXO</i>	21
14.	<i>The Likelihood of UXO Contamination Summary</i>	23
15.	<i>The Likelihood that UXO Remains</i>	25
15.1.	<i>Introduction</i>	25
15.2.	<i>UXO Clearance</i>	25
15.3.	<i>Post-War Redevelopment</i>	25
16.	<i>The Likelihood of UXO Encounter</i>	26
16.1.	<i>Introduction</i>	26
16.2.	<i>Encountering Air Delivered Ordnance</i>	26
17.	<i>The Likelihood of UXO Initiation</i>	27
17.1.	<i>Introduction</i>	27
17.2.	<i>Initiating Air Delivered Ordnance</i>	27
18.	<i>Consequences of Initiation/Encounter</i>	28
18.1.	<i>Introduction</i>	28
18.2.	<i>Consequences of Detonation</i>	28
19.	<i>1st Line Defence Risk Assessment</i>	29
19.1.	<i>Risk Assessment Stages</i>	29
19.2.	<i>Assessed Risk Level</i>	29
20.	<i>Proposed Risk Mitigation Methodology</i>	30
20.1.	<i>General</i>	30
	<i>Bibliography</i>	31

Annexes

List of Report Annexes	
Annex A	Site Location Maps
Annex B	Recent Aerial Photography
Annex C	Client Provided Site Plan
Annex D	Pre and Post-WWII Historical Maps
Annex E	Pre-WWII Oblique Aerial Photography
Annex F	Example of UXO Entry Hole / The 'J-curve' Effect Principle
Annex G	Examples of UXO Incidents
Annex H	WWI Map of Air Raids and Naval Bombardments
Annex I	Luftwaffe Target / Reconnaissance Photography
Annex J	Kent Daily Bomb Mapping
Annex K	V-1 and Shells Daily Bomb Census Map
Annex L	Northfleet and Medway Group War Diary
Annex M	WWII-era RAF Aerial Photography of the Site & Damage Overlay

Appendices

List of Report Appendices	
Appendix i-iii	Examples of German Air-Delivered Ordnance
Appendix iv	Examples of Anti-Aircraft Projectiles

1st Line Defence Limited

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Northfleet, Gravesend, Kent
Client: GVR Geoservices Ltd

1. Introduction

1.1. Background

1st Line Defence has been commissioned by GVR Geoservices Ltd to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at Northfleet, Gravesend, Kent.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in CIRIA C681, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Northfleet, Gravesend, Kent. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and Kent History and Library Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied GVR Geoservices Ltd.
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'¹

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

¹ <http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/>.

4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII air bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams' judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

The site is located in Northfleet, in the borough of Gresham, Kent.

The site is bordered to the north by the remainder of a wharf adjacent to the Thames River, to the east by a combination of commercial structures, warehouses and hard-ground, including roadways and car parking space. To the south the site is bound by foliage and hard standing car parking space adjacent to London Road, and to the west by Granby Road and associated foliage and shrubbery.

The site is approximately centred on the OS grid reference: TQ 62680 74392.

Site location maps are presented in Annex A.

6.2. Site Description

The site comprises a large section of an industrial and commercial wharf area, located on the south side of the Thames estuary. Within the southern section is several large industrial and commercial warehouse structures of the former Kimberley-Clark Factory and associated hard ground. The northern section of the site comprises partially of a large warehouse structure, various smaller industrial structures, associated hard-ground, and wharf structures adjacent to the Thames River.

A recent aerial photograph and site plan are presented in Annex B and Annex C respectively.

7. Scope of the Proposed Works

7.1. General

The client is undertaking a Phase 1 Geoenvironmental Desk Study to ascertain the historical and current land use history of the Northfleet Kimberley Clark Papermill site and the potential for ground and groundwater contamination at the site. The desk study is a non-intrusive geoenvironmental assessment not requiring site works.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to comprise Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock formed approximately 72 to 94 million years ago in the Cretaceous Period.

8.2. Site-Specific Geology

Whilst geotechnical data was provided by GVR Geoservices Ltd, owing to this information relating to an area beyond the site boundary, it is not considered relevant for an assessment of the precise conditions on site.

9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in Annex D. See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	Scale	Description
1939	1:2,500	Pre-WWII OS mapping indicates the south of the site is occupied mainly by a large area of undeveloped land, labelled as Callybank. Individual rectangular plots of land are situated in the western part of this section, whilst a row of terraced houses is partially included within the eastern boundary. A Tramway line also intersects this section along the eastern and southern boundaries. The northern section of the site comprises more landscaped land, labelled as allotment gardens, and various small structures associated with the docklands area. Several small roadways and paths intersect this section, whilst the very northern section of the site comprises sediment adjacent to the Thames River. To the immediate north-east of the site boundary is a large industrial Paper Mill, structure. According to historical sources this structure, known as The Bowater Paper Mill, was established in 1914 and then expanded to include the site boundary by 1960. The Paper Mill was closed down in 1972. To the south lies London Road, to the west Granby Road, and to the north the Thames River.

Post-WWII		
Date	Scale	Description
1946	1:10,560	Post-WWII OS mapping of a slightly lower quality shows no major structural developments occurred within the site boundary or its immediate vicinity during the war.
1967	1:2,500	Post-WWII OS mapping from a later date shows major structural developments have occurred on-site. The Paper Mill factory to the north-east of the site has expanded to include the land encompassing the site. Various industrial structures are now included within the site boundary and its vicinity.

9.3. Pre-WWII Photography of the Site

Pre-WWII aerial photography has been obtained from the Aerofilms collection available from *Britain From Above*. This imagery is presented in Annex E. See below for a description:

Title of Photograph	Comments
August 1932	The oblique image partially covering the site corroborates the layout of the site presents in historical OS mapping. The northern section can clearly been seen to comprise landscaped allotments, whilst the southern section of the site appears entirely undeveloped. The large Bowater Paper Mill can be observed immediately west of the site.
12 th May 1939	This oblique covering the entire site from a later date again corroborates the layout of the site presented in historical OS mapping.

10. Introduction to German Air Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German air delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Air Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German air delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in Appendices i-iii.

Generic Types of WWII German Air Delivered Ordnance		
Type	Frequency	Likelihood of detection
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex F). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

10.3. Failure Rate of German Air Delivered Ordnance

It has been estimated that 10% of WWII German air delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in Annex G.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Effect Principle

J-curve is the term used to describe the characteristic curve commonly followed by an air delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see Annex F).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters should be used:

- WWII geology – Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the flying bomb or pilotless aircraft, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today. Even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time. Therefore, V-weapons are referenced in this report not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships, as well as Gotha and Giant fixed-wing aircraft. A WWI map of air raids and naval bombardments across England is presented in Annex H. Although several WWI bombs were recorded in the general area, this source does not record any WWI bombing incidents to have affected the site.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of the Urban District of Northfleet

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing with an average of 103.2 items of ordnance falling per 1,000 acres according to official Home Office bombing statistics, as represented in the table below. This was mainly due to the industrial capacity of the town and its position on the River Thames, with numerous factories and commercial ports located along the harbour area. The town was thus a prominent target for Luftwaffe attacks, with prominent industrial entities such as the Bowater Paper Mill attracting bombing raids, which were just east of the site (Luftwaffe target photography presented in Annex I).

The town's position on the Thames Estuary, in close proximity to London, made it an ideal target for German bomber aircraft returning from a raid on the capital and to undertake 'tip and run' style attacks prior to returning across the channel.

Records of bombing incidents in the civilian areas of the Urban District of Northfleet were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German air delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Urban District of Northfleet between 1940 and 1945.

Record of German Ordnance Dropped on the Urban District of Northfleet		
Area Acreage		3,770
Weapons	High Explosive bombs (all types)	364
	Parachute mines	3
	Oil bombs	7
	Phosphorus bombs	0
	Fire pots	9
	Pilotless aircraft (V-1)	5
	Long range rocket bombs (V-2)	1
Total		389
Number of Items per 1,000 acres		103.2

Source: Home Office Statistics

This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Kent Daily Bomb Maps

To understand the density of bombing in the region of the site areas, bomb maps covering the entirety of Kent were obtained from the Kent History and Library Centre for the purposes of this assessment. Whilst the mapping is a useful resource for understanding the general locations of incidents across individual districts on a daily basis, the mapping was recorded on small scale maps that depicted the whole county. Consequently, it is not possible to determine the exact locations of individual strikes, beyond establishing the approximate locality of the incident.

Furthermore, it is typical that single plotted strikes may represent numerous incidents of bombing. This is especially likely in cases of incendiary bombing, as incendiary bombs were frequently deployed in high numbers. As a result, this mapping has been used largely as an initial reference tool, which has subsequently been cross-referenced with other resources to fully appreciate the risk to the site area.

Examples of the Kent daily bomb maps are presented in Annex J. Unfortunately, due to the small-scale of the mapping it has not been possible to precisely overlay the site areas onto the mapping. Map editions plotting incidents on or close to the approximate site area are discussed in the table below.

Kent Daily Bomb Maps	
Date Range	Comments
28 th August 1940	Incendiary bombing recorded in the vicinity of the site.
8 th September 1940	Incendiary bombing recorded to the east of the site.
14 th September 1940	Two HE bomb incidents recorded in the wider vicinity east of the site, on the Thames River
5 th October 1940	Incendiary bombing recorded in the vicinity of the site.
23 rd October 1940	One HE bomb incident recorded in the vicinity of the site.
14 th September 1940	One HE bomb incident and incendiary bombing recorded in the wider vicinity west of the site.
17 th March 1941	One HE bomb incident recorded in the vicinity of the site.
23 rd March 1941	One HE bomb incident recorded in the vicinity of the site.

11.5. V-1 and Shells Daily Bomb Census Map

Bomb plot maps showing the location of all the V-1 and shell incidents in the County of Kent was compiled by the Kent Messenger in 1944. Due to the large scale of the maps, only the incidents wherein the radius of the incident overlapped with the site have been listed below. The sections covering the area of the site were checked and are presented in Annex K.

V-1 and Shells Daily Bomb Census Maps	
Date Range	Comments
19 th July 1944	One V-1 Bomb Strike recorded to the south-west of the site.

11.6. Northfleet and Medway Group War Diary

War diaries covering the Urban District of Northfleet and the wider Medway group area were obtained from the Kent History and Library Centre. These diaries were likely compiled by local Air Raid Precaution (ARP) personnel and volunteers during the war and provide the location, time, type of bomb and damage caused by bombing incidents across numerous areas in the Urban District of Northfleet. This record set is not believed to be comprehensive and does not appear to cover certain periods of the war. .

A transcription of the associated written records for bombs which fell in the site area is presented in the table below. The relevant records are presented in Annex L.

Northfleet and Medway Group War Diary			
Date	Location	Type of Bomb (s)	Comments
14 th September 1940	Northfleet 083/932	4 HE Bombs and Incendiary Bomb	Minor bombing. 4 HE's in pulp yard of Bowater Paper Mills and Incendiary Bombs found in vicinity
12 th December 1940	Northfleet 074/930	2 HE Bombs and 1 Oil Bomb	Bowater Paper Mills. 1.Bs exploded in Boiler Room. 1 HE UXB in fitters shop. Production suspended
23 rd October 1940	Northfleet 074/930	500kg HE Bomb	One large HE exploded in Cretehall Road
11 th February 1944	Northfleet 063/931	2 HE bombs	Factory Road

11.7. Anecdotal Accounts of Bombing in Northfleet

Sourced from the BBC's 'WW2 People's War', an online archive of anecdotal accounts of air raids drawn from the experiences of British citizens alive during the War. In this extract, a Peter Rowdan details an air raid in Northfleet:

*"In 1943 I left school at the age of 14 and he went to work at Bowater's making munitions they manufactured Bofor guns and Triple oerlican guns which were mounted in coal railway wagons. The factory was bombed twice during the war... Bowater's yard had a massive shower of what look like leaves falling from the sky but it was actually pieces of aluminium shrapnel from the V2 rocket."*²

This anecdote confirms that the Bowater factory complex, immediately west of the site, did indeed suffer multiple bomb strikes, including from a V-2 weapon.

11.8. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photography provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (see Annex M).

WWII-Era Aerial Photography	
Date	Description
18 th April 1944	This aerial image taken during the later stages of the war covers most of the site boundary, albeit not a small section of the southern part of the site. As with pre-war photography, the site appears to be predominantly undeveloped ground. No obvious indications of bomb damage, such as craters, or areas of disturbed ground, are evident within this image. The residential housing situated in the south-eastern section of the site appears externally intact, with no indications of bomb damage such as clearance or missing roofs. It appears that the Paper Mills factories, just east of the site, have been damaged. Some of the roofing is white – white tiled roofing is often indicative of repair work resulting from bomb damage. A visual overlay highlighting the damage to the Paper Mill factories is presented in Annex M2.

² <https://www.bbc.co.uk/history/ww2peopleswar/stories/82/a4401082.shtml>

11.9. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.10. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) no longer processes commercial requests for information. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, GVR Geoservices Ltd will be advised.

11.11. Evaluation of German Air Delivered UXO Records

Factors	Conclusion
Density of Bombing <i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.</i>	During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing with an average of 103.2 items of ordnance falling per 1,000 acres according to official Home Office bombing statistics. This was mainly due to the industrial capacity of the town and its position on the River Thames, with numerous factories and commercial ports located along the harbour area. Kent Daily Bomb Mapping records numerous bomb incidents within the Northfleet area, although the mapping was recorded on small scale maps and thus it is not possible to determine the exact locations of individual bomb strikes, beyond establishing the approximate locality of the incidents. Northfleet and Medway Group War Diary written records record several bomb incidents within the vicinity of the site, most notably at the location of the Paper Mills directly north-east of the site.. No bomb incidents are recorded directly within the site boundary, although there are no major structures within the site boundary from which to identify the location of a bomb strike. Anecdotal evidence corroborates these written records, confirming Bowater Paper Mill did indeed suffer several bomb strikes.

Damage <i>If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.</i>	WWII-era aerial photography of the site from 1944 shows no obvious indications of bomb damage such as craters, or ground disturbances in the undeveloped portions of the site. The housing, situated in the south-eastern section of the site, also appears externally intact and undamaged. There is evidence of bomb damage in the vicinity of the site, and roofing repairs can be observed on the Paper Mills factory to the north-east of the site- see Annex M2. This damage to the Paper Mills complex is also recorded in written records, matching with the observable damage on WWII-era aerial photography.
Ground Cover <i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i>	The ground cover is not considered to be homogenous across the site boundary. The south of the site is not considered to have had ground cover conducive to the detection of UXO as it was occupied by predominantly undeveloped ground. UXO entry holes, which could be as small as 20cm in diameter and could have easily been obscured by the vegetation present within the site and its surrounds. The ground cover in the north of the site is considered to have been more conducive to the detection of UXO. This is because the site comprised of more developed land, including landscaped allotments, small structures and roadways.
Access Frequency <i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.</i>	The access frequency of access to the site is not considered to have been homogenous. The southern section of the site, comprising of predominantly undeveloped ground, is considered to have experienced a low degree of access, owing to the lack of structures. The northern section of the site is considered to have experienced a higher degree of access, due to the presence of on-site structures and roadways, and the proximity of the nearby Paper Mills factory. How often the allotment gardens in this area were accessed is wholly dependent upon how often each owner visited their allotment garden. The south-eastern section of the site was occupied by residential housing. It appears that the housing survived the war structurally intact. Therefore, it is thought likely that residents would have continued to live there and therefore conduct post-raid checks, for evidence of UXO. Generally, more frequent access increases the likelihood UXO could go noticed and reported.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

12. Introduction to Allied Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

12.2. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.2.1. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	Description			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LAA Ammunition	Gun type	Calibre	Shell Weight	Shell Dimensions
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as "Z" batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding air delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Air Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at Appendix iv.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Military History of the Site of Proposed Works

Anecdotal evidence sourced online suggests that the Bowater Paper Mills, situated immediately east of the northern section of the site, may have been requisitioned during the war for the production of weaponry. It has not been possible to completely verify the information, but it is not considered likely that this would have involved the large-scale use and storage of explosives. Instead anecdotal accounts suggest that the factory was used to produce gun components. The factory was also outside the site boundary. Thus the factory is not considered to have any significant impact on the risk of Allied UXO contamination on-site.

It should also be highlighted that there is no evidence that the site itself formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

13.3. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Allied UXO Contamination	Conclusion
Military Camps <i>Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.</i>	1 st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences <i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i>	1 st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 3.5km east of the site, however the range of a projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.
Home Guard Activity <i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i>	Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.

Defensive Positions <i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i>	There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.
Training or firing ranges <i>Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.</i>	No evidence of training or firing ranges could be found within the site or surrounding area.
Defensive Minefields <i>Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.</i>	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture <i>Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.</i>	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields <i>Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.</i>	The site was not situated within the perimeters or vicinity of a military airfield.

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German air delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, post-war aerial imagery, Kent Daily Bomb Census Mapping, Medway Group War Diaries, WWII-era aerial imagery, in-house data and online sources The record set is of generally satisfactory quality. Although some incidents and evidence of damage are corroborated across the record-set, there are many discrepancies owing to the uncomprehensive nature of many sources.
German Aerial Delivered Ordnance	- During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing with an average of 103.2 items of ordnance falling per 1,000 acres according to official Home Office bombing statistics. This was mainly due to the industrial capacity of the town and its position on the River Thames, with numerous factories and commercial ports located along the harbour area - Kent Daily Bomb Mapping records numerous bomb incidents within the Northfleet area, although the mapping was recorded on small scale maps and thus it is not possible to determine the exact locations of individual bomb strikes, beyond establishing the approximate locality of the incidents. - Northfleet and Medway Group War Diary written records record several bomb incidents within the vicinity of the site, most notably at the location of the Paper Mills directly north-east of the site.. No bomb incidents are recorded directly within the site boundary, although there are no major structures within the site boundary from which to identify the location of a bomb strike. - Anecdotal evidence corroborates these written records, confirming Bowater Paper Mill did indeed suffer several bomb strikes. - WWII-era aerial photography of the site from 1944 shows no obvious indications of bomb damage such as craters, or ground disturbances in the undeveloped portions of the site. The housing, situated in the south-eastern section of the site, also appears externally intact and undamaged. There is evidence of bomb damage in the vicinity of the site, and roofing repairs can be observed on the Paper Mills factory to the north-east of the site- see Annex M2. - The south of the site is not considered to have had ground cover conducive to the detection of UXO as it was occupied by predominantly undeveloped ground. UXO entry holes, which could be as small as 20cm in diameter and could have easily been obscured by the vegetation present within the site and its surrounds. The ground cover in the north of the site is considered to have been more conducive to the detection of UXO. This is because the site comprised of more developed land, including landscaped allotments, small structures and roadways - The access frequency of access to the site is not considered to have been homogenous. The southern section of the site, comprising of predominantly undeveloped ground, is considered to have experienced a low degree of access, owing to the lack of structures. The northern section of the site is considered to have experienced a higher degree of access, due to the presence of on-site structures and roadways, and the proximity of the nearby Paper Mills factory. How often the allotment gardens in this area were accessed is wholly dependent upon how often each owner visited their allotment garden. The south-eastern section of the site was occupied by residential housing. It appears that the housing survived the war structurally intact. Therefore, it is thought likely that residents would have continued to live there and therefore conduct post-raid checks, for evidence of UXO. Generally, more frequent access increases the likelihood UXO could go noticed and reported.

	To summarise, no positive evidence of on-site bomb strikes or bomb damage could be found. However, there is evidence of bomb strikes and bomb damage to roads and structures within the wider vicinity of the site, particularly in relation to the nearby former Bowater Paper Mill factory. Subsequently, although the evidence available does not indicate the UXO risk on site to be significantly elevated above the 'background level' of risk for Gravesend, the risk from UXO cannot be entirely discounted and has been designed as Low-Medium. As a result of this risk level, it is recommended that a UXO risk management plan is in place prior to intrusive works taking place and that any staff undertaking such works receive UXO awareness briefings.
Allied Ordnance	- Anecdotal evidence sourced online suggests that the Bowater Paper Mills, situated immediately east of the northern section of the site, may have been requisitioned during the war for the production of weaponry. It has not been possible to completely verify the information, but it is considered likely that this would have involved the large-scale use and storage of explosives, as the available evidence indicates that the factory was used to build the components of weapons. The factory was also outside the site boundary. This factor is thus not considered to have any significant impact on the risk of Allied UXO contamination on-site. - There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

The site has been significantly redeveloped post-war. Historical OS mapping and current satellite imagery indicates that a large area of industrial structures and associated hard-ground has been developed on the previously mostly undeveloped land within the site boundary, which has subsequently been redeveloped. 1st Line Defence has found no evidence to suggest that any items of UXO were encountered during these prior post-war works on site.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed works would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Air Delivered Ordnance

Since an air delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Air Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production.

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall Low-Medium Risk from German and anti-aircraft unexploded ordnance at the site of proposed works. There is also an assessed Low Risk from Allied ordnance.

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Allied Anti-Aircraft Artillery Projectiles		✓		
Allied Land Service and Small Arms Ammunition		✓		

Please note – although the risk from unexploded ordnance on this site has been assessed as ‘Low’, this does not mean there is ‘no’ risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the ‘Proposed Works’ section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at Northfleet, Gravesend, Kent:

Type of Work	Recommended Mitigation Measure
All Works	- UXO Risk Management Plan It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. - Site Specific UXO Awareness Briefings to all personnel conducting intrusive works. As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

19/05/23

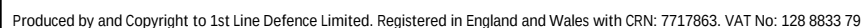
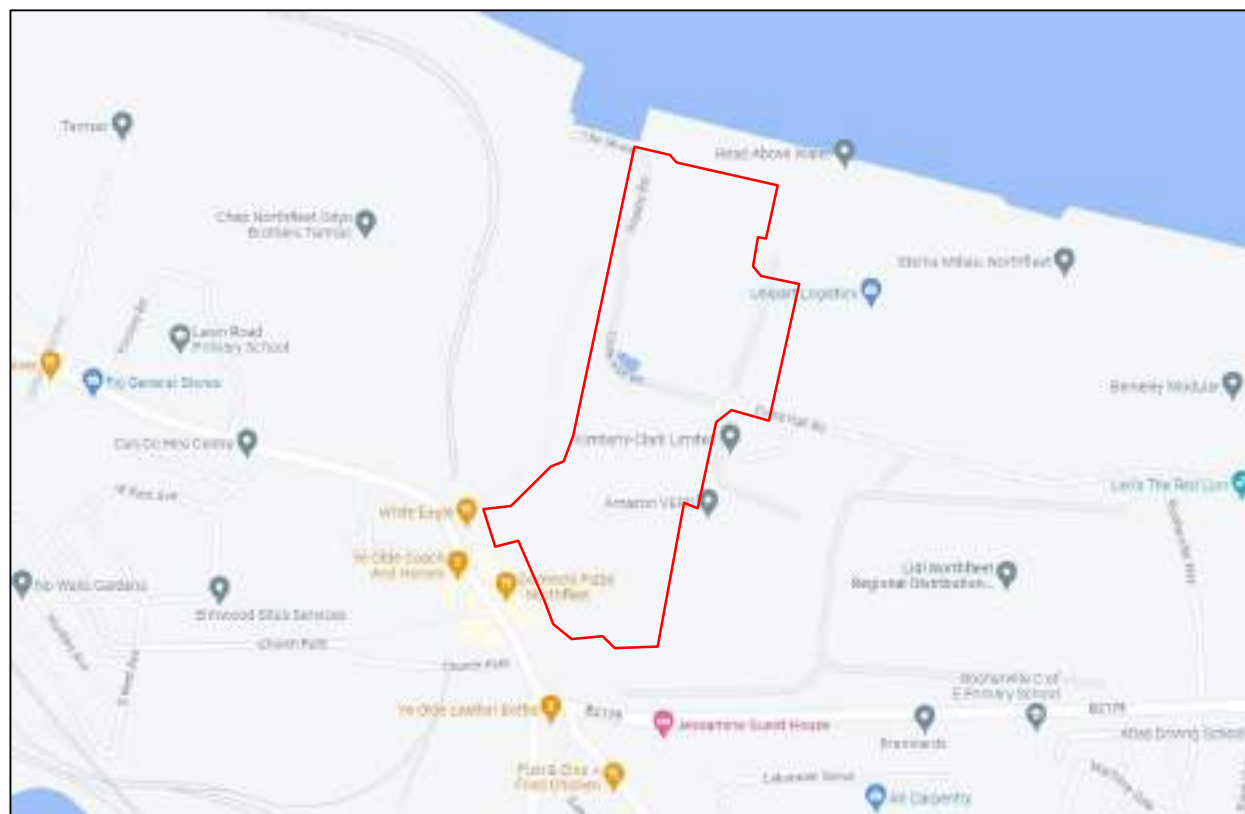
This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

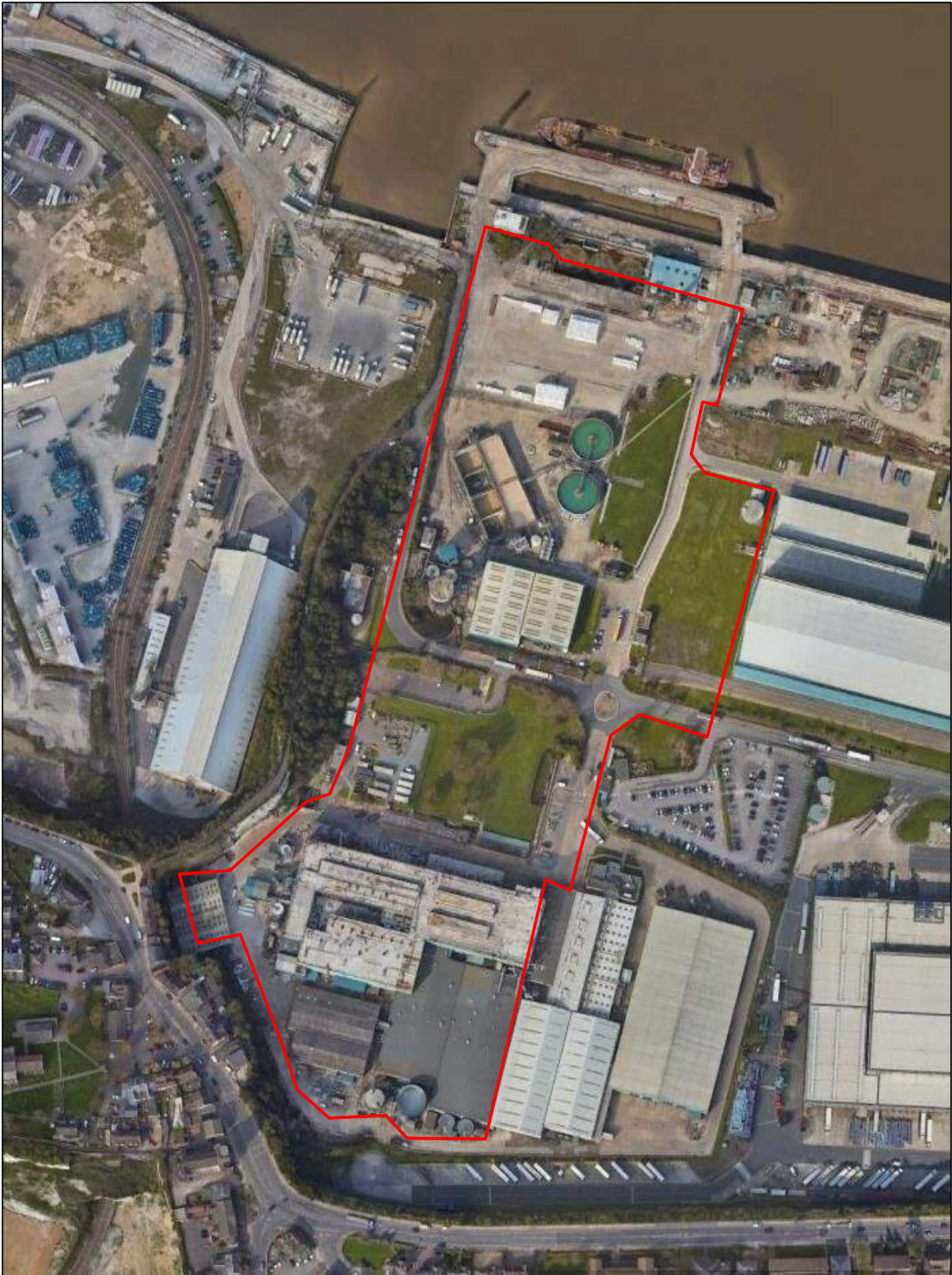
Bibliography

- Bates, H. E., *Flying Bombs over England*, Frogletts Publications Ltd., 1994
- Dobinson, C., *AA Command: Britain's Anti-Aircraft Defences of the Second World War*, Methuen., 2001
- Fegan, T., *The 'Baby Killers': German Air raids on Britain in the First World War*, Leo Cooper Ltd., 2002
- Fleischer, W., *German Air-Dropped Weapons to 1945*, Midland Publishing., 2004
- Jappy, M. J., *Danger UXB: The Remarkable Story of the Disposal of Unexploded Bombs during the Second World War*, Channel 4 Books., 2001
- Price, A., *Blitz on Britain, The Bomber Attacks on the United Kingdom 1939 – 1945*, Purnell Book Services Ltd., 1977
- Ramsey, W., *The Blitz Then and Now, Volumes 1,2 & 3*, Battle of Britain Prints International Ltd., 1987, 1988 & 1990
- Scofield, J., *Modern Military Matters.*, Council for British Archaeology., 2004
- Stone, K., et al., *Unexploded Ordnance (UXO) A Guide For The Construction Industry (C681).*, CIRIA, 2009
- Whiting, C., *Britain Under Fire: The Bombing of Britain's Cities 1940-1945*, Pen & Sword Books Ltd., 1999

This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

This report was written by, is owned by and is copyrighted to 1st Line Defence Limited. It contains important 1st Line Defence information which is disclosed only for the purposes of the client's evaluation and assessment of the project to which the report is about. The contents of this report shall not, in whole or in part be used for any other purpose apart from the assessment and evaluation of the project; be relied upon in any way by the person other than the client, be disclosed to any affiliate of the client's company who is not required to know such information, nor to any third party person, organisation or government, be copied or stored in any retrieval system, be reproduced or transmitted in any form by photocopying or any optical, electronic, mechanical or other means, without prior written consent of the Managing Director, 1st Line Defence Limited, Unit 3, Maple Park, Essex Road, Hoddesdon EN11 0EX. Accordingly, no responsibility or liability is accepted by 1st Line Defence towards any other person in respect of the use of this report or reliance on the information contained within it, except as may be designated by law for any matter outside the scope of this report.





1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

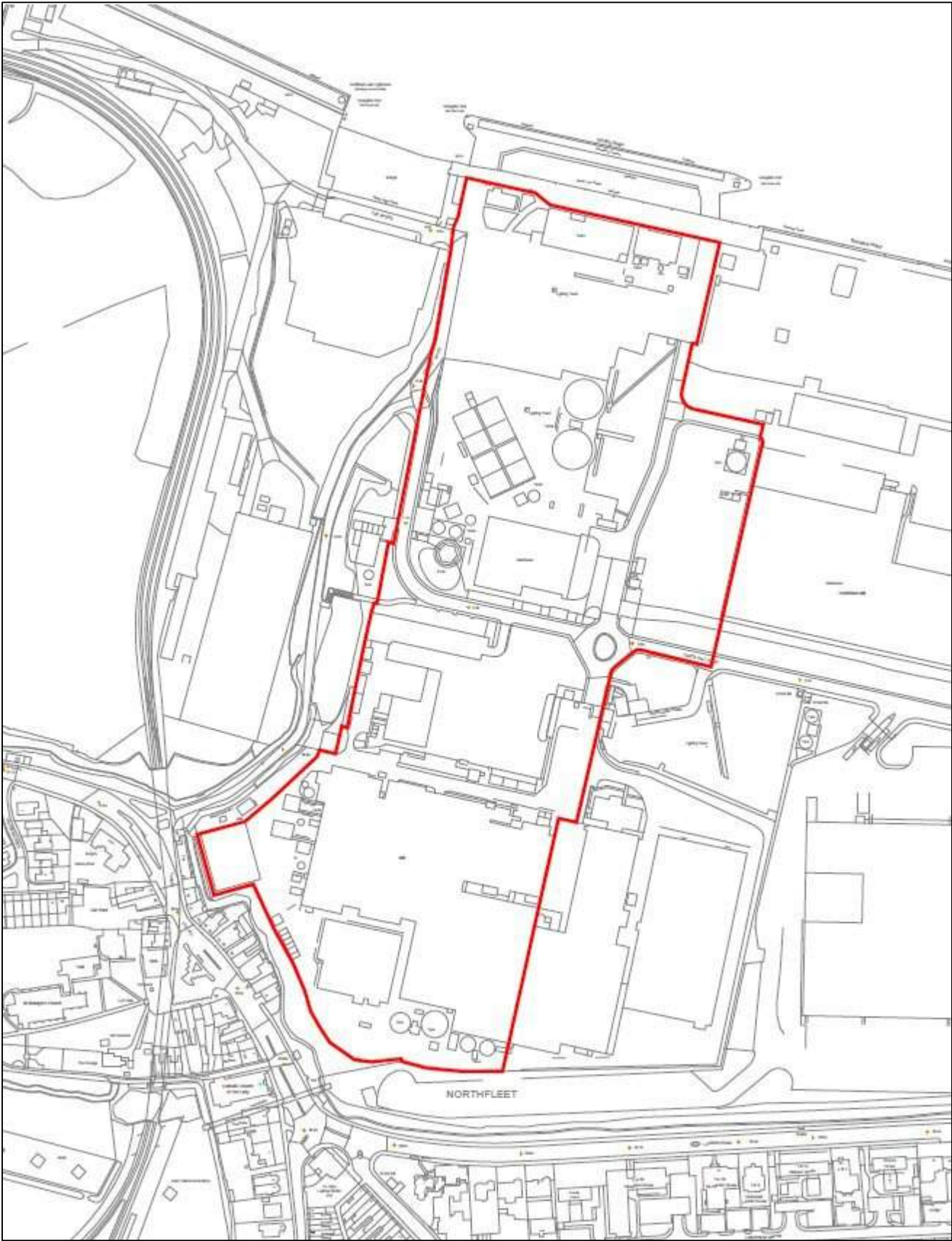
Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Google Earth™ Mapping Services

— Approximate site boundary

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

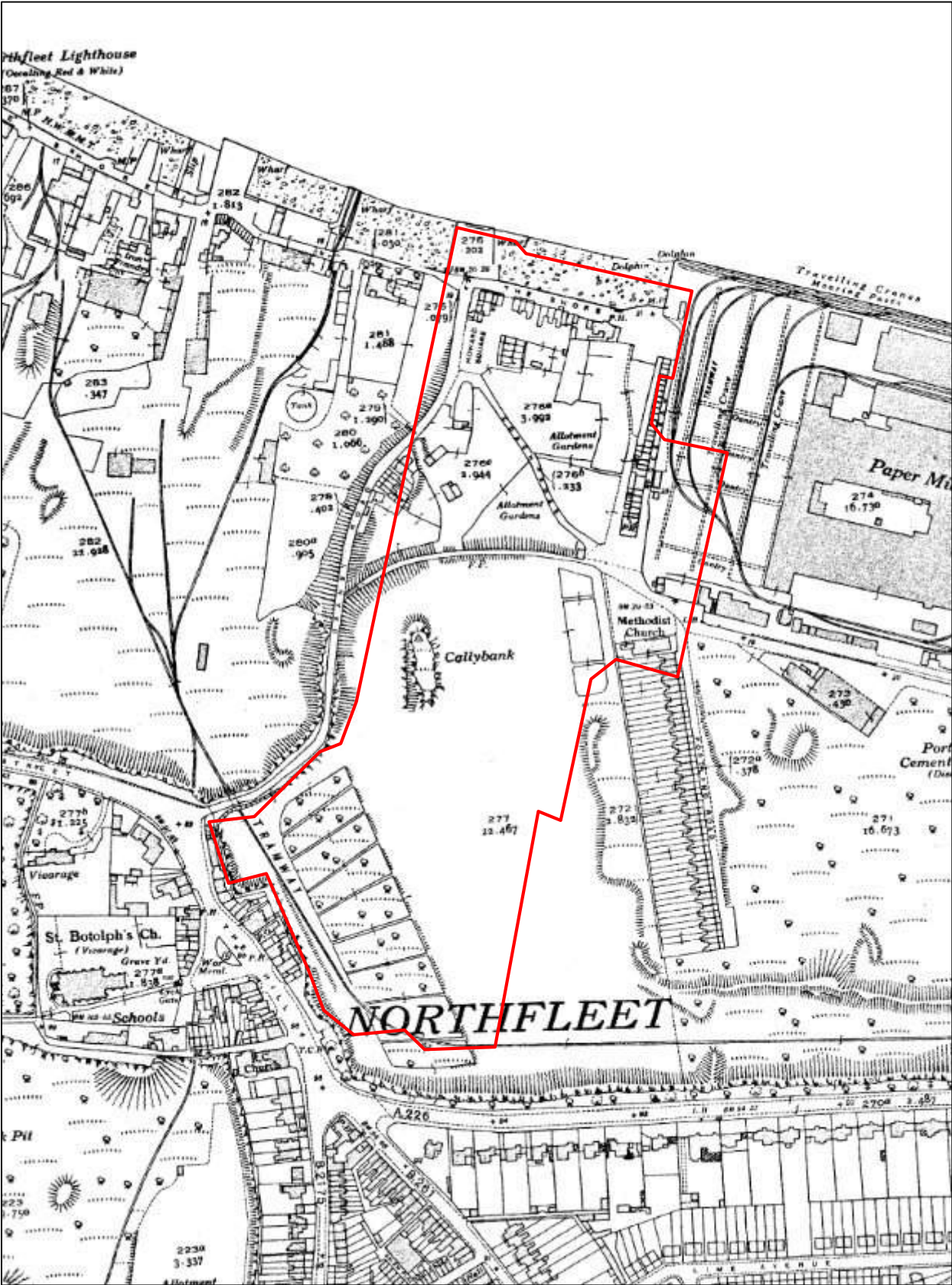
— Approximate site boundary

Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: GVR Geoservices Ltd

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

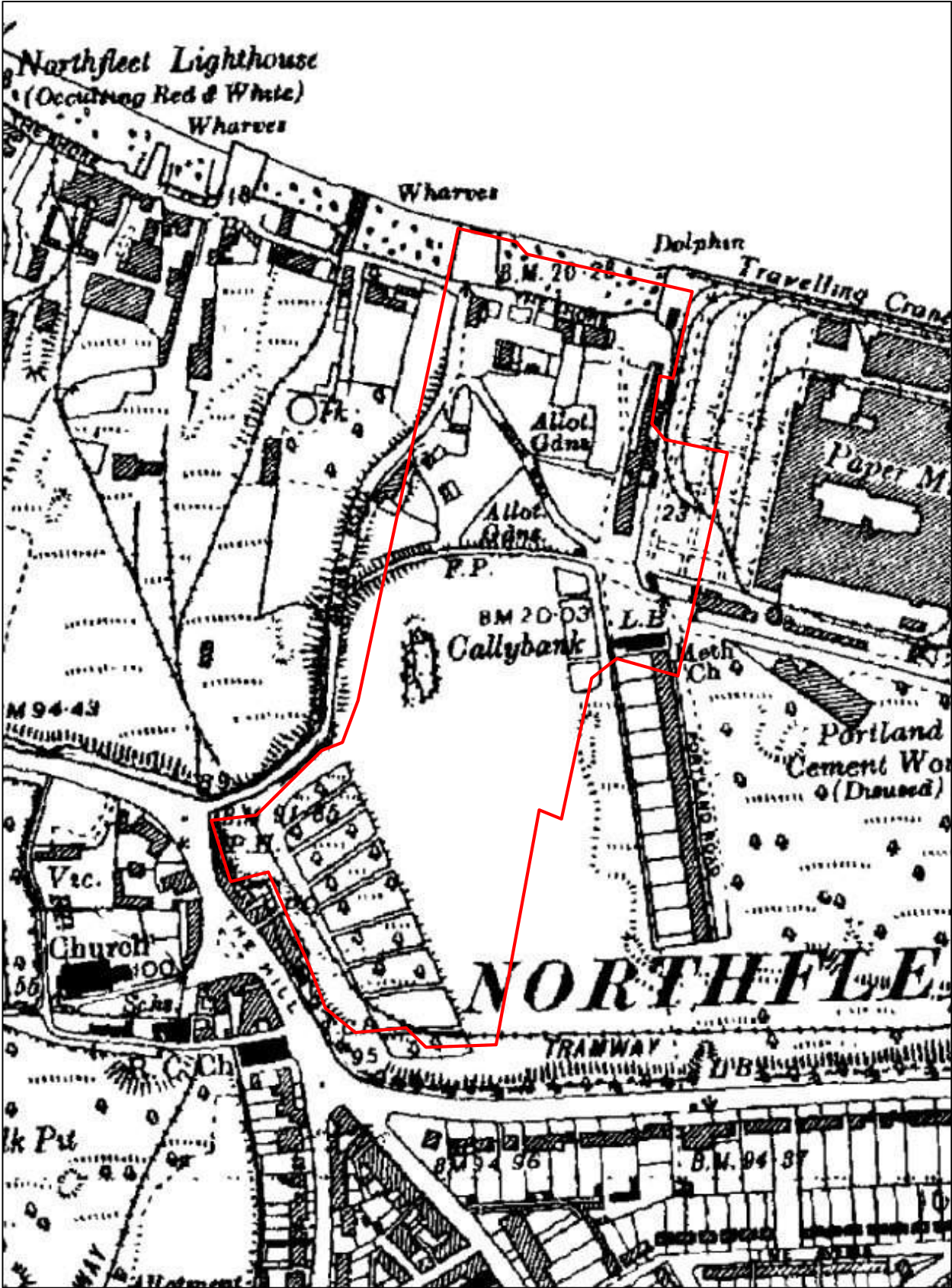
Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Landmark Maps

— Approximate site boundary

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

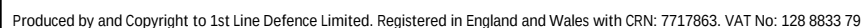
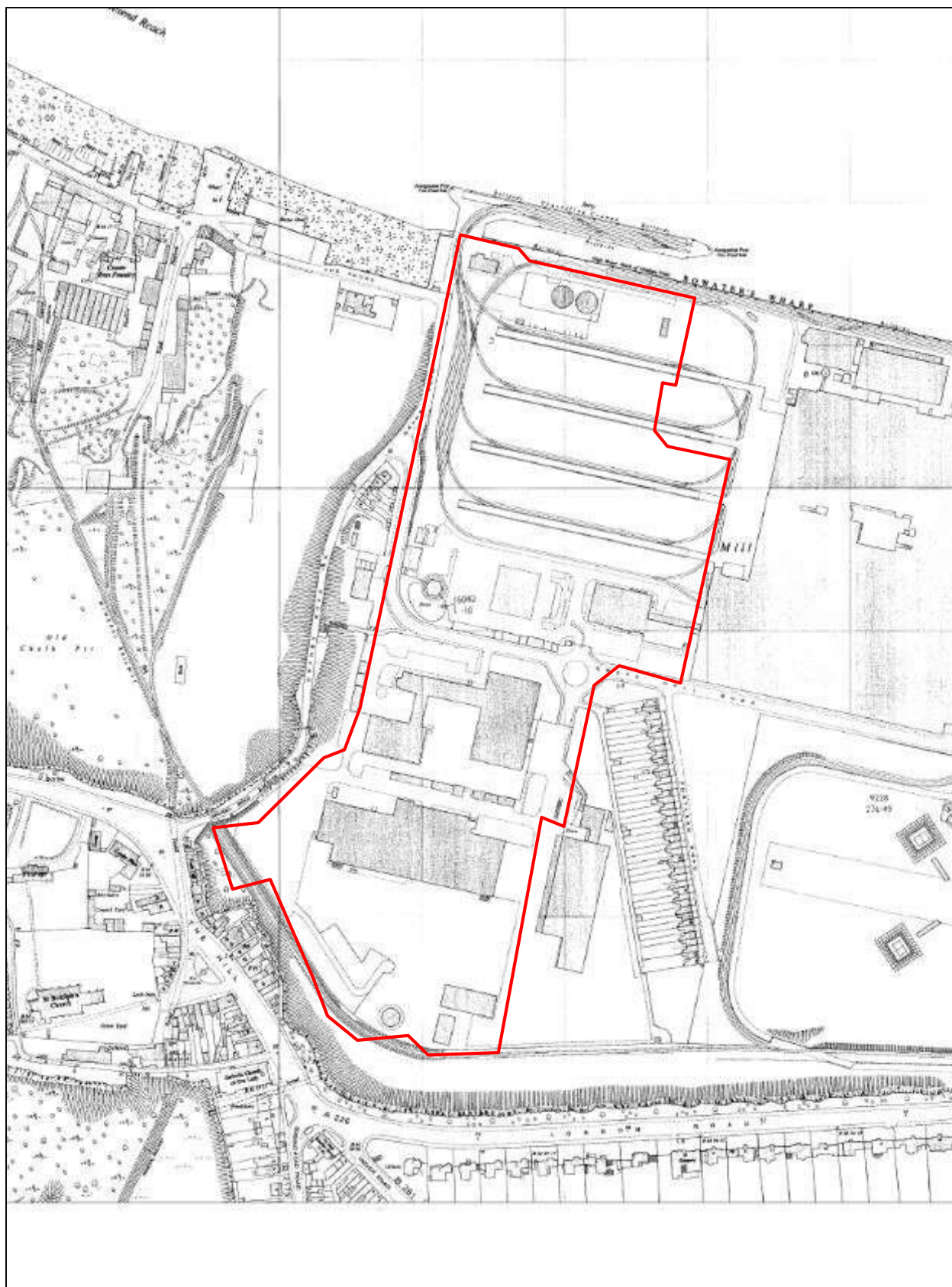
Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

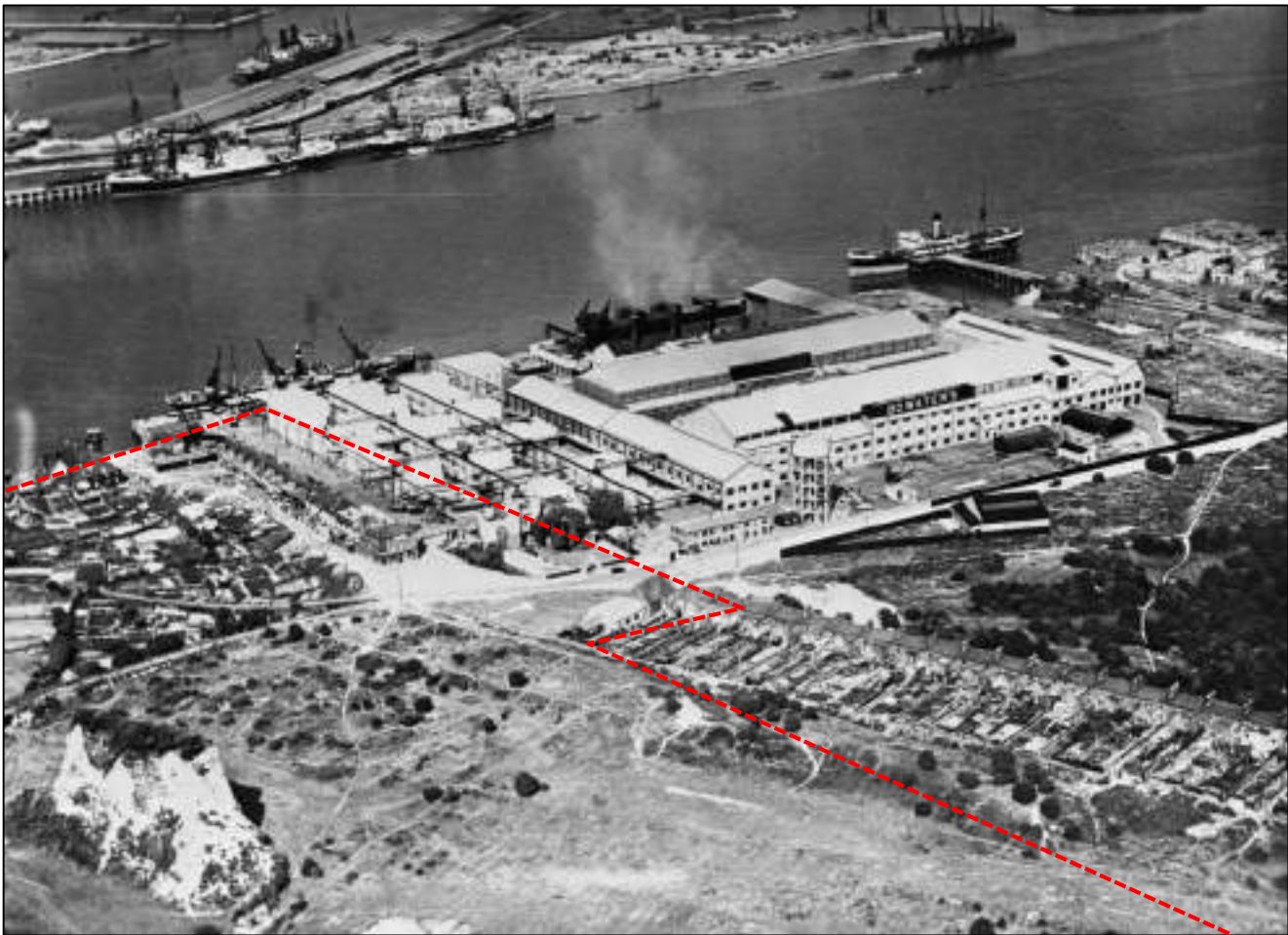
Source: Landmark Maps

— Approximate site boundary

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79



Approximate Partial Site Area.



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

-- Approximate site boundary

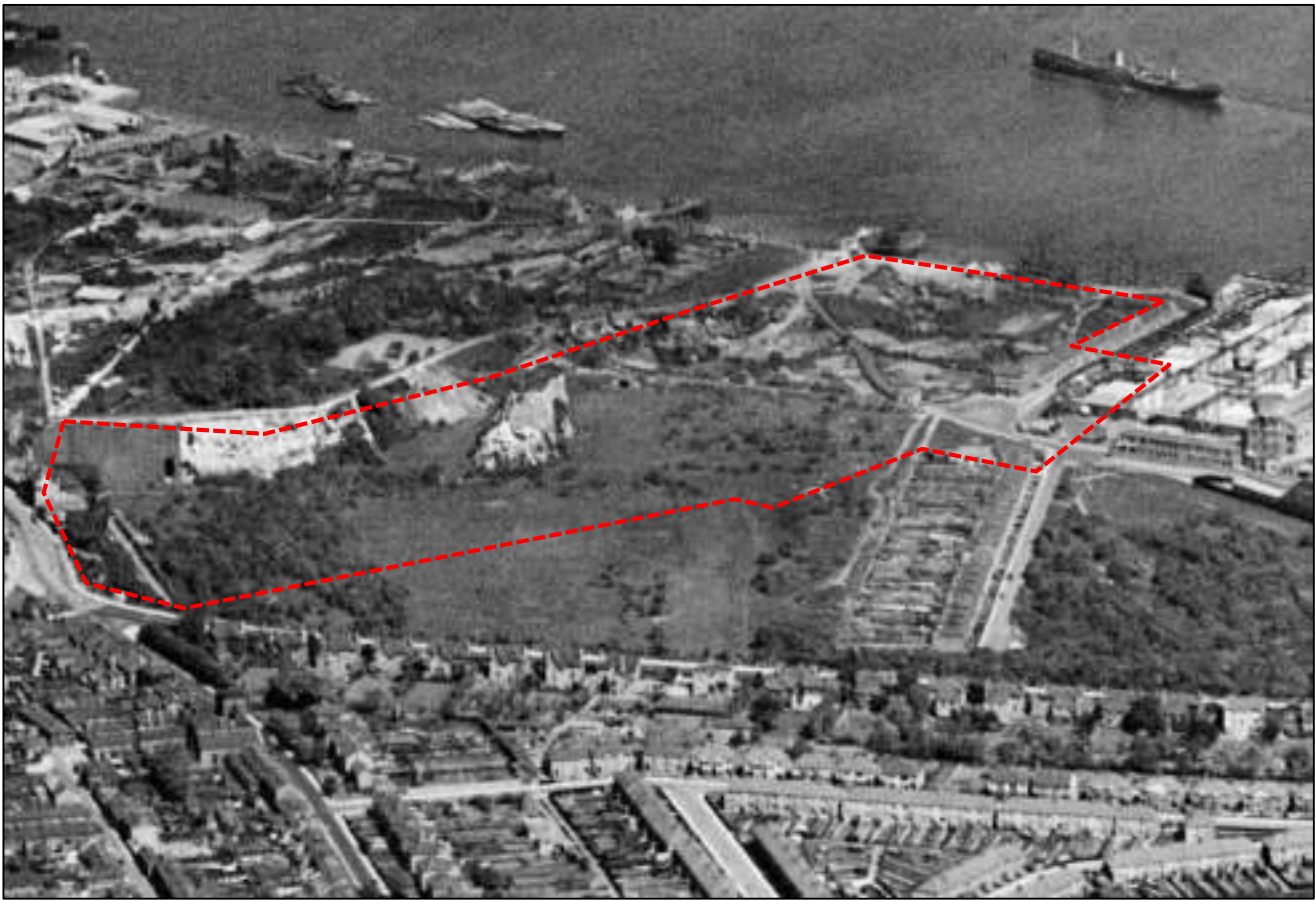
Project: Northfleet, Gravesend, Kent

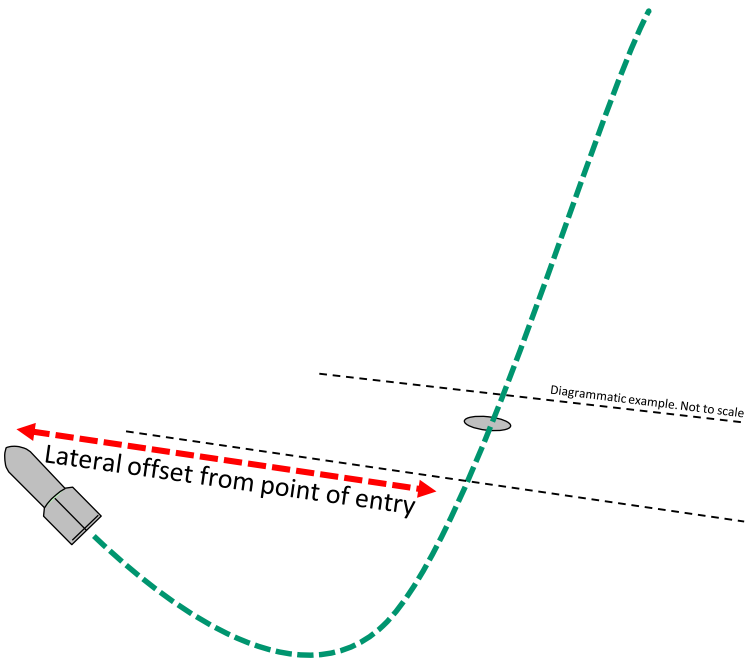
Ref: DA11104a-00

Source: Britain From Above

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79

Approximate Site Area.





Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows a 250kg unexploded bomb found in Bermondsey in 2015, pointing upwards, demonstrating 'J-curve'.

One of the most common scenarios for UXO going unnoticed was when a UXB fell into a 'bomb site' (such as the area shown Top Left), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (Left).



BBCNEWS

Bermondsey bomb: World War Two device safely removed



An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (230kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

Two primary schools were closed and hundreds of homes were evacuated as a precaution.

A cordon and 650ft (200m) exclusion zone was lifted at about 18:15 GMT as the bomb was removed to a quarry in Kent to be detonated, police said.

The Metropolitan Police force said the device was a 'SA' 250kg WW2 German air-dropped bomb, known to the Army's Royal Logistic Corps bomb-disposal experts.

250kg German HE Bomb, March 2015

BBCNEWS

WW2 bomb found near London City Airport blown up



An unexploded World War Two bomb found near London City Airport has been detonated.

The 500kg device was discovered at the King George V Dock on Sunday during planned work at the airport.

It was closed and all flights were cancelled on Monday after an exclusion zone was put in place.

The detonation, which took place off Shoeburyness, Essex, was postponed on Tuesday because of high winds and dangerous conditions for divers.

The 1.5m-long German bomb - which was found in a bed of silt, 15m underwater - was carefully removed from the Thames and placed in a secure location a mile away from the coast of Essex.

500kg German HE Bomb, February 2018

BBCNEWS

Exeter WW2 bomb is detonated after homes evacuated



More than 2,600 households and 12 university halls of residence were cleared before the 2,200lb (1,000kg) device was destroyed on Saturday.

Police said the blast left a crater about the size of a double-decker bus.

Police have reported large pieces of metal debris hitting buildings and said some properties in the 100m (330ft) exclusion zone had sustained "structural damage".



1000kg German HE bomb, February 2021

BBCNEWS

Great Yarmouth: Huge blast after unplanned WW2 bomb detonation



A World War Two bomb found in Great Yarmouth has detonated while work was being done to defuse it, causing a huge blast that was heard for miles.

Army specialists were attempting to disarm it when there was an unplanned detonation at about 17:00 GMT.

People on social media said they heard a loud bang and felt buildings shake 15 miles (24km) away.

There have been no reports of injuries among the Army, emergency services or the public, Norfolk Police said.

Cordons were put in place when the bomb was first discovered close to two gas pipes on Tuesday, and work began to make it safe.

250kg German HE Bomb, February 2023

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from *FaintSquares News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:30 a.m. One person was injured, the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told *The Local*. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013

BBC

NEWS

World War II bomb kills three in Germany



A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Clara Langescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 30 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006



June 2006

Unexploded Second World War bomb discovered under Somerset footpath

By Rebecca Daily Price, The Somerset Times, 21 Dec 2019



The unexploded bomb was found in a field.

Two unexploded bombs dropped in 1940 during the Battle of Britain are found in a field in Somerset.

Unexploded WW2 bomb found at Kenting Pool, Bridgend

21 August 2018 (Last updated on 11 Oct)



Unexploded bomb found in Kenting Pool, Bridgend.

Unexploded bomb found in Kenting Pool, Bridgend.

Mortar thought to be from WWII found on Oshawa's Camp-X grounds

August 18, 2018 10:40 am



A mortar shell thought to be from WWII was found on Oshawa's Camp-X grounds.

Unexploded bomb found in farmer's field

21 Dec 2019



Unexploded bomb found in farmer's field.

Royal Navy bomb disposal experts remove a World War Two shell discovered in a nature reserve

A World War Two bomb was discovered in a Plymouth nature reserve.

A bomb disposal expert removed the shell and partially dug it up.

Royal Navy experts removed the explosive today before disposing of it.



Holiday beach cordoned off after landslide sends more than a THOUSAND Second World War bombs and rockets tumbling onto the sands

- Beach cordoned off after landslide which exposed the huge arsenal at Mappleton, East Riding
- A dog walker stumbled across the deadly Etonian Saturday and 15-controlled explosion were carried out
- Rockets, mortar bombs and 25-pounder bombs were recovered after they were fired into the sea by RAF jets during the war
- Most of the devices were stored in a bunker used for training purposes but remain mostly undamaged because of the beach's location



Army bomb disposal team called to Blackside Bridge in Here Bay

By Mike Davies, South Wales Evening Post, 14 Dec 2019



Army bomb disposal team called to Blackside Bridge in Here Bay.

Unexploded bomb found in Aomster

Unexploded bomb found in Aomster.



Storms and floods unearth unexploded wartime bombs

By Claire Marshall, BBC, 10 November 2019



Storms and floods unearth unexploded wartime bombs.

Land Service Ammunition (LSA) resulting from historic military activity is commonly encountered across the UK by the public and construction industry alike. Such finds are much more common in rural areas than in urban environments, and can often be anticipated in areas such as former RAF stations or ranges. However, such items are also encountered entirely by surprise where the landowner or developer has no knowledge of any previous military use of the land.



Luftwaffe Photograph, 4th June 1939



Kent Gravesend
A) 'Kraftwerk' (Power station)– Designated Luftwaffe target

The site located immediately west of target A



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client:	GVR Geoservices Ltd		
Project:	Northfleet, Gravesend, Kent		
Ref:	DA11104a-00	Source:	Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"
Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79			

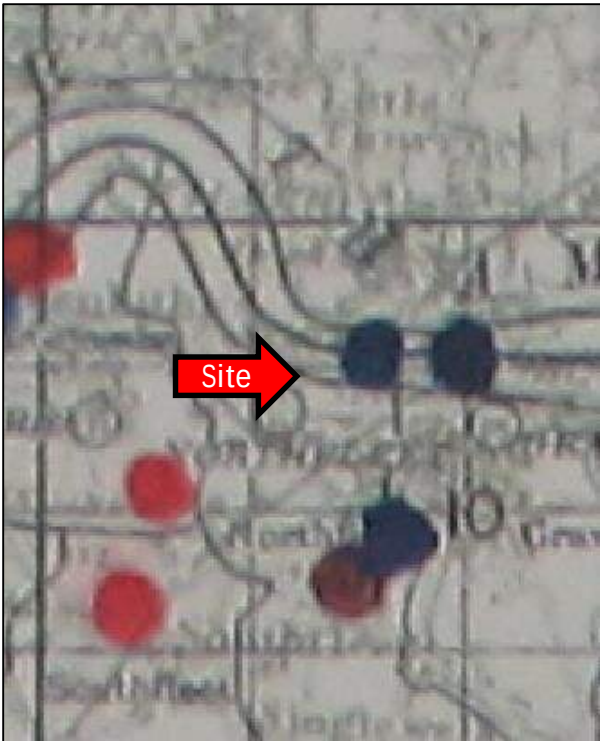
28th August 1940



8th September 1940



14th September 1940



5th October 1940



● Recorded bomb strike ● Incendiary bomb strike



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Kent History and Library Centre

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79

23rd October 1940



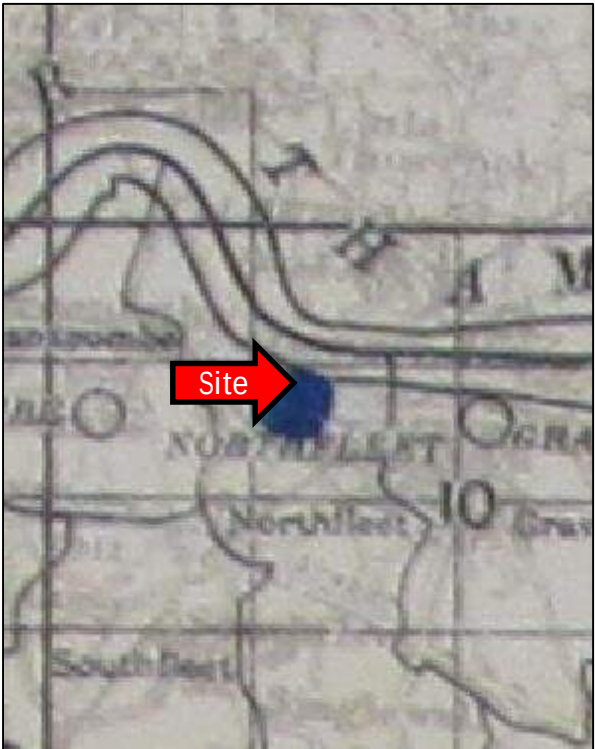
14 September 1940



17th March 1941



March 23rd 1941



● Recorded bomb strike ● Incendiary bomb strike



Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Kent History and Library Centre

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79

19th July 1944



Recorded V-1 bomb strike



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Kent History and Library Centre

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79

16th August 1940

MEDWAY GROUP INCIDENTS WAR DIARY. Date 16. 8. 40											
Time	Place	Type of Incident	Particulars	Time of Day	No.	Remarks	Location	Remarks	Action Taken	Remarks	Notes
12.30	W. of Colyer R. area	H.E.	W. of Colyer R. area	12.30	1	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area

4th September 1940

14.9.40	W. of Colyer R. area	H.E.	W. of Colyer R. area	14.9.40	1	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area
---------	----------------------	------	----------------------	---------	---	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

12th December 1940

12.12.40	W. of Colyer R. area	H.E.	W. of Colyer R. area	12.12.40	1	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area
----------	----------------------	------	----------------------	----------	---	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

23rd October 1940

MEDWAY GROUP INCIDENTS WAR DIARY. Date 23-10-40											
Time	Place	Type of Incident	Particulars	Time of Day	No.	Remarks	Location	Remarks	Action Taken	Remarks	Notes
22.10.40	W. of Colyer R. area	H.E.	W. of Colyer R. area	22.10.40	1	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area

11th February 1944

NORTHFLEET INCIDENTS WAR DIARY. Date 11.2.44											
Time	Place	Type of Incident	Particulars	Time of Day	No.	Remarks	Location	Remarks	Action Taken	Remarks	Notes
11.2.44	W. of Colyer R. area	H.E.	W. of Colyer R. area	11.2.44	1	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area	W. of Colyer R. area



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: GVR Geoservices Ltd

Project: Northfleet, Gravesend, Kent

Ref: DA11104a-00

Source: Kent History and Library Centre

Produced by and Copyright to 1st Line Defence Limited. Registered in England and Wales with CRN: 7717863. VAT No: 128 8833 79